

Pre-Packaged Meals (PPM) Accessibility Design Guidelines



A practical guide to creating easy to open and safe
pre-packaged meals for all consumers

Prepared by:



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Executive Summary

Closing the gap between accessibility needs of consumers and existing packaging

Food packaging delivers many benefits to society including helping keeping food fresh for extended periods and protecting it from damage during transport. It helps reduce food waste which is increasingly important for the environment. Food packaging helps prevent food tampering and delivers to consumers a level of choice and variety that was unavailable to previous generations.

Packaging does need to be 'fit for purpose' including for accessibility, meaning all consumers can easily and safely open and use packaging and read the label. Sadly, much of the food packaging available on a retail level falls short of consumer needs from an accessibility perspective. Only 11%* of global consumers are completely satisfied with packaging today, leaving the vast majority of people wanting more from their packaging. For those living with a physical, visual or cognitive limitations, packaging can be a barrier to consuming and/or purchasing the food. Hard to open packaging can be a barrier to independent living especially for those with a disability and/or as the population ages. Many older adults naturally transition from kitchen prepared meals to pre-packaged meals as their family size goes down and difficulty preparing recipe-based meals increases.

Very little research exists in published literature about packaging design for accessibility, which is why the Pre-Packaged Meal Accessibility Design Guidelines (PPM Guidelines) were created. The country a person is from, does not pre-determine their ability to open packaging or read small text on a label. Hard to open and read packaging is a global challenge that transcends, age, gender, culture and lifestyle. The one advantage of this, is that the PPM Guidelines are applicable on a global level, with only some cultural and language limitations.

The purpose of the PPM Guidelines is to help close the gap between consumer needs and many existing PPM packaging formats available today. Packaging designers can use the PPM Guidelines to make informed decisions about the challenges many consumers face and how to overcome them, throughout the design process. This will help avoid costly redesigns and lost sales due to people not been able to open the packaging.

The inspiration for the PPM Guidelines was meeting consumer needs in a health care setting in New South Wales (Australian) hospitals. Almost everyone has, or will end up, being a patient in hospital at some stage in their life. So people who purchase food at a retail level and people who are patients in hospital, are one in the same. There is an increased focus on safety in a healthcare setting and likely to be a higher incidence of the frail and elderly, but the design challenges and solutions provided are applicable to a retail and healthcare setting.

Quick Guide to using PPM Guidelines

Once designers become familiar with **PPM Guidelines** in this document, they need only use the attached Excel **PPM Worksheet**. The PPM Guidelines are primarily designed to be a reference document and the PPM Worksheet is the working document for designing/redesigning packaging. There are 28 Design Guidelines & 21 Design Issues which are ranked in terms of importance and safety, so companies can quickly ascertain priorities.

The PPM Worksheet summarizes all of the Design Guidelines & Issues including their rankings into a single page. There is a self-assessment section where designers need to determine if they are non-compliant, partially or fully compliant with the PPM Guidelines. There are links embedded in the PPM Worksheet that allow you to click through to every Design Guideline & Issue for reference. The Design Issues & Guidelines can be sorted using the PPM Worksheet, so companies can quickly determine how to best allocate resources for the greatest return.

*Packaging Matters: A 2014 global study of flexible packaging by MWV on 7655 consumers across 10 markets.

Background to Pre-packaged Meal Guidelines (PPM Guidelines)

HealthShare NSW – Patient centered approach to innovation & pre-packaged meals

Note: This section covers how HealthShare NSW intends to use pre-packaged meals to provide patients more choice, variety and quality food in NSW hospitals. It is not applicable to companies supplying meals to retail.

HealthShare NSW is health services division of the NSW Government, and the Food and Patient Services division serves 22 million meals to patients in NSW hospitals each year. HealthShare NSW is in the process of introducing pre-packaged meals to hospital menus to increase choice, variety, taste and quality.

It is critical that the pre-packaged meals be easy to open and safe, which is why the Pre-Packaged Meal (PPM) Accessibility Design Guidelines were commissioned. Independent accessibility testing for food packaging, has been mandatory in NSW hospitals for suppliers since 2012. HealthShare NSW is committed to recognizing and rewarding suppliers for patient centered innovation at a procurement level. The PPM Accessibility Guidelines will help reduce the time and cost to innovate, by helping suppliers understand consumer challenges and how to overcome them.

A key objective of providing pre-packaged meals is to challenge how patients perceive hospital food. The role of Pre-Packaged Meals is to increase the choice, taste quality and variety of meals offered to people in a timely manner. This will contribute to significantly reducing waiting times between people ordering and receiving their food. This will also help lead to increased meal intake and patient satisfaction.

More Variety - Meeting a variety of dietary and multicultural needs

New South Wales is the largest state in Australia and has a population of over eight million people. Australia is a multicultural society with 43% of the Australian population having at least one parent born overseas. Patients are of all ages but also from an incredibly diverse set of cultures, cuisines and spiritual beliefs. HealthShare aims to introduce an increased variety and choice of meals through the use of Pre-Packaged Meals.

More Choice - Pre-packaged meals enable significantly increased choice on a daily basis

HealthShare NSW needs to offer a choice of meals to suit this diverse range of tastes and cultures, on a daily basis. HealthShare are planning to structure menus so that patients will have the ability to choose their favorite meal daily (if desired) rather than waiting for it to appear within a weekly or fortnightly cycle.

Contributing to improved Nutrition

Pre-packaged meals can contribute to increased nutrition for patients via increased choice, variety, taste & quality. The PPM Guidelines help ensure the packaging design is patient centered, easy to open/ read and safe.

Scope of the PPM Accessibility Design Guidelines

Different population segments have various abilities and experiences that may impact the perceived accessibility of a given packaging solution. Consumers bring their own experiences and preconceived notions about the accessibility of a packaging solution's design elements.

The focus of the PPM Guidelines is on accessibility and safety as defined by the ability of the consumer to complete the required task or tasks of opening the packaging, and consuming the food products contained in the packaging. Specifically the design elements of pre-packaged meal packaging that have been shown to increase performance and reduce errors regardless of how consumers might perceive the value of such features

This PPM Guidelines does not cover tasks associated with managing the inventory, preparing the meal for consumption, delivering the meal, or disposing the waste associated with the meal. Bulk outer packaging and bulk outer packaging labeling are design elements that are also outside the scope of this report. A separate, but related, topic is the development of design elements that communicate to the consumer that the packaging solution is easy to open and/or use. For example, a manufacturer may choose to utilize oversized design features in an attempt to communicate that the packaging solution is easy to use. Such oversized features may or may not contribute to the actual accessibility of the packaging solution.

PPM Table: Tasks covered by PPM Guidelines including those in healthcare setting

The PPM Table below contains some of the many tasks associated with managing pre-packaged meals (PPMs) in the health care setting. The tasks relevant to this report are highlighted in bold.

- | |
|---|
| <ol style="list-style-type: none"> 1. Manage Inventory <ol style="list-style-type: none"> a. Accept delivery b. Identify product c. Determine storage requirements d. Check PPMs for spoilage e. Handle bulk packaging f. Store PPMs g. Count PPMs h. Determine product needs i. Unpack PPMs from bulk packaging j. Inspect bulk packaging for damage k. Inspect for tampering l. Check expiration date m. Remove products <ol style="list-style-type: none"> i. Remove expired products ii. Remove damaged products n. Transfer products to meal preparation stations o. Determine product needs for a given meal p. Retrieve PPMs needed for a given meal 2. Prepare Meals <ol style="list-style-type: none"> a. Identify heating instructions b. Set oven according to instructions c. Place PPMs in oven d. Monitor heating e. Verify product heating completion f. Remove product from oven g. Place product in transfer cart h. Label product for patient i. Maintain product warmth during delivery j. Verify PPM contents 3. Deliver Meals <ol style="list-style-type: none"> a. Identify patient meals b. Remove meal from transfer cart c. Transfer meal to patient |
|---|

- d. **Place meal on serving tray**
 - e. **Verify correct meal is served**
 - f. **Verify meal readiness**
 - g. **Verify expiration date**
- 4. Consume Meal
 - a. **Remove PPM seal**
 - b. Access utensils
 - c. Use provided utensils
 - i. **Use spoon**
 - ii. **Use fork**
 - iii. **Use knife**
 - d. Add seasoning or condiments
- 5. Dispose of Waste
 - a. Remove waste from the patient's room
 - b. Transport waste
 - c. Separate waste
 - d. Identify recycling requirements
 - e. Store recyclables
 - f. Transport recyclables

Understanding the PPM Guidelines from a design perspective

The PPM Accessibility Design Guidelines were developed using published research related to food packaging, systematic studies of retail pre-packaged meals, and the author's experience in researching and developing food packaging solutions over the last 14 years.

Food packaging design is a function of the degree to which the task or tasks associated with the packaging is supported by the design elements. A design element is the specific portions of the packaging that consumers interact with to achieve some desired goal. Tabs, handles, labels, and illustrations are all examples of design elements. Accessibility is the degree to which consumers are expected be able to perform the necessary actions to complete the sequence of tasks necessary to open the packaging and consume the contained food products. Other tasks such as storage and preparation may also impact accessibility but are out of scope of this current effort.

Task performance depends on the consumers' ability to comprehend the required sequence of tasks and to execute those tasks. The design is easy to use if consumers are able to perform the tasks with the functional abilities at their disposal and without expending excessive effort or making mistakes. Accessibility is concerned with how well the various design elements are matched to the needs of the users and the tasks they are designed to support.

A designer must consider the person, the environment, and the design of the packaging. All three considerations interact to determine the accessibility of a design element. For example, a person with a disability may not have the fine motor control to grasp a small tab while a person without a disability may find the same design element easy to use. Likewise, a label that is designed to be used by someone with unimpaired vision may be difficult to see for someone with cataracts. Finally, a packaging solution that is designed to be used in a lit room may not be easy to use when illumination is poor. Exploring how all three considerations interact will assist in defining accessibility.

