



final report

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Introduction

The Packaging Toolkit is a guide to assist you in dealing with packaging within your organisation whether this is from the inception stage or an up-dating of an existing pack.

It provides an outline of the factors which need to be considered in contemplating or introducing a new pack in a step-wise progression. Equally it can be used to review an existing pack with the aim of updating or modification.

THE PACKAGING BRIEF

The first requirement is the development of a packaging brief to record the development and progress leading to the selection of a pack(s) and to itemize at each stage the key information. This Toolkit can also be used at intermediate stages as a check list of items and the data that needs to be covered.

The first stage in any development is examine the current market to provide a benchmark against which targets can be set.

The Market

Whether it be a new product or an existing product in a new pack, some examination and assessment of the market is essential. The information required includes the following

Total Size - Volume and Value.

It is desirable to have some concept of the market size in terms of value and the volume. Furthermore are there any perceptible trends, for example the growth of ready prepared meals (HMR – Home Meal replacements). In some cases a referral to other criteria can prove valuable. For example the growth in refrigerators in the 1960 led to the introduction of frozen foods, coupled with the growth in television sets this extended into TV dinners. Currently microwave ovens are incorporating grill systems and can also operate as convection ovens thus increasing their flexibility of use in the kitchen

Brand Fragmentation

In the case of branded products some indication of brand share is a valuable guide. Who is the brand leader; how much shelf space do they occupy? What part does their packaging and promotional activity play and how far are these interrelated. Who is the competition? Is the product regional? Is the product seasonal?

Product Outlets

Is the product intended for sale in specialist or retail stores as opposed to supermarkets? If it is the latter then it is likely that the product will be required to be packaged and delivered in a specific pack type/presentation e.g shelf ready. Details of pack requirements are available from the principal supermarkets.

Consumer Profile

Which sector of the consumer market is your project aimed at? Is it a commodity based, low cost, or a niche product? With the growth of gourmet/ upmarket shopping centres or 'shopping villages' the opportunity of premium products has increased. Commonly in areas of higher income professionals and business people demand for 'quality' products is on the increase. Such locations are to be found in major conurbations are becoming more apparent in the larger apartment block areas where ease of access to food outlets is growing.

The Product

Is the product new to the market or is it an extension to an existing line? Alternatively is their perceived need to update the brand or project an updated image.

Existing Line

In the case of existing lines, data such as description and usage; frequency of purchases; sizes; costs; prices etc provide valuable information in developing the pack concept. The opportunity to use new style packaging, for example a shift to pouches from cans or paperboard containers can mean a wholesale changeover to an entirely new production line. Equally a change to an existing line may also provide an opportunity for rebranding and to bring a family of products together with one cohesive image.

New Line

In the development of a new line, examination of similar products can provide useful information. Many companies recognise the opportunity to develop "me-too" products. With the initial development of a new market the initiator will have done much of hard work in the development stage in terms of product acceptance.

The approach to the introduction of a new product will be influenced by company size and the resources which can be allocated. In the case of small individual operators this aspect of the operation can be kept under control. However medium sized operators may find that whilst a product is attractive to a supermarket chain pack specifications, logistics, volume, distribution etc can become major hurdles. If volume is a major consideration then a strategic relationship with a larger organisation in order to access suitable resources for manufacturing under licence or some other contractual agreement might be necessary.

It is worth noting that the life cycle of new products in the food industry can be very short. There is a relentless demand for new products or new versions of old products. Relatively few products progress to commodity status in which case only the brand leader and possibly a follower can realize good returns in the longer term.

Competition

It is important to know the scene in respect to the competition. What does your product offer which is different to the opposition? How does the packaging contribute in differentiating your product? Is it quality, presentation, cost, convenience, or simply a pack that says "buy me"? It is important to identify what are the key features which you believe will give you a competitive edge and how they might be best presented. We know from many studies that you have to gain the customers attention and that in the case of familiar products this amounts to 2.5 seconds. Many food products involve direct eye contact with the food. Thus in the case of fresh meat the consumer will want to see the

meat at least in part. To this extent coverage of fresh meat by banding or labels should be approached with caution. Replacing the product with a picture either entirely or in part can be counterproductive if the two are not complementary.

Distribution and Retailing

In respect to distribution is this local, regional, national? What type of outlets will be taking the product, wholesale, retail? Will sales be by counter or self service? What type of distribution is envisaged? Will it be company owned vehicles or by contracted transport? Any bulk packaging will need to be considered carefully particularly if multiple handling is involved. Will automated handling be involved and if so does this raise any specific requirements. Factors such as the location of bar codes are well known. Specifically requirements such as temperature during distribution become critical if product is to arrive in pristine condition.