Technical Terms and Definitions

The technical terms used in this report are defined as follows:

Term	Definition
Accessibility	For packaging to be accessible it needs to be designed to be easy to open, use and close as well as legible. Sustainable packaging needs to fit for purpose including for accessibility and not compromise safety or quality.
Applicable Guidelines	The Guideline or set of Guidelines that address a given Design Issue.
Coefficient of Friction	In this circumstance, coefficient of friction refers to the amount of resistance that a finger exerts on the surfaces of the PPM such as the film membrane tab or the plate grasp point.
Contrast	The difference in reflected light between the label and the surfaces immediately surrounding the label.
Design Element	A design element is a feature of the packaging solution that the user is expected to interact with in order to achieve some desired goal. For example, a packaging solution may contain a tab design element that the user is intended to grasp and apply force to separate a film from the plate.
Design Issue	A potential design barrier that may impact the accessibility of the PPM for the general population or a portion of the population impacted by functional limitations.
PPM Worksheet (See Excel attachment)	<p>The PPM Worksheet allows designers to gain an overview of all Guidelines and Design Issues. Designers can use the PPM Worksheet to evaluate their performance on individual Guidelines and Design Issues & prioritize and/or allocate resources accordingly. The self-evaluation column uses a traffic light system where:</p> <p>Red bar is Non-compliant: The design requirements for an individual Design Issue and/or Guideline have not been complied with.</p> <p>Orange bar is Partially compliant: Some design requirements have been complied with but some remain and/or the designer cannot determine if all design requirements have been met or not.</p> <p>Green bar is compliant: All design requirements for an individual Design Issue or Design Guideline have been met.</p> <p>Note: It is strongly recommended that independent testing be performed to confirm self-evaluations, including consumer testing, to reduce the risk of error.</p>
Film Membrane	The material covering the plate and sealing in the food prior to consumption. The film membrane is typically bonded to the plate and removed by the consumer prior to consumption.
Guideline	A recommended best practice or course of action designed to address one or more Design Issues that may impact the accessibility of the product.
Grasp point	The area of the plate where the consumer is expected to hold the plate during transport or while steadying the plate while removing the film membrane.
Labeling	The text and symbols affixed to the PPM that describe information about the PPM.
Legibility	The ease of which the consumer can recognize individual characters or symbols in the label.

Potential Solutions	Suggested solutions to a given design issue. The potential solutions are not meant to be exhaustive; however, they do suggest methods of addressing design issues using accessible design best practices.
PPM	A pre-packaged meal (PPM) is a plated meal, often compartmentalized, containing one, two, or three food items. A thin film membrane typically covers the plated meal until it is ready to be consumed.
Readability	The ease of which the consumer can understand information on the label.
Safety Risk (Ranking)	<p>The risk that the consumer's health may be impacted by a given design issue. Every Guideline and Design Issue is given a safety ranking.</p> <p>HIGH safety risk means that the consumer is likely experience a significant injury or painful experience if the design issue is not addressed.</p> <p>MEDIUM safety risk means that the consumer may experience a significant injury or painful experience if the design issue is not address.</p> <p>LOW safety risk means that the consumer is unlikely to be injured because of the design issue.</p>
Structural Integrity	Structural integrity refers to the ability of the plate to maintain its original shape. A plate with sufficient structural integrity is unlikely to deform under its own weight after being heated.
Tab	The area on the film membrane where the user is intended to grasp the membrane so that the membrane can be pulled away to open the plate.
Task Criticality (Ranking)	<p>Task criticality refers to the importance of the sensory, cognitive, of physical task associated with consumers using PPMs. Every Guideline and Design Issue is given a Task Criticality ranking where a:</p> <p>CRITICAL task is a task that must be performed in order to effectively consume the PPM.</p> <p>MODERATE task is a task that may be necessary under some circumstances.</p> <p>MINOR task is not required in order to effectively use the PPM but may yield important information about the product or may enhance the experience of using the product.</p>

Limits of Photos and/or Illustrations: Example photos and/or illustrations of packaging that are 'Not Designed for Accessibility' and is 'Designed for Accessibility' are provided with each Guideline. These examples are not prescriptive nor are they necessarily best practice because examples in the marketplace are not always available, their purpose to facilitate understanding.

When viewing photos of Designed and/or Not Designed for Accessibility, only pay attention to the design element that the Guidelines specifically refers to. There may be other aspects of the design that may/may not be designed for accessibility. The written Guideline versus the photo should be the designer's primary reference.

Note: Using HealthShare NSWs - PPM Guidelines versus Food Packaging Guidelines

HealthShare NSW previously commissioned a series of general guidelines for food packaging entitled "NSW Health Food Packaging Design Accessibility Guidelines". The research for the Food Packaging Guidelines was conducted by Arthritis Australia and GTRI and documents 19 general guidelines that apply to a variety of food packaging solutions. While the published guidelines were useful in the development of this research report, the guidelines themselves were not specific enough to provide useful guidance for pre-packaged meal packaging solutions.

Design Guidelines (1 – 28)

There are 28 Design Guidelines related to pre-packaged meal design. The Design Guidelines are designed to identify key design elements of best practice from an accessibility perspective. The importance of complying with each Design Guideline is documented in the Ranking column.

#1

Film membrane shall not tear

The film membrane shall remain intact while being removed from the plate. The film membrane shall be able to be separated from the plate in one continuous motion without leaving remnants of the film membrane on the plate or in the food.

Ranking

Task Criticality: Critical

Safety Risk: Medium

#2

Plate grasp points shall be provided

A grasp point shall be positioned on each side of the plate so that the plate is balanced when carried. The grasp point shall extend away from the body of the plate by at least 10 mm and the grasp point shall be at least 30 mm in length.

Ranking

Task Criticality: Critical

Safety Risk: High

#3

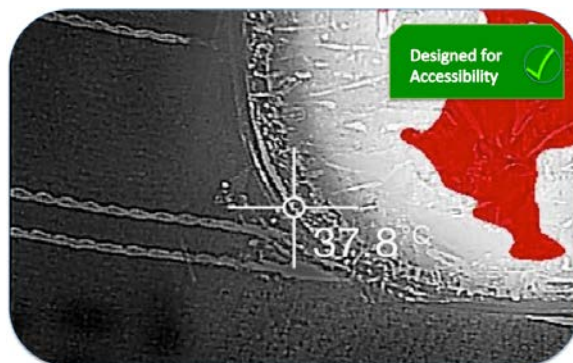
Plate grasp points shall not become too hot

The surface of the plate grasp points shall not exceed 41 degrees C after the PPM is prepared in the prescribed manner.

Ranking

Task Criticality: Critical

Safety Risk: High



#4

Eliminate excess water

Excess water shall be removed from the PPM. The plate shall be designed to minimize the risk of scalding due to a spill of excess fluid.

Ranking

Task Criticality: Moderate

Safety Risk: High



#5

Contents shall be identifiable after preparation

The food contents of the PPM shall be identifiable after the product has been prepared according to manufacturer instructions without requiring the interpretation of codes, abbreviations, or jargon.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



#6

Consumer can determine food contents are safe to eat

The consumer shall be able to determine by inspection of the PPM packaging that the food product has not expired, is safe to eat, and has not been tampered with prior to being delivered to the consumer.

Ranking

Task Criticality: Moderate

Safety Risk: High



#7

Minimize film membrane peel force

The force required to separate the film membrane from the plate shall not exceed 8.0 N.

Ranking

Task Criticality: Critical

Safety Risk: High



#8

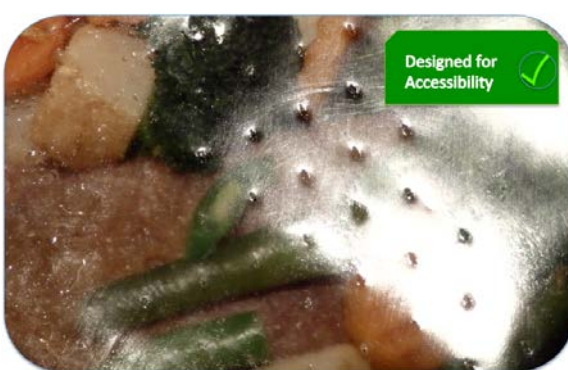
Minimize steam release

The design of the PPM packaging solution shall minimize the likelihood that escaping steam will burn the consumer's fingers as the film membrane is separated from the plate.

Ranking

Task Criticality: Critical

Safety Risk: High



#9

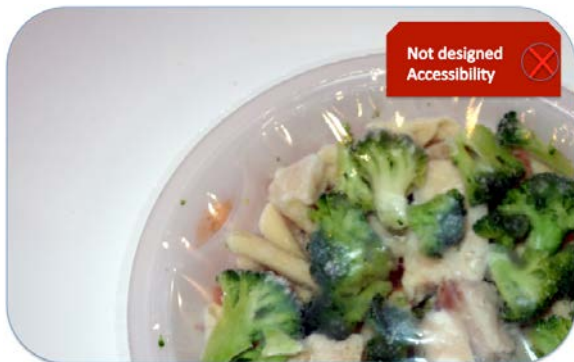
Provide sufficient tab size

The film membrane tab shall extend from the plate at least 30 mm and have a surface area beyond the plate of at least 400 mm².

Ranking

Task Criticality: Critical

Safety Risk: Medium



#10

Tab shall be visible

The film membrane tab shall be made readily apparent to the consumer. Visual cues shall be provided to assist in the location of the film membrane tab.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



#11

Plate shall not deform or bend after heating

The plate material shall remain rigid during transport after heating. The plate shall not deform under the weight of the contents when being held by the grasp points.

Ranking

Task Criticality: Critical

Safety Risk: Medium



#12

Don't require tool usage

The consumer shall not be required to use a tool to safely remove the film membrane.

Ranking

Task Criticality: Critical

Safety Risk: High



#13

Avoid sharp edges

Sharp edges around the plate shall be avoided. If the plate is made of a paper material, steps shall be taken to minimize the likelihood of the user receiving a paper cut.

Ranking

Task Criticality: Moderate

Safety Risk: High



#14

Plate shall resist puncture

The plate shall resist puncture from eating utensils.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



#15

Plate coatings shall be steadfast

The plate coatings or materials shall not be dislodged if scraped by eating utensils.

Ranking

Task Criticality: Critical

Safety Risk: Medium



#16

Plate and eating utensils shall be compatible

The plate contours shall be compatible with the eating utensils so that the consumer can easily extract all of the food from the plates.

Ranking

Task Criticality: Minor

Safety Risk: Low



#17

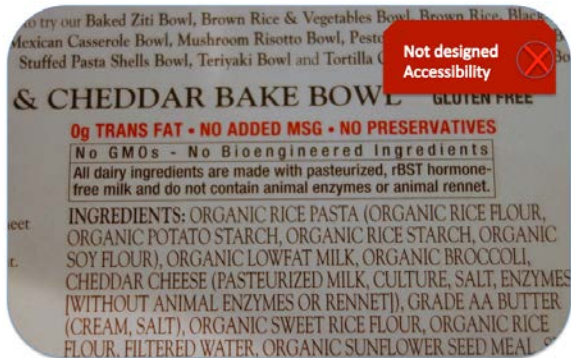
Labels are readable and comprehensible by the consumer

All labels on the PPM as delivered to the consumer shall be readable and comprehensible by the consumer. Avoid ambiguous labels such as uncommon symbols, unfamiliar abbreviations, or uncommon technical terms.

Ranking

Task Criticality: Critical

Safety Risk: Medium



#18

Critical text shall be legible

Enhance legibility and comprehension of labels, critical instructions, and expiration dates. Print critical text with large print in a sans-serif font with high contrast on a solid background. Select fonts that have been designed for enhanced legibility for those with limited vision.

Source: American Printing House for the Blind, Inc; Canadian National Institute for the Blind

Ranking

Task Criticality: Moderate

Safety Risk: Medium



#19

Critical text shall be sufficiently sized

The recommended minimum type size is 12 point (4.25 mm), especially for warnings, expiry dates and instructions. For small packaging or portion control items with a surface area of less than 100 cm², then the minimum type size is 9 point (3.17 mm).

Source: American Printing House for the Blind, Inc; Canadian National Institute for the Blind

Ranking

Task Criticality: Critical

Safety Risk: Medium



#20

Mixed case shall be used on long lines of text

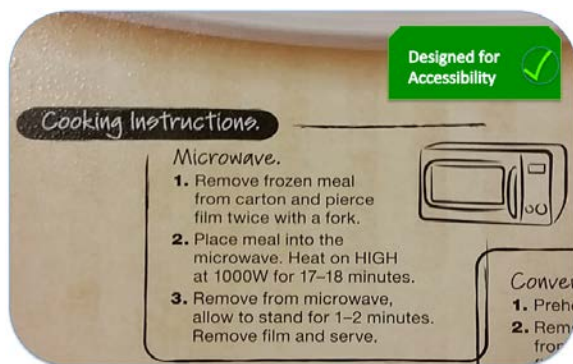
Avoid all capital letters on long lines of text. Lower case text is easier to read, especially if the text is several lines long, so avoid using text consisting entirely of capital letters. The height of and spacing between letters should not be modified.

Source: American Printing House for the Blind, Inc; Canadian National Institute for the Blind

Ranking

Task Criticality: Minor

Safety Risk: Low



#21

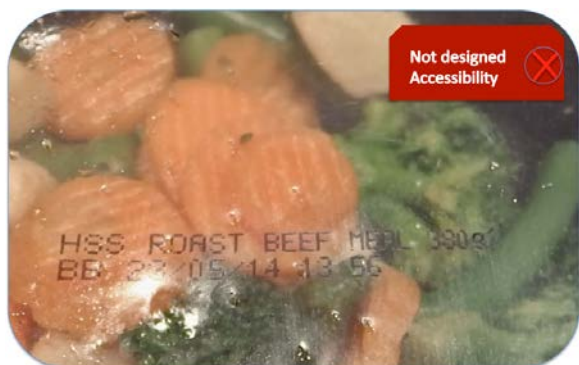
Expiry data format shall be easy to understand

Expiry or best before dates should be formatted in such a way that the day, month and year are distinct from each other. Use the four digit format for the year and at least three letters for the month (e.g., JAN for January).

Ranking

Task Criticality: Minor

Safety Risk: Medium



#22

The label and the actual expiry date shall be in close proximity

A label identifying the date as an expiry or best before date (i.e. best if used by) should be provided in close proximity to the actual date.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



#23

The expiry date shall be distinct from the lot number

To avoid confusion, the label and date should be visually distinct from the lot number. This can be accomplished by placing the label and date on the same line or with white space so that the date is closer to its label than it is to the lot number.

Ranking

Task Criticality: Minor

Safety Risk: Low



#24

Require only one hand

The film membrane shall require the use of only one hand to separate the film membrane from the plate.

Ranking

Task Criticality: Minor

Safety Risk: Medium



#25

Film membrane separation force shall not be variable

The force required to separate the film membrane from the plate shall remain consistent from the initial separation until the film is completely separated from the plate. The initiating peel force shall not significantly differ from the continuation peel force or the force required to finally separate the film membrane from the plate.

Ranking

Task Criticality: Moderate

Safety Risk: High



#26

Plate shall have a sufficient sidewall

The plate shall have 20 mm of empty sidewall to facilitate transport, stirring, or consumption without causing the food to overflow or spill from the plate.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



#27

The packaging shall have a GS1 compliant machine readable code (i.e. barcode)

A machine readable code which is GS1 compliant and includes identifiers which allow any trade item/product to be quickly and efficiently tracked and/or traced across the supply chain. Barcodes assist in providing business intelligence & communication amongst trade partners and helps locate stock with product recalls. Identifiers can include ingredients, nutritional information, preparation and storage information. Identifiers can aid food safety by containing allergy statements, expiry dates, and microbiological data and ideally be scanned by consumers using mobile phones etc.

Ranking

Task Criticality: High

Safety Risk: High



#28

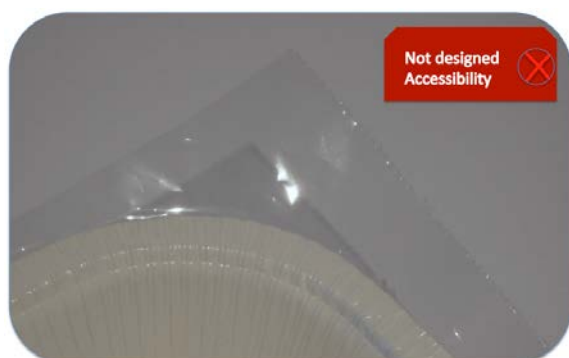
The film membrane tab shall have design elements to increase the tab coefficient of friction

The film membrane tab shall have verifiable design elements such as a texture or coating that increases the coefficient of friction between the film membrane tab and the user's fingers at the film membrane tab grasp point.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



Design Issues - Detailed Guidance

There are a total of 21 Design Issues related to pre-packaged meal design. Design Issues cover the three main elements of pre-packaged meals the film membrane, the plate (tray/container) and the labelling. Design Issues often requires the understanding and application of multiple Design Guidelines.

There are multiple Potential Solutions to any particular Design Issue, some but not all are highlighted here. Gaining a good understanding of Design Guidelines is critical to understanding the often complex interrelationship between Design Issues and multiple Design Guidelines.

The type of user impacted by conformance with the PPM Guidelines is documented in the column labeled **Populations Impacted**. This could be food service workers and/or consumers because PPM Guidelines were designed for a healthcare setting but with retail in mind.

Term	Definitions used in Design Issues Section
Applicable Guidelines	The Guideline or set of Guidelines that address a given Design Issue.
Design Issue	A potential design barrier that may impact the accessibility of the PPM for the general population or a portion of the population impacted by functional limitations.
Guideline	A recommended best practice or course of action designed to address one or more PPM Design Issues that may impact the accessibility of the product.
Potential Solutions	Suggested solutions to a given Design Issue. The potential solutions are not meant to be exhaustive; however, they do suggest methods of addressing design issues using accessible design best practices.
Safety Risk (Ranking)	<p>The risk that the consumer's health may be impacted by a given design issue. Every Guideline and Design Issue is given a safety ranking.</p> <p>HIGH safety risk means that the consumer is likely experience a significant injury or painful experience if the design issue is not addressed.</p> <p>MEDIUM safety risk means that the consumer may experience a significant injury or painful experience if the design issue is not address.</p> <p>LOW safety risk means that the consumer is unlikely to be injured because of the design issue.</p>
Task Criticality (Ranking)	<p>Task criticality refers to the importance of the sensory, cognitive, of physical task associated with consumers using PPMs. Every Guideline and Design Issue is given a Task Criticality ranking, where a:</p> <p>CRITICAL task is a task that must be performed in order to effectively consume the PPM.</p> <p>MODERATE task is a task that may be necessary under some circumstances.</p> <p>MINOR task is not required in order to effectively use the PPM but may yield important information about the product or may enhance the experience of using the product.</p>

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Design Issues –Detailed Guidance

A. Film Membrane Issue 1 of 9 – Condensation obscures food contents

A. Film Membrane Issue 1 of 9	<p>Condensation obscures food contents</p> <p>Consumers and food service workers may have difficulty identifying the contents of the PPM after the product has been heated due to condensation on the film membrane created during the heating process.</p>
Ranking	<p>Task Criticality: Moderate Safety Risk: Medium</p>
Populations Impacted	<p>Consumers, Food Service Workers</p>
Applicable Guidelines	<p><i>5 - Contents shall be identifiable after preparation</i></p> <p><i>6 - Consumer can determine food contents are safe to eat</i></p> <p><i>17 - Labels are readable and comprehensible by the consumer</i></p> <p><i>27 - The packaging shall have a machine readable code (i.e. barcode) that enables traceability</i></p>

Background: It is important that the correct PPM be delivered to the consumer for which it was intended. Condensation formed on the film membrane sealing the product may obscure the contents of the plate (see Figure 1).



Figure 1: Condensation on the film membrane of the PPM.

The food service worker delivering the meal and the person consuming the meal should have a method of verifying the contents of the plate before removing the film to help prevent dietary errors or wastage.

Potential Solutions:

- *Film membrane label:* Provide an overlay label directly affixed to the film membrane that describes the content of the plate.
- *Vented film membranes:* Provide a design feature such as a perforation or slit in the film membrane that is design to all steam to escape from the plate during the heating process.
- *Reduce excess water:* Remove excess water from the food minimizing the condensation formed on the film membrane during preparation.
- *Hydrophilic materials:* Select a film membrane material that is resistant to condensation formation.

Applicable Guidelines:

#5

Contents shall be identifiable after preparation

The food contents of the PPM shall be identifiable after the product has been prepared according to manufacturer instructions without requiring the interpretation of codes, abbreviations, or jargon.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



#6

Consumer can determine food contents are safe to eat

The consumer shall be able to determine by inspection of the PPM packaging that the food product has not expired, is safe to eat, and has not been tampered with prior to being delivered to the consumer.

Ranking

Task Criticality: Moderate

Safety Risk: High



#17

Labels are readable and comprehensible by the consumer

All labels on the PPM as delivered to the consumer shall be readable and comprehensible by the consumer. Avoid ambiguous labels such as uncommon symbols, unfamiliar abbreviations, or uncommon technical terms.

Ranking

Task Criticality: Critical

Safety Risk: Medium



#27

The packaging shall have GS1 compliant machine readable code (i.e. barcode)

A machine readable code which is GS1 compliant and includes identifiers which allow any trade item/product to be quickly and efficiently tracked and/or traced across the supply chain. Barcodes assist in providing business intelligence & communication amongst trade partners and helps locate stock with product recalls. Identifiers can include ingredients, nutritional information, preparation and storage information. Identifiers can aid food safety by containing allergy statements, expiry dates, and microbiological data and ideally be scanned by consumers using mobile phones etc.

Ranking

Task Criticality: High

Safety Risk: High



B. Film Membrane Issue 2 of 9 – Film membrane may rupture

B. Film Membrane Issue 2 of 9	Film membrane may rupture Damage during transportation or preparation may make it difficult to verify that the product is safe for consumption.
Ranking	Task Criticality: Moderate Safety Risk: High
Populations Impacted	Consumers, Food Service Workers
Applicable Guidelines	6 - <i>Consumer can determine food contents are safe to eat</i>

Background: It is important that the end user be able to verify that the meal is safe to consume. Inspection of the product should reveal that the product has not been tampered with prior to being delivered. The film membrane may be torn or punctured during transportation or handling (see Figure 2).