Advertising & Promotion

How is the product to be promoted? Will there be an advertising campaign, if so, what media will used? If a promotion is planned what form will this take? Do you contemplate using bonusing in order to 'kick start' sales? Are there to be "tear-off coupons" or special offers? Will you consider in-store promotion with free samples for tasting by consumers?

How will you collect and use the information?

Test Market

In order to test the product concept do you intend to test market? If so will this be through limited outlets? Will it cover the spectrum of end users in terms of socio-economic groups; market sector? How will you recover the data? It is not uncommon in the case of larger organisations to use limited TV or newspaper coverage in a geographically defined area in order to assess consumer acceptance.

TECHNICAL CONSIDERATIONS

Pre-eminent in considering packaging requirements there are a number of key aspects to be considered these are: -

- i. Product characteristics
- ii. Packaging requirements
- iii. Production facilities
- iv. Legal requirements

Product Characteristics

It is essential in developing a packaging brief to have a clear and comprehensive picture of the product and the expectations in respect to shelf life, presentation etc in order to arrive at a satisfactory pack.

In the case of meat there are a number of possible product types ranging from carcase to primals to case and shelf packs. With respect to manufactured and processed meats the range is even more extensive. The features which have to be quantified are as follows

1. Product size and weight.

2. Projected shelf life
3. Package function
 - a. Bulk pack
 - b. Transit pack
 - c. Retail pack
4. Distribution requirements
 - a. Regional
 - b. National
 - c. Export
5. Legislative and Regulatory Requirements

Each of these factors require further examination;-

1. Product size and weight.

Bulk Packs

In the case of bulk packs the well established “boxed beef” presentation provide for the carcass to be subdivided ,vacuum packed and contained in corrugated board box. This system provides for minimal weight loss, retention of colour and quality.

A recent development is the “mother bag” concept which involves the individual packaging of carcass components which are then placed in a larger outer bag and the atmosphere modified using selected gas mixtures. The mother bags allow for extended storage and provide for ease of stock control.

Transit packs

The current trend is towards the use of collapsible plastic crates. These come in a range of sizes and are hygienic in terms of the materials and the design. Automated systems for handling crates on a large scale are emerging on the packaging scene.

Weight factors

The need to observe the weight restrictions for lifting determined by Occupational Health and Safety (O.H. & S.) legislation need to be borne in mind, particularly where manual handling is likely.

Retail packs

So called “case or shelf ready” packs spearhead the retail sector. The range of design options is considerable and is addressed in detail under Pack Design. At the initial stage certain criteria need to be defined in order to brief the packaging designer and in the case of the major supermarkets these are already available to potential suppliers on application.

In terms of consumer requirements these can be identified as follows:-

1. Quantities, sizes and weights

These requirements can be approached in a number of ways, e.g.,

How many portions/servings are catered for in a range of packs? Is a family pack required? How many portions/weight are needed for a single person?

Is the product to be sold on a portion and/or weight basis?

How will these packs convey value for money? Will this be a design factor?

2.Product visibility

The customer will want to pick up and examine the product prior to purchase. This should be considered in the design.

3.Ease of opening (and reclosing)

There is considerable focus on ease of opening and any difficulty simply results in a reluctance to purchase and usually adverse comments. Can the pack be opened easily, and does it take account of people who may have some physical impairment?

In the case of a reclosable pack is the reclosure adequate to prevent incidental contamination and simple to use? Many of the reclosure problems are traceable to poor attention to perforations on packs which are easily cured by proper attention to perforators on the cartoning machine.

4.Environmental considerations

Factors which need to be considered are

- i. Disposability
- ii. Recyclability
- iii. Overpackaging

Is the company a signatory to the National Packaging Covenant? If so has account been taken of the packaging material minimisation requirements? Keep in mind that once the outer has been removed from a retail pack it undergoes change in the eye of the purchaser and becomes waste. This is followed by a judgement abused on the ratio of packaging to the product

Product Requirements

In terms of product requirements a number of factors have to be considered:-

- i. compatibility
- ii. deterioration factors
- iii. shelf life
- iv. protection requirements

Compatibility

The first requirement is that the packaging material shall be compatible with the product. There should be no migration from the packaging material to the product. Plastic materials in direct contact with the product should meet the requirements of FDA 121 CFR174 Equally there should be no unintended migration from the product to the packaging material, a process referred to as “scalping”. In the case of meat and meat products the use of absorbent pads to absorb exudates is a specific requirement. Within the EU there are specific regulations in respect to migration from packaging materials in contact with food products and exporters should be aware of these requirements

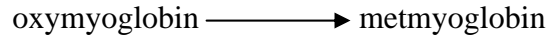
Purchaser-Qualitative Factors.