Figure 2: Film membrane ruptured during transport.

The heating process may cause film membrane may rupture during the heating process.

Potential Solutions:

- *Protective bulk packaging:* Design the bulk packaging for the PPMs so that they are protected during transport. Design the bulk packaging to reduce the likelihood that the film membranes will be damaged when the bulk packaging is opened.
- *Resilient film membranes:* Select film membrane materials that are resistant to tear or puncture.
- *Vented film membranes:* Provide a design feature such as a perforation or slit in the film membrane that is design to all steam to escape from the plate during the heating process.
- *Heat resistant film membrane bonding:* Select a bonding method that is resistant to release during heating.

Applicable Guidelines:

#6	<i>Consumer can determine food contents are safe to eat</i> The consumer shall be able to determine by inspection of the PPM packaging that the food product has not expired, is safe to eat, and has not been tampered with prior to being delivered to the consumer.	
Ranking	Task Criticality: Moderate	Safety Risk: High
<div></div> <div></div>		

C. Film Membrane Issue 3 of 9 – Film membrane removal force too high

C. Film Membrane Issue 3 of 9	Film membrane removal force too high A consumer with limited strength may have difficulty separating the film membrane from the plate.	
Ranking	Task Criticality: Critical	Safety Risk: Medium
Populations Impacted	Consumers, Food Service Workers	
Applicable Guidelines	<i>1 - Film membrane shall not tear</i> <i>7 - Minimize film membrane peel force</i> <i>9 - Provide sufficient tab size</i> <i>10 - Tab shall be visible</i> <i>12 - Don't require tool usage</i> <i>28 - The film membrane tab shall have design elements to increase the tab coefficient of friction</i>	

Background: Our abilities change as a function of disease or the natural aging process. Common diseases, such as arthritis, often make simple interactions with packaging challenging. Older consumers and consumers with some disabilities may have limited muscle strength. Limited strength may make it difficult to grasp and remove the film membrane from the PPM. Consumers with limited finger and hand strength should be able to access the contents of the PPMs without experiencing pain or difficulty.

Potential Solutions:

- *Low separation force film membrane bonding:* Select a bonding method that is resistant to accidental separation but within the functional capabilities of the consumers intended to be served.

- *Sufficiently sized tab*: Design a film membrane tab that is sufficiently sized to allow the consumer to maintain a strong grasp so that they may apply sufficient grip to the tab without causing pain or discomfort.
- *High coefficient of friction tab*: Embed a texture or coating onto the film membrane at the tab to facilitate a sufficient grip.

Applicable Guidelines:

#1	<p>Film membrane shall not tear</p> <p>The film membrane shall remain intact while being removed from the plate. The film membrane shall be able to be separated from the plate in one continuous motion without leaving remnants of the film membrane on the plate or in the food.</p>
Ranking	<p>Task Criticality: Critical</p> <p>Safety Risk: Medium</p>
	

#7

Minimize film membrane peel force

The force required to separate the film membrane from the plate shall not exceed 8.0 N.

Ranking

Task Criticality: Critical

Safety Risk: High



#9

Provide sufficient tab size

The film membrane tab shall extend from the plate at least 30 mm and have a surface area beyond the plate of at least 400 mm².

Ranking

Task Criticality: Critical

Safety Risk: Medium



#10

Tab shall be visible

The film membrane tab shall be made readily apparent to the consumer. Visual cues shall be provided to assist in the location of the film membrane tab.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



#12

Don't require tool usage

The consumer shall not be required to use a tool to safely remove the film membrane.

Ranking

Task Criticality: Critical

Safety Risk: High



#28

The film membrane tab shall have design elements to increase the tab coefficient of friction

The film membrane tab shall have verifiable design elements such as a texture or coating that increases the coefficient of friction between the film membrane tab and the user's fingers at the film membrane tab grasp point.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



D. Film Membrane Issue 4 of 9 – Steam causes burns

D. Film Membrane Issue 4 of 9	Steam causes burns Escaping steam formed during the heating process may escape from under the film membrane burning the fingers of the consumer.	
Ranking	Task Criticality: Critical	Safety Risk: High
Populations Impacted	Consumers	
Applicable Guidelines	4 - <i>Eliminate excess water</i> 8 - <i>Minimize steam release</i>	

Background: While separating the film membrane from the plate steam formed during the heating process may escape and burn the fingers of the consumer. Consumers with reduced sensitivity to pain due to an injury or neuropathy are particularly vulnerable. Manufacturers should provide for a mechanism to all trapped steam to escape from the packaging prior to being opened by the consumer.

Potential Solutions:

- *Vented film membranes:* Provide a design feature such as a perforation or slit in the film membrane that is design to all steam to escape from the plate during the heating process.
- *Reduce excess water:* Remove excess water from the food minimizing the condensation formed on the film membrane during preparation.

Applicable Guidelines:

#4

Eliminate excess water

Excess water shall be removed from the PPM. The plate shall be designed to minimize the risk of scalding due to a spill of excess fluid.

Ranking

Task Criticality: Moderate

Safety Risk: High



#8

Minimize steam release

The design of the PPM packaging solution shall minimize the likelihood that escaping steam will burn the consumer's fingers as the film membrane is separated from the plate.

Ranking

Task Criticality: Critical

Safety Risk: High



E. Film Membrane Issue 5 of 9 – Tab hard to grip

E. Film Membrane Issue 5 of 9	Tab hard to grip Consumers with fine motor control limitations may have difficulty grasping a small tab in order to remove the film membrane.	
Ranking	Task Criticality: Critical	Safety Risk: Medium
Populations Impacted	Consumers, Food Service Workers	
Applicable Guidelines	9 - <i>Provide sufficient tab size</i> 28 - <i>The film membrane tab shall have design elements to increase the tab coefficient of friction</i>	

Background: Older consumers or consumers with certain disabilities may have diminished fine motor control abilities. A hand tremor or excessive shaking may make it difficult for such consumers to grasp the tab of the film membrane for removal. Small, difficult to locate tabs (see Figure 3) will be difficult for consumers to grasp and apply sufficient force to separate the film membrane from the plate.



Figure 3: Example of a difficult to see grasp point.

Potential Solutions:

- *Sufficiently sized tab:* Design a film membrane tab that is sufficiently sized to allow the consumer to maintain a strong grasp so that they may apply sufficient grip to the tab without causing pain or discomfort.
- *High coefficient of friction tab:* Embed a texture or coating onto the film membrane at the location of the tab to facilitate a sufficient grip.
- *Low separation force film membrane bonding:* Select a bonding method that is resistant to accidental separation but within the functional capabilities of the consumers intended to be served.

Applicable Guidelines:

#9

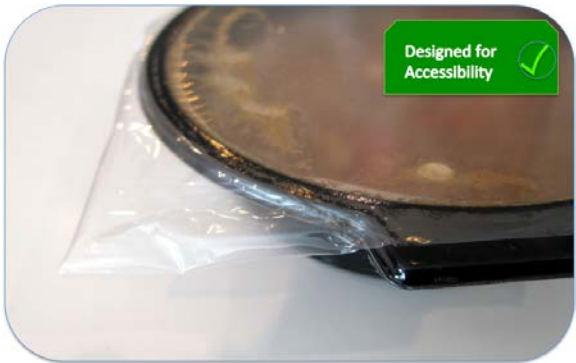
Provide sufficient tab size

The film membrane tabs shall extend from the plate at least 30 mm and have a surface area beyond the plate of at least 400 mm².

Ranking

Task Criticality: Critical

Safety Risk: Medium



#28

The film membrane tab shall have design elements to increase the tab coefficient of friction

The film membrane tab shall have verifiable design elements such as a texture or coating that increases the coefficient of friction between the film membrane tab and the user's fingers at the film membrane tab grasp point.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



F. Film Membrane Issue 6 of 9 – Design elements hard to see

F. Film Membrane Issue 6 of 9	Design elements hard to see Poor vision may make it difficult for users to locate design elements such as film membrane tabs.	
Ranking	Task Criticality: Moderate	Safety Risk: Medium
Populations Impacted	Consumers, Food Service Workers	
Applicable Guidelines	9 - <i>Provide sufficient tab size</i>	

Background: Contrast sensitivity declines even more rapidly as we age. Contrast sensitivity is defined as our ability to distinguish between two adjacent shades of color that are similar but not identical. Reduced contrast sensitivity may make it more difficult to use a product in low illumination environments or when there is little difference between the foreground and background colors of design elements. Clearly labeling tabs with a high contrast, large font size label (see Figure 4) will enable consumers to quickly identify critical design elements.



Figure 4: Example of a clearly defined tab attached to a film membrane.

Potential Solutions:

- *Sufficiently sized tab*: Design a tab on the film membrane that is sufficiently sized to allow the consumer to maintain a strong grasp so that they may apply sufficient grip to the tab without causing pain or discomfort.
- *Film membrane label*: Provide an overlay label directly affixed to the film membrane that describes the content of the plate.

Applicable Guidelines:

#9	<p><i>Provide sufficient tab size</i></p> <p>The film membrane tab shall extend from the plate at least 40 mm and have a surface area beyond the plate of at least 400 mm².</p>
Ranking	<p>Task Criticality: Critical</p> <p>Safety Risk: High</p>
	

G. Film Membrane Issue 7 of 9 – Film membrane rips

G. Film Membrane Issue 7 of 9	Film membrane rips The film membrane may fail to separate from the plate in one piece.	
Ranking	Task Criticality: Moderate	Safety Risk: Medium
Populations Impacted	Consumers	
Applicable Guidelines	1 - <i>Film membrane shall not tear</i>	

Background: The material selected for the film membrane and / or modifications to the film membrane necessitated by the preparation process can impact the ease of removal of the membrane. As part of the research for this technical report a number of retail PPMs were evaluated. Meals were prepared according to package directions and a qualified human factors engineer documented any issues associated with each task in preparation and consumption of the meal. On several occasions it was noted that the film membrane split or broke while trying to separate the film from the plate (see Figure 5). The film membrane should be sturdy enough to withstand the expected forces associated with separating the film membrane from the plate. The film membrane should be resistant to tearing



due to shear forces.

Figure 5: Image of film membrane broken during removal attempt.

Potential Solutions:

- *Low separation force film membrane bonding:* Select a bonding method that is resistant to accidental separation but within the functional capabilities of the consumers intended to be served.
- *Resilient film membranes:* Select film membrane materials that are resistant to tear or puncture.

Applicable Guidelines:

#1

Film membrane shall not tear

The film membrane shall remain intact while being removed from the plate. The film membrane shall be able to be separated from the plate in one continuous motion without leaving remnants of the film membrane on the plate or in the food.

Ranking

Task Criticality: Critical

Safety Risk: Medium



H. Film Membrane Issue 8 of 9 – PPM requires two hands

H. Film Membrane Issue 8 of 9	PPM requires two hands to open versus one The consumer may only have the use of one hand and the PPM may require two hands to safely separate the film membrane from the plate.	
Ranking	Task Criticality: Moderate	Safety Risk: Medium
Populations Impacted	Consumers	
Applicable Guidelines	<i>24 - Require only one hand</i> <i>28 - The film membrane tab shall have design elements to increase the tab coefficient of friction</i>	

Background: Users may require two hands to safely separate the film membrane from the plate (see Figure 5). Consumers with hand injuries, consumers with amputations of one hand, and consumers with medical devices attached to one hand may have difficulty separating the film membrane from the plate if the PPM is designed in such a way that consumer must hold both the plate and the film membrane simultaneously.

High removal forces could require users to hold both the plate and the film membrane tab at the same time. Plates that slide easily may cause consumer to need to steady the plate with one hand while the film membrane is removed using the other hand. The PPM should be designed so that the consumer can remove the film membrane from the plate while the plate rests on a flat surface.



Figure 6: Image of consumer struggling to remove the film membrane using both hands.

Potential Solutions:

- *Low separation force film membrane bonding:* Select a bonding method that is resistant to accidental separation but within the functional capabilities of the consumers intended to be served.
- *Resilient film membranes:* Select film membrane materials that are resistant to tear or puncture.
- *Slide resistant plates:* Select plates that are resistant to sliding when the film membrane is being removed.

Applicable Guidelines:

#24

Require only one hand

The film membrane shall require the use of only one hand to separate the film membrane from the plate.

Ranking

Task Criticality: Minor

Safety Risk: Medium



#28

The film membrane tab shall have design elements to increase the tab coefficient of friction

The film membrane tab shall have verifiable design elements such as a texture or coating that increases the coefficient of friction between the film membrane tab and the user's fingers at the film membrane tab grasp point.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



I. Film Membrane Issue 9 of 9 – Variable forces cause spills

I. Film Membrane Issue 9 of 9	Variable forces cause spills The forces required to remove the film membrane may vary during the removal process causing the hand to slide or the food to spill. Coming into contact with the hot food accidentally may injure consumers.	
Ranking	Task Criticality: Critical	Safety Risk: High
Populations Impacted	Consumers	
Applicable Guidelines	25 - Film membrane separation force shall not be variable	

Background: The force required to initiate the removal of the film membrane may be different than the force required to continue removing the film membrane. The force required to fully separate the film membrane from the plate may also be different than the forces required to initiate removal.

The transitions in the amount of force required may cause consumers to spill the contents of the plate increasing the likelihood of a burn. The bond between the film membrane and the plate should be designed so that the consumer experiences a consistent amount of force required to separate the film membrane throughout the removal process.

Potential Solutions:

- *Consistent separation force film membrane bonding:* Select a bonding method that is consistent in the amount of force required to separate the film from the plate throughout the separation process.

Applicable Guidelines:

#25

Film membrane separation force shall not be variable

The force required to separate the film membrane from the plate shall remain consistent from the initial separation until the film is completely separated from the plate. The initiating peel force shall not significantly differ from the continuation peel force or the force required to finally separate the film membrane from the plate.

Ranking

Task Criticality: Moderate

Safety Risk: High



J. Plate Design Issue 1 of 9 – Hot plate causes burns

J. Plate Design Issue 1 of 9	Hot plate causes burns Consumers may burn their hands by touching the packaging while moving the PPM.	
Ranking	Task Criticality: Critical	Safety Risk: High
Populations Impacted	Consumers, Food Service Workers	
Applicable Guidelines	<i>2 - Plate grasp points shall be provided</i> <i>3 - Grasp points shall not become too hot</i>	

Background: The PPM will become hot during the heating process. Parts of the packaging in direct contact with the food items may burn the skin if touched. The plate becomes heated during the preparation process. The portion of the plate that is directly in contact with the food product is generally hotter than the portion of the plate that is not exposed to food (Figure 7).

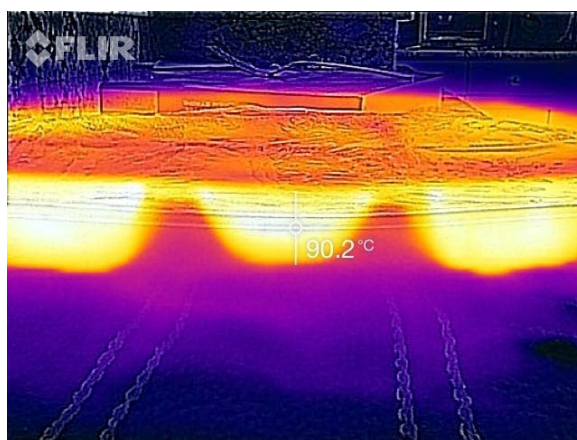


Figure 7: Image of the bottom of a PPM after heating showing hot regions.

Touching the portions of the plate in direct contact with the food may cause burns. It is important that manufacturers of PPM packaging provide sufficient handles on the plate to prevent burns during transport. The surface of the plate can exceed 90C as evident by inspection after a PPM was prepared according to the manufacturer instructions. The pain threshold for adults is typically between 41C and

42C. A second-degree burn can occur in less than a second (see Figure 8) at the temperatures seen at the surface of the plate.

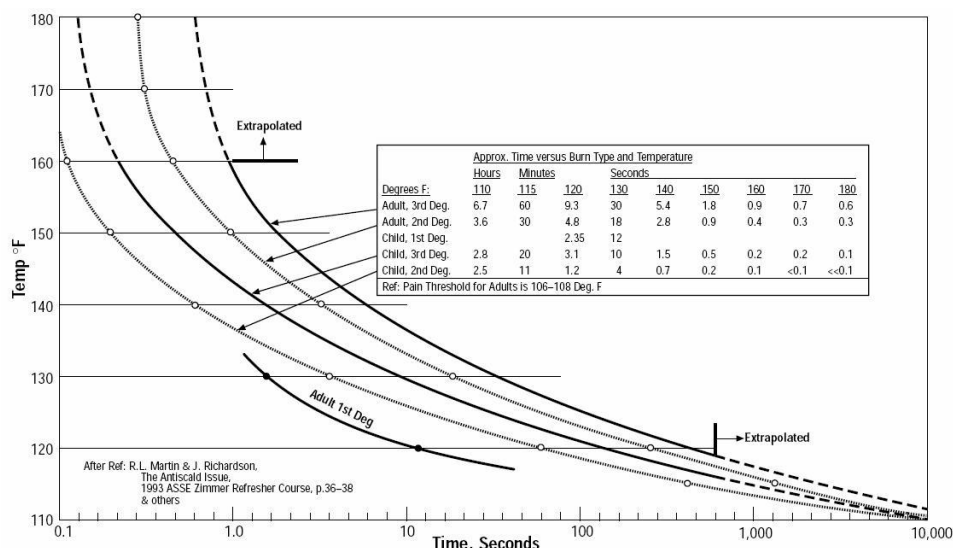


Figure 8: Tissue damage as a function of time and temperature.

The packaging solution should facilitate transfer of the product as necessary by providing a grasp point that is safe to touch.

Populations Impacted: Consumers, Food Service Workers

Potential Solutions:

- *Integrate grasp points into the plate:* Placing grasp point on either side of the plate would enable consumers to safely carry the plate while keeping fingers away from hot surfaces.
- *Select materials unlikely to retain heat:* Select materials that do not retain heat in areas in which consumers are likely to touch. Ensure that the material cools to a safe temperature before the plate is likely to be handled.

Applicable Guidelines:

#2

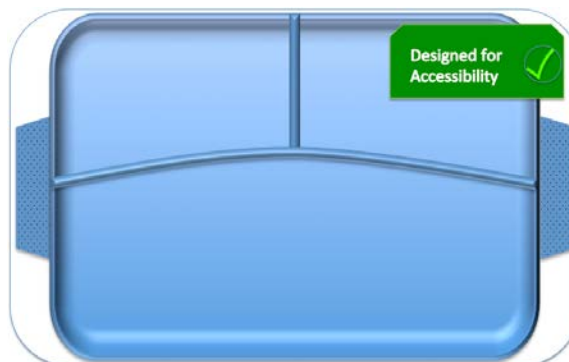
Plate grasp points shall be provided

A grasp point shall be positioned on each side of the plate so that the plate is balanced when carried. The grasp point shall extend away from the body of the plate by at least 10 mm and the grasp point shall be at least 30 mm in length.

Ranking

Task Criticality: Critical

Safety Risk: High



#3

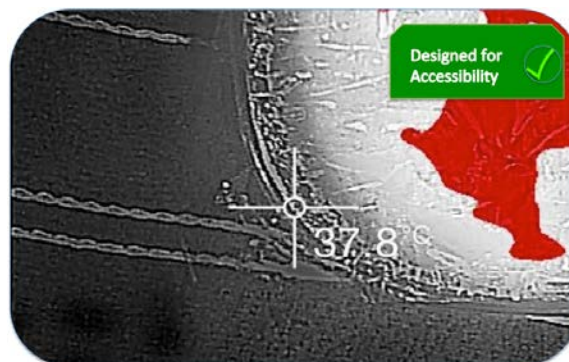
Grasp points shall not become too hot

The surface of the plate grasp points shall not exceed 41 degrees C after the PPM is prepared in the prescribed manner.

Ranking

Task Criticality: Critical

Safety Risk: High



K. Plate Design Issue 2 of 9 – Hot fluids cause scalds

K. Plate Design Issue 2 of 9	Hot fluids cause scalds Consumers may scald themselves if the heated fluid or water in the plate is spilled.	
Ranking	Task Criticality: Critical	Safety Risk: High
Populations Impacted	Consumers, Food Service Workers	
Applicable Guidelines	<i>3 - Grasp points shall not become too hot</i> <i>4 - Eliminate excess water</i> <i>11 - Plate shall not deform or bend after heating</i> <i>13 - Avoid sharp edges</i>	

Background: During the preparation process excess fluid or water may gather in the plate. The fluid, if spilled, may scald the consumer. The meal should be design so that free fluid or water is minimized. The plate should be designed so that the consumer is not likely to tip the plate in such a way as to cause the fluid to spill.

The PPM should be designed to minimize the amount of excess fluid after the meal is prepared according to the heating instructions. The risk of significant injury is a function of the time and temperature of the fluid (see Figure 9). Temperatures of the fluid in the products tested for this report were commonly in the 90C range. At that temperature, tissue damage can occur in a fraction of a second injuring the consumer.