In the case of fresh meat and the purchaser the first recognisable indicator in terms of product quality is colour. As a general guide to colour the perceived requirements for meats are:-

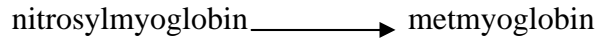
- i. beef –cherry red
- ii. lamb –brick red
- iii. pork and chicken-uniform pink

Taylor 1996) (

Over time and depending on the storage conditions the colour of fresh meat will change from cherry red to a brown colour



In the case of cured meats, the colour is stable in the absence of oxygen, as in the case with vacuum packaging, but once exposed to oxygen the change can be quite rapid



It is worth noting that light can have an effect and cured meats can change in retail display cabinets due to the susceptibility of nitrosylmyoglobin. This can be minimised by vacuum or gas packaging.

These factors are important in terms of the presentation to the consumer and need to be considered carefully in the selection of packaging materials.

The second factor to be aware of is smell and whilst fresh meat may be pre-wrapped thus preventing the consumer from making this immediate assessment, it is nevertheless a factor to be borne in mind. Films which allow the escape of volatile odour compounds do not present a serious problem. However in the case of packs where the internal atmosphere is predetermined, as in the case of Modified Atmosphere Packaging (MAP) a build-up of odours can occur and can be detected. The problem is exacerbated in the case of comminuted products due to the increase in surface area. In the use of MAP high levels of oxygen in oxygen/carbon dioxide mixtures have been implicated in this type of flavour deterioration.

It is important to keep a sense of perspective in respect to deterioration factors and keep in mind that a strict regime of temperature control, is essential, if products are to be displayed for sale in a pristine condition. Packaging has its limitations and external atmospheric factors play a major role in the life of the product.

Shelf Life

The issue of shelf life is complex and is dependent on a wide range of factors. ‘Shelf Life’ has been defined by a number of sources the basic principles are best articulated by the following:

Shelf Life is the period of time during which the food product will:

- a) remain safe;
- b) be certain to retain desired sensory, chemical, physical and microbiological characteristics;
- c) comply with any label declaration of nutrition data;

when stored under the recommended conditions.

In arriving at this statement it is important to recognise that it is inclusive of all the components of the chain from the point of departure from the farm through to the point of consumption. Whilst the packaging operation is an important and crucial

factor events leading up to this point are just as important as the packaging its subsequent passage to the consumers plate.

Insofar as meat and meat products are concerned the hygiene, processing, handling, storage conditions etc. are crucial in ensuring that the consumer receives the product in the best possible condition. Laxity or non compliance at ANY stage can lead to product deterioration.

Current thinking is towards product traceability back to the farm and increasingly the move is towards expectation by consumers that this information can be readily accessed and at the point of retailing.

Protection Requirements

The protection required in terms of packaging needs to be considered from the perspective of the entire chain through which the pack will pass. Damage can occur at numerous points and the pack needs to be sufficiently robust to withstand a number of different handling processes.

With a continuing shift to robotic handling there are changing requirements in terms of pack structure. That is not to suggest that these are critical, but it is advisable to have some overview of the handling operations which the pack is likely to experience. It is especially important to understand the handling operations at the retail locations where the handling on unit packs is pre-eminent.

The hazards to which a pack can be exposed during the distribution operation can be assessed by three principal methods

- i. observation (inspection prior to and at the end of the journey)
- ii. hidden cameras
- iii. instrumentation e.g. shock recorders

In the case of instrumental techniques these can range from the use of vibration tables for palletised loads with simulated journey patterns to the use of small shock recorders. The use of instrumental methods has to be considered carefully taking into account the nature of the distribution system the distance to be traveled and the type of pack requiring assessment. In the case of robust products such as meat a careful examination of packs at the retail outlet will determine whether any problems have to be addressed. Physical damage, pack crushing, deformation, puncturing and disturbance of the contents can be readily detected.

Shelf ready packs need to be in first class condition. Aside from the store requirements consumers are averse to pick up a pack which clearly shows signs of handling i.e. a pack which has slight creasing, or wrinkles on an otherwise perfect surface. For the purchaser such marks can suggest that there is something wrong with the product, even though this may not be the case. It may also be a requirement of any contractual agreement as to the minimal number of packs showing damage before the invocation of penalties.

It is important to consider the secondary, tertiary or transit packs to provide protection from the elements. This will be influenced by the distance from the processor to the retailing point. Similarly the use of refrigerated distribution will need to be taken into account in terms of protection.

Production Facilities

A major consideration is the provision of packaging facilities and it can be critical in terms of timelines. Whilst the packaging materials can be obtained within a matter of weeks, the acquisition of new machinery is a different matter. In the case of large scale lines using automated case packers it is likely to be a matter of months which in the case of large imported installations may be a year or more

The issue of delivery can result in alternative equipment being sought in order to meet a marketing launch. This in turn can have a 'knock-on' effect in terms of layouts, ancillary equipment etc. In the case of high speed and automated lines the packaging material specifications must be taken into account. As line speeds increase so does the need to work to smaller tolerances in respect to the packaging material. It is not uncommon for problems to occur because of conflicts between a retail pack material's physical properties and the requirements of the packaging machinery. The correct marriage of these two components is important if smooth running leading to maximum efficiency is to be achieved.