Hot Water Burn & Scalding Graph

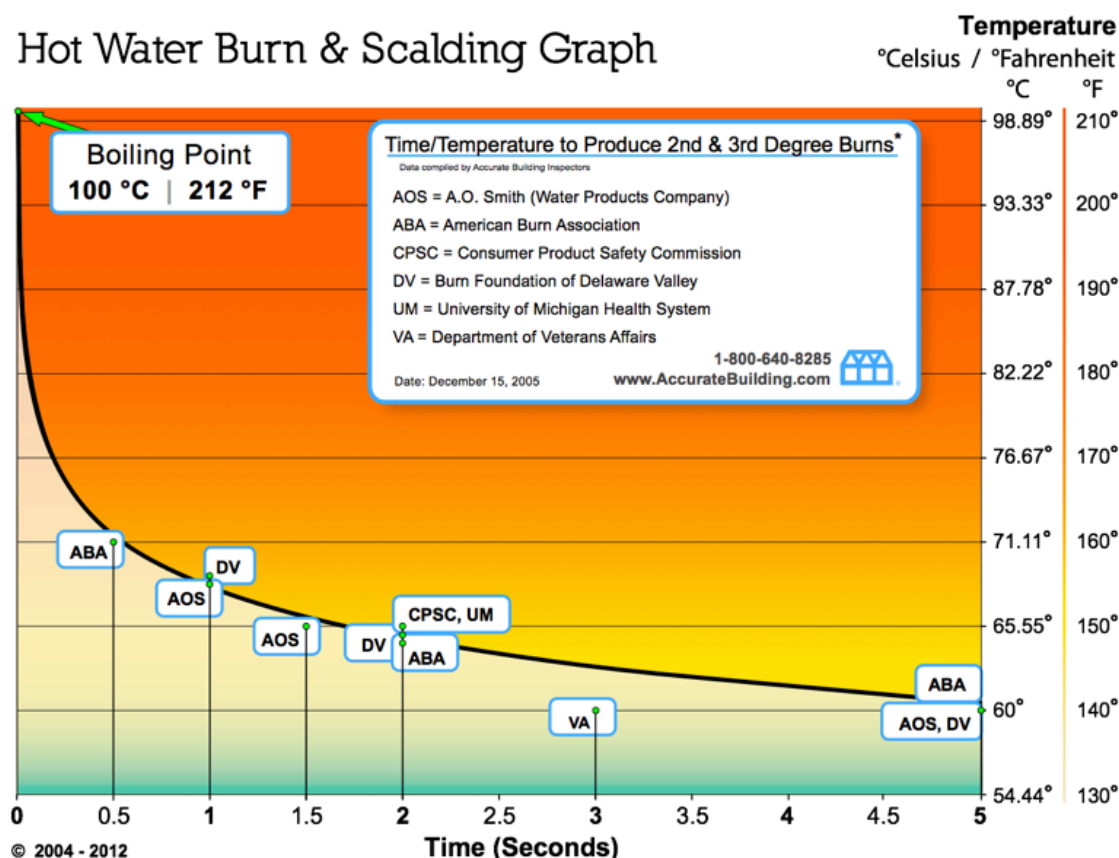


Figure 9: Risk of scalding as a function of time and temperature.

Steps should be taken by the manufacturer to minimize the risk of scalding.

Potential Solutions:

- *Reduce excess water:* Remove excess water from the food minimizing the pooled water after the meal has been heated.
- *Plate rigidity:* Ensure that the plate is designed to be rigid along the axis spanning the plate grasp points. The plate should not deform under its own weight or while being carried.
- *Integrate grasp points into the plate:* Placing grasp point on either side of the plate would enable consumers to safely carry the plate and avoid spills.

Applicable Guidelines:

#3

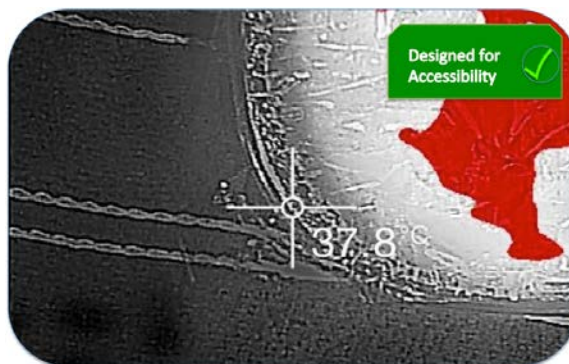
Grasp points shall not become too hot

The surface of the plate grasp points shall not exceed 41 degrees C after the PPM is prepared in the prescribed manner.

Ranking

Task Criticality: Critical

Safety Risk: High



#4

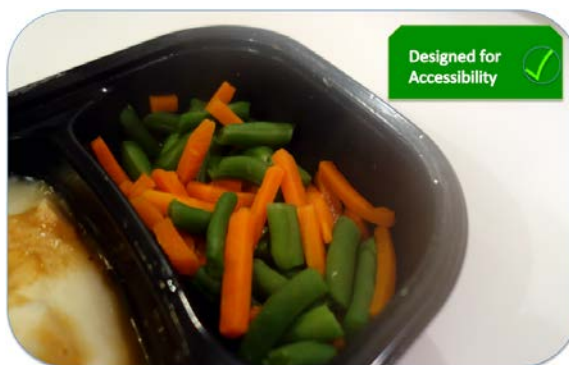
Eliminate excess water

Excess water shall be removed from the PPM. The plate shall be designed to minimize the risk of scalding due to a spill of excess fluid.

Ranking

Task Criticality: Moderate

Safety Risk: High



#11

Plate shall not deform or bend after heating

The plate material shall remain rigid during transport after heating. The plate shall not deform under the weight of the contents when being held by the grasp points.

Ranking

Task Criticality: Critical

Safety Risk: Medium



#13

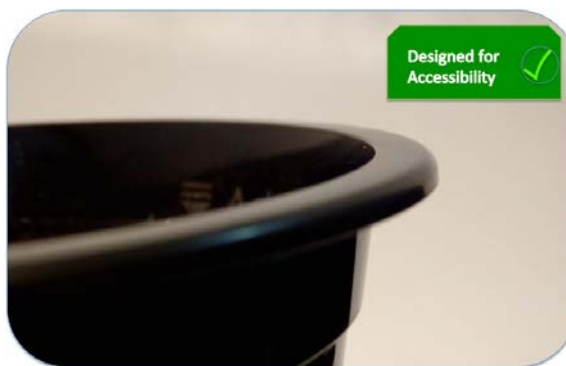
Avoid sharp edges

Sharp edges around the plate shall be avoided. If the plate is made of a paper material, steps shall be taken to minimize the likelihood of the user receiving a paper cut.

Ranking

Task Criticality: Moderate

Safety Risk: High



L. Plate Design Issue 3 of 9 – Grasp points too small

L. Plate Design Issue 3 of 9	Grasp points too small Grasp points may not be sufficiently sized or shaped to facilitate safe movement of a heated PPM.	
Ranking	Task Criticality: Critical	Safety Risk: High
Populations Impacted	Consumers, Food Service Workers	
Applicable Guidelines	2 - Plate grasp points shall be provided 13 - Avoid sharp edges	

Background: Food service workers will be required to handle and transport many heated PPMs at every meal. Consumers will need to occasionally re-position and move a heated PPM after delivery. Grasp points should be provided to facilitate safe transport of a heated PPM. Grasp point positioned on either side of the plate (see Figure 10) would allow consumers to safely transport the PPM without coming into contact with the heating portion of the plate.

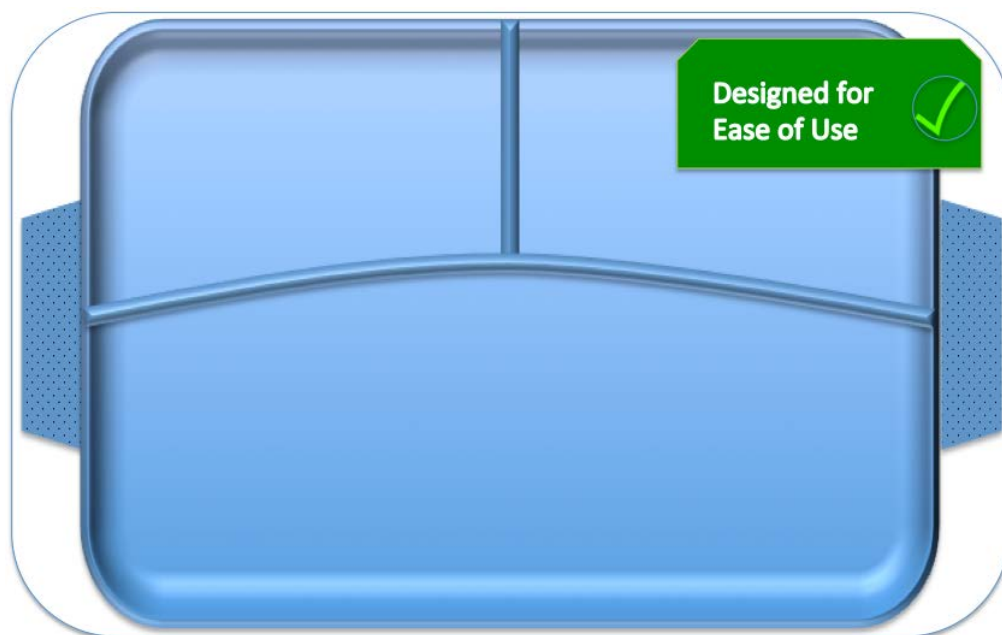


Figure 10: Illustration of grasp points positioned on the sides of the plate.

The grasp point should be textured to minimize slipping.

The plate below (see Figure 11) has a sharp edge along the rim of the plate. The edge could have been avoided by machining the edge or by rounding the edge. Sharp edges should be particularly avoided in patients that are at high risk for hospital-acquired infections.



Figure 11: Example of a plate with a sharp edge along the rim.

Sharp edges can make transporting the PPM difficult or may cause skin abrasions that may later become vectors for nosocomial infections.

Potential Solutions:

- *Integrate grasp points into the plate:* Placing grasp point on either side of the plate would enable consumers to safely carry the plate and avoid spills.
Eliminate sharp edges: Design rolled or blunt edges on and around the touch points to minimize discomfort while grasping the plate.

Applicable Guidelines:

#2

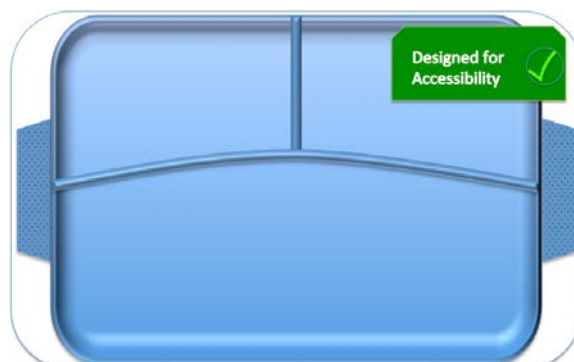
Plate grasp points shall be provided

A grasp point shall be positioned on each side of the plate so that the plate is balanced when carried. The grasp point shall extend away from the body of the plate by at least 10 mm and the grasp point shall be at least 30 mm in length.

Ranking

Task Criticality: Critical

Safety Risk: High



#13

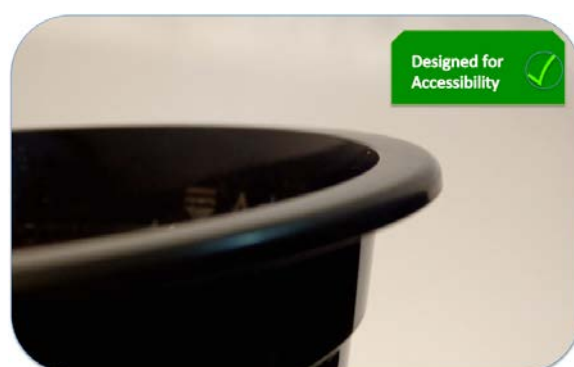
Avoid sharp edges

Sharp edges around the plate shall be avoided. If the plate is made of a paper material, steps shall be taken to minimize the likelihood of the user receiving a paper cut.

Ranking

Task Criticality: Moderate

Safety Risk: High



M. Plate Design Issue 4 of 9 – Grasp points too hot

M. Plate Design Issue 4 of 9	Grasp points too hot Grasp points may become hot during the heating process and may burn the person holding the plate.	
Ranking	Task Criticality: Critical	Safety Risk: High
Populations Impacted	Consumers, Food Service Workers	
Applicable Guidelines	<i>3 - Grasp points shall not become too hot</i> <i>4 - Eliminate excess water</i>	

Background: The PPM plate material may retain sufficient heat to burn the consumer. Some heating of the grasp points during the preparation process is to be expected. However, the average temperature of the grasp points should not exceed a safe handling temperature.

In the figure below (see Figure 12) the grasp point was clearly heated beyond a safe handling threshold. If a consumer were to transport the PPM by holding the grasp points then they could have

experienced tissue damage as a result in this example.



Figure 12: Image of PPM packaging handle that is too hot to safely handle.

The handle for the PPM should not exceed the pain threshold for the average adult consumer. Extra care may be necessary for children since their skin may be more susceptible to thermal damage.

Potential Solutions:

- *Select materials unlikely to retain heat:* Select grasp point materials that do not retain heat. Ensure that the material cools to a safe temperature before the plate is likely to be handled.

Applicable Guidelines:

#3

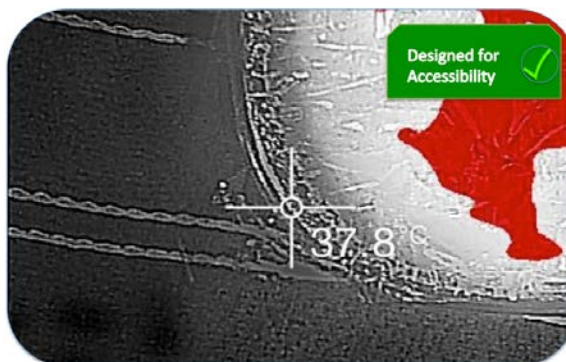
Grasp points shall not become too hot

The surface of the plate grasp points shall not exceed 41 degrees C after the PPM is prepared in the prescribed manner.

Ranking

Task Criticality: Critical

Safety Risk: High



#4

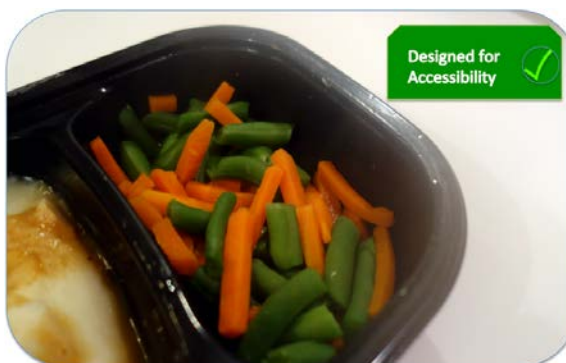
Eliminate excess water

Excess water shall be removed from the PPM. The plate shall be designed to minimize the risk of scalding due to a spill of excess fluid.

Ranking

Task Criticality: Moderate

Safety Risk: High



N. Plate Design Issue 5 of 9 – Lack of structural integrity causes burns

N. Plate Design Issue 5 of 9	<p>Lack of structural integrity causes burns</p> <p>Heating may cause increased pliability of the plate. The consumer may spill or drop the PPM, potentially causing injury, if the plate deforms during transfer.</p>
Ranking	<p>Task Criticality: Moderate Safety Risk: Medium</p>
Populations Impacted	<p>Consumers, Food Service Workers</p>
Applicable Guidelines	<p>4 - <i>Eliminate excess water</i></p> <p>11 - <i>Plate shall not deform or bend after heating</i></p>

Background: Heating may cause some materials used in the plate portion of the PPM to become pliable. Consumers moving the PPM may have difficulty because the plate is likely to bend or deform. The contents could spill or the PPM may be dropped. Loss of rigidity is especially a problem for plate designs that lack the structural features necessary to strengthen the plate.

In one of the products tested for this report, heating the plate according to the manufacturer's instructions caused the plate to buckle under its own weight (see Figure 13). In this particular case the condition was dangerous because the food product could have easily spilled causing severe burns by scalding. It is important to both select materials that maintain rigidity under heating conditions and add appropriate structural features design to reinforce the rigidity of the plate.



Figure 13: Image of plate losing rigidity after heating.

Potential Solutions:

- *Plate rigidity:* Ensure that the plate is designed to be rigid along the axis spanning the plate grasp points. The plate should not deform under its own weight or while being carried.
- *Reduce excess water:* Remove excess water from the food minimizing the pooled water after the meal has been heated.

Applicable Guidelines:

#4

Eliminate excess water

Excess water shall be removed from the PPM. The plate shall be designed to minimize the risk of scalding due to a spill of excess fluid.

Ranking

Task Criticality: Moderate

Safety Risk: High



#11

Plate shall not deform or bend after heating

The plate material shall remain rigid during transport after heating. The plate shall not deform under the weight of the contents when being held by the grasp points.

Ranking

Task Criticality: Critical

Safety Risk: Medium



O. Plate Design Issue 6 of 9 – Scraping causes food contaminants

O. Plate Design Issue 6 of 9	Scraping causes food contaminants Use of a utensil, such as a knife, to cut food items on the plate may scrape plate coatings or materials from the plate into the food. The consumer may accidentally consume the materials.	
Ranking	Task Criticality: Moderate	Safety Risk: Medium
Populations Impacted	Consumers	
Applicable Guidelines	15 - Plate coatings shall be steadfast	

Background: Moisture in the plated foods may saturate the plate. The abrasive use of utensils may cause some of the material coating the plate or the actual plate itself to enter the food. The plate material and coating should be resistant to the forces typically exerted by the consumer.

Potential Solutions:

- *Reduce excess water:* Remove excess water from the food minimizing the pooled water after the meal has been heated.
- *Scratch resistant plate materials:* Select a plate material unlikely to be scraped into the food during abrasion with common eating utensils.
- *Avoid unsafe coatings:* Avoid the use of unsafe plate coatings that might be scraped into the food during abrasion with common eating utensils.

Applicable Guidelines:

#15

Plate coatings shall be steadfast

The plate coatings or materials shall not be dislodged if scraped by eating utensils.

Ranking

Task Criticality: Critical

Safety Risk: Medium



P. Plate Design Issue 7 of 9 – Utensils puncture the plate

P. Plate Design Issue 7 of 9	Utensils puncture the plate A fork or other sharp utensil may puncture the plate causing the food to be contaminated or to leak.	
Ranking	Task Criticality: Minor	Safety Risk: Medium
Populations Impacted	Consumers	
Applicable Guidelines	14 - Plate shall resist puncture	

Background: Utensils such as a fork may puncture the plate causing the food product to be exposed to contamination or leak onto the table surface. A fork may pierce the plate as it is pushed into the plate to grasp a morsel.





Figure 14: Example of a plate scraped and punctured by a fork.

A knife may cut through the plate while slicing meat. The plate materials should be resistant to the forces typically exerted during consumption of the meal.

Potential Solutions:

- *Puncture resistant plate materials:* Select a plate material unlikely to be punctured with common eating utensils.
- *Reduce excess water:* Remove excess water from the food minimizing the pooled water after the meal has been heated.

Applicable Guidelines:

#14	<i>Plate shall resist puncture</i> The plate shall resist puncture from eating utensils.
Ranking	Task Criticality: Moderate Safety Risk: Medium
	

Q. Plate Design Issue 8 of 9 – Food difficult to extract

Q. Plate Design Issue 8 of 9	Food difficult to extract Consumers may have difficulty extracting the food products from the plate because of incompatibilities between the utensils and the shape and contours of the plate.	
Ranking	Task Criticality: Minor	Safety Risk: Low
Populations Impacted	Consumers	
Applicable Guidelines	14 - Plate shall resist puncture 15 - Plate coatings shall be steadfast 16 - Plate and eating utensils shall be compatible	

Background: The contours of the plate may not accommodate the complete extraction of the food items using the utensils preferred by the consumer. The consumer may have difficulty getting into sharp corners or non-rounded edges. Food may become trapped in ridges or decorative edges of the plate.

Potential Solutions:

- *Contoured compartments:* Design the plate compartments with rounded contours to facilitate food removal.
- *Eliminate decorative edges:* Eliminate decorative edges where food may be trapped and difficult to access with standard utensils.

Applicable Guidelines:

#14

Plate shall resist puncture

The plate shall resist puncture from eating utensils.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



#15

Plate coatings shall be steadfast

The plate coatings or materials shall not be dislodged if scraped by eating utensils.

Ranking

Task Criticality: Critical

Safety Risk: Medium



#16

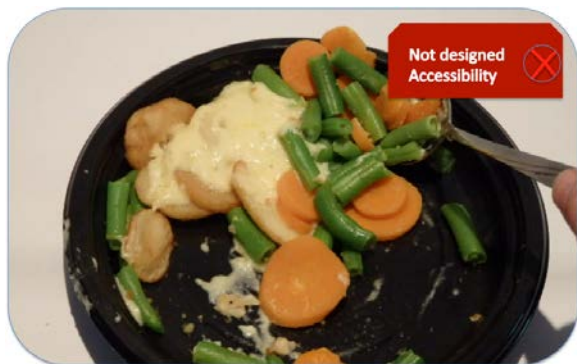
Plate and eating utensils shall be compatible

The plate contours shall be compatible with the eating utensils so that the consumer can easily extract all of the food from the plates.

Ranking

Task Criticality: Minor

Safety Risk: Low



R. Plate Design Issue 9 of 9 – Food may spill

Q. Plate Design Issue 9 of 9	Food may spill If the plate is too full, food may overflow. The consumer may cause the food to overflow potentially causing injury, while eating.	
Ranking	Task Criticality: Moderate	Safety Risk: Medium
Populations Impacted	Consumers	
Applicable Guidelines	26 - Plate shall have a sufficient sidewall	

Background: Adequate headspace on the sidewall is needed to prevent overflow while the consumer is carrying, stirring, or consuming the food. Overflow may spill onto the consumer cause an injury. Liquid may slosh during transport of the PPM causing scalding. The lack of empty sidewall may be particularly problematic if the plate is not fully rigid after heating.

In one of the products tested for this report, food was easily spilled from the plate because the contents of the plate were filled to the topmost surface (see Figure 13). In this particular case the condition was dangerous because the food product could have easily spilled causing severe burns by scalding.



Figure 15: Image of PPM where the food content is likely to overflow due to the lack of headspace on the sidewall of the plate.

Potential Solutions:

- *Plate sidewall:* Ensure that the plate is designed so that when filled to capacity 20 mm of sidewall is reserved to help prevent accidental overflow.
- *Reduce excess water:* Remove excess water from the food minimizing the pooled water after the meal has been heated.

Applicable Guidelines:

#26

Plate shall have a sufficient sidewall

The plate shall have 20 mm of empty sidewall to facilitate transport, stirring, or consumption without causing the food to overflow or spill from the plate.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



S. Labeling Issue 1 of 3 – Confusing labels

S. Labeling Issue 1 of 3	Confusing labels Some consumers with language limitations may have difficulty comprehending labels particularly if the labels use technical jargon.	
Ranking	Task Criticality: Moderate	Safety Risk: Medium
Populations Impacted	Consumers	
Applicable Guidelines	17 - Labels are readable and comprehensible by the consumer 27 - The packaging shall have a machine readable code (i.e. barcode) that enables traceability	

Background: Consumers with limited reading ability, consumers that do not read English, or consumers that speak English as a second language may have difficulty comprehending labels especially if they are technical in nature. Use of non-standard symbols, ambiguous abbreviations, and technical terms should be avoided. Symbols should be avoided unless the symbol is commonly recognized. Abbreviations are often ambiguous and difficult to comprehend. If abbreviations are used they should be familiar to the users and used consistently.

Potential Solutions:

- *Use plain language for labeling:* Use plain language for all information intended to be understood by the consumer.
- *Use effective illustrations:* Illustrations may be an effective way to communicate information independent of language issues. Test illustrations with consumers that are representative of the target populations to ensure that they communicate the desired information.

Applicable Guidelines:

#17

Labels are readable and comprehensible by the consumer

All labels on the PPM as delivered to the consumer shall be readable and comprehensible by the consumer. Avoid ambiguous labels such as uncommon symbols, unfamiliar abbreviations, or uncommon technical terms.

Ranking

Task Criticality: Critical

Safety Risk: Medium



#27

The packaging shall have a GS1 compliant machine readable code (i.e. barcode)

A machine readable code which includes identifiers which allow any trade item/product to be quickly and efficiently tracked and/or traced across the supply chain and help locate stock with product recalls. Barcodes assist in providing business intelligence & communication amongst trade partners. Identifiers can include ingredients, nutritional information, preparation and storage information. Identifiers can aid food safety by containing allergy statements, expiry dates, and microbiological data and ideally be scanned by consumers using mobile phones etc.

Ranking

Task Criticality: High

Safety Risk: High



T. Labeling Issue 2 of 3 – Labeling legibility

T. Labeling Issue 2 of 3	Labeling legibility The consumer may not be able to identify critical information.
Ranking	Task Criticality: Moderate Safety Risk: Medium
Populations Impacted	Consumers
Applicable Guidelines	<i>18 - Critical text shall be legible</i> <i>19 - Critical text shall be sufficiently sized</i> <i>27 - The packaging shall have a machine readable code (i.e. barcode) that enables traceability</i>

Background: Critical information should be legible. Packaging solutions that are to be opened in low or no illumination must be designed for that environment in order to be easy to use. The font size should be based on the expected viewing distance. The Human Factors Design Standard (HFDS) recommends that the height of characters occupy a visual angle of 16 to 24 minutes of arc. Visual angle is the angle a viewed object subtends at the eye. The perceived size of an object depends on the physical size of the object as well as the distance the observer is from the object. As a person moves away from an object, the object will subtend a smaller and smaller visual angle. If the person is stationary and the object grows in size, the object will subtend a larger and larger visual angle. The minimum size of an object is expressed in terms of a visual angle to account for the distance between the user and the object. For example, a 12 point font is fine for a printed book but would be too small to be read on a billboard.

To compute the character height, use the following formula:

$$h = 2d \tan(x/2)$$

The variable “h” is the character height, “d” is the viewing distance, and “x” is the desired visual angle in radians. One radian equals 3437.747 arc minutes. Divide the visual angle in arc minutes by 3437.747 to obtain the visual angle in radians.

Potential Solutions:

- *Use high contrast labels:* Ensure that all critical information is printed in a high contrast.
- *Use large font sizes:* Ensure that all critical information is printed using a large font.
- *Ensure labels are printed against a solid background:* Labels printed on a translucent film with a varied background can be difficult to read particularly in low light situations.

Applicable Guidelines:

#18

Critical text shall be legible

Enhance legibility and comprehension of labels, critical instructions, and expiration dates. Print critical text with large print in a sans-serif font with high contrast on a solid background. Select fonts that have been designed for enhanced legibility for those with limited vision.

Source: American Printing House for the Blind, Inc.; Canadian National Institute for the Blind

Ranking

Task Criticality: Moderate

Safety Risk: Medium



#19

Critical text shall be sufficiently sized

The recommended minimum type size is 12 point (4.25 mm), especially for warnings, expiry dates and instructions. For small packaging or portion control items with a surface area of less than 100 cm², then the minimum type size is 9 point (3.17 mm).

Source: American Printing House for the Blind, Inc.; Canadian National Institute for the Blind

Ranking

Task Criticality: Critical

Safety Risk: Medium



#27

The packaging shall have a GS1 compliant machine readable code (i.e. barcode)

A machine readable code which includes identifiers which allow any trade item/product to be quickly and efficiently tracked and/or traced across the supply chain and help locate stock with product recalls. Barcodes assist in providing business intelligence & communication amongst trade partners. Identifiers can include ingredients, nutritional information, preparation and storage information. Identifiers can aid food safety by containing allergy statements, expiry dates, and microbiological data and ideally be scanned by consumers using mobile phones etc.

Ranking

Task Criticality: High

Safety Risk: High



U. Labeling Issue 3 of 3 – Labeling readability

U. Labeling Issue 3 of 3	Labeling readability Poor labeling may not communicate critical information such as directions and warnings.
Ranking	Task Criticality: Critical Safety Risk: Medium
Populations Impacted	Consumers, Food Service Workers
Applicable Guidelines	17 - <i>Labels are readable and comprehensible</i> 20 - <i>Mixed case shall be used on long lines of text</i> 21 - <i>Expiry data format shall be easy to understand</i> 22 - <i>The label and the actual expiry date shall be in close proximity</i> 23 - <i>The expiry date shall be distinct from the lot number</i> 27 - <i>The packaging shall have a machine readable code (i.e. barcode) that enables traceability</i>

Background: Critical information such as 1) the contents of the PPM, 2) the presence of allergens, and 3) the expiration date of the meal must be presented in a clear and easy to read manner. Poor labeling can make it difficult to locate and read critical information.

Potential Solutions:

- *Use high contrast labels:* Ensure that all critical information is printed in a high contrast.
- *Use large font sizes:* Ensure that all critical information is printed using a large font.
- *Ensure labels are printed against a solid background:* Labels printed on a translucent film with a varied background can be difficult to read particularly in low light situations.

Applicable Guidelines:

#17

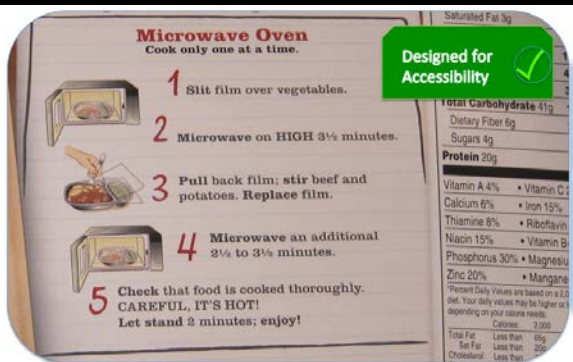
Labels are readable and comprehensible

All labels on the PPM as delivered to the consumer shall be readable and comprehensible by the consumer. Avoid ambiguous labels such as uncommon symbols, unfamiliar abbreviations, or uncommon technical terms.

Ranking

Task Criticality: Critical

Safety Risk: Medium



#20

Mixed case shall be used on long lines of text

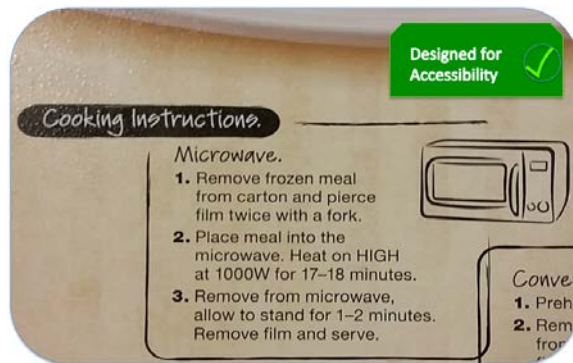
Avoid all capital letters on long lines of text. Lower case text is easier to read, especially if the text is several lines long, so avoid using text consisting entirely of capital letters. The height of and spacing between letters should not be modified.

Source: American Printing House for the Blind, Inc.; Canadian National Institute for the Blind

Ranking

Task Criticality: Minor

Safety Risk: Low



#21

Expiry data format shall be easy to understand

Expiry or best before dates should be formatted in such a way that the day, month and year are distinct from each other. Use the four digit format for the year and at least three letters for the month (e.g., JAN for January).

Ranking

Task Criticality: Minor

Safety Risk: Medium



#22

The label and the actual expiry date shall be in close proximity

A label identifying the date as an expiry or best before date (i.e. best if used by) should be provided in close proximity to the actual date.

Ranking

Task Criticality: Moderate

Safety Risk: Medium



#23

The expiry date shall be distinct from the lot number

To avoid confusion, the label and date should be visually distinct from the lot number. This can be accomplished by placing the label and date on the same line or with white space so that the date is closer to its label than it is to the lot number.

Ranking

Task Criticality: Minor

Safety Risk: Low



#27

The packaging shall have GS1 compliant machine readable code (i.e. barcode)

A machine readable code which includes identifiers which allow any trade item/product to be quickly and efficiently tracked and/or traced across the supply chain and help locate stock with product recalls. Barcodes assist in providing business intelligence & communication amongst trade partners. Identifiers can include ingredients, nutritional information, preparation and storage information. Identifiers can aid food safety by containing allergy statements, expiry dates, and microbiological data and ideally be scanned by consumers using mobile phones etc.

Ranking

Task Criticality: High

Safety Risk: High



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