The installation of a new custom built line is not a common event and it is more likely that existing plant will be used, possibly incorporating some new equipment. In this case this can result in a mismatch in speeds between different stages in the overall line. The slowest machine will dictate the overall line speed.

In a small number of instances a more radical approach may be taken with the introduction of new processes and technology. A good example is the use of in-package pasteurisation. Temperature ranges from 70-96 °C and a holding time of 30 seconds to 10 minutes.

In such cases it is important to obtain a thorough assessment of the complete line. This is best achieved by visiting existing installations and seeing lines in operation wherever possible.. The next stage is to try and have your product put through the line on a trial basis. This can be an expensive operation, but does provide reassurance and in particular the opportunity to see the impact on ancillary services which are necessary. Ancillary services such as the provision of materials and services to the line, the space and energy requirements necessary down to staffing levels can be assessed in this way. Finally it may be possible to provide some on-line experience where a new and sophisticated plant is proposed.

The introduction of new developments is more common with the use of some old and some new/secondhand plant. Clearly from a financial perspective, risk has to be minimised particularly where a completely new product concept is to be introduced. Compromise will be a key requirement in terms of layout, line speeds etc and it is important to recognise this at the outset.

Reference should be made to **Boning Room Layout in Packaging (PPI) MLA - publication**

Other factors which may need to be considered are:

- i. are there any ties to existing suppliers;
- ii. are the new lines packaging material specific/sensitive or will they handle a range of materials?
- iii. checkweighing with statistical analysis;
- iv. labelling
- v. metal detection

- vi. bone fragment detection
- vii. collation
- viii. outerpackaging
- ix. palletisation

In selecting suppliers there are a number of major considerations which need to be kept in mind, these are summarised as follows.

Manufacturer or agency

Much of the equipment used in the food industry in Australia is manufactured overseas and distributed through local agents. This system, which works well, can impose some constraints. For example delivery may not be 'off the shelf' but subject to the suppliers own queue of orders. This can result in the delivery time being longer than anticipated. It may necessitate another supplier being selected as an alternative which in turn may result in some adjustments to the original line.

Equipment selection

In the process of equipment selection it is always valuable to be able to see a line or specific piece of equipment in operation furthermore, to be able to talk directly with the line operators. Remember suppliers don't live with their equipment in a production situation, line operators do! As a lot of equipment is now 'built' from standard components it is beneficial to see how far this relates to existing equipment within the existing production plant. Anything which can help to minimise the number of stock items is a bonus. A useful test is to examine the equipment manuals, are they clear; are they in English; are they thorough? Do they cover all the components or are these supplied with their own instructions (sometimes not in English).

Training

In the commissioning stages it is essential that training of your own staff takes place and this should include operators as well as maintenance staff. Be aware however that a pristine piece of equipment should run perfectly (when we purchase a motor car we expect it to operate first time and the same principle applies to a machine). Problems arise when plant has been running for some time more often than not this is due to a failure to keep the equipment properly maintained, poor cleaning and/or changes to the original pack. Keep in mind there are National Competency Standards for many operations which can be of value in staff training.

After sales service

Every plant engineer's nightmare is a breakdown which requires a spare part to be brought from overseas. As a first requirement it is important to establish what stocks of spares are available locally and the delivery times. In the case of servo-mechanical parts these are usually readily available locally. Similarly in the case of electronic components 'plug and play' is commonplace. However, when the problem is more complex, and an electronics specialist is required this can lead to delays.

Whilst these factors may seem basic and even pedantic, the expectation is that when a new piece of equipment is installed it will operate perfectly from the start and continue to do so. A stoppage in the first few weeks can be a severe embarrassment, particularly if this is the result of an oversight in the selection of the equipment.

Finally the installation of plant needs to be carefully planned. This may be no more than a simple placement of a machine or it can entail the gutting of a site involving a considerable upheaval affecting the whole of production. In either event the process requires planning and clear advice to departments which will be affected. In some cases the whole proposal may result in a turnkey operation on a clean site which obviates many of the difficulties outlined above.

Legal Requirements

In the case of products sold in Australia, each State has its own Trade Measurement Packaging Legislation and **reference should be made to the detailed requirements** when considering the pack design. As a general guide the following outlines are common to States and Territories.

Marking of the name and Address

In the case of pre-packed items the name and address of the packer or, the person on whose behalf the product was packed must appear on the pack. The markings must be:

- i. readily visible and legible;
- ii. enable the person ,company concerned to be identified and located;
- iii. an address in a State or Territory to which a legal notice or process can be served.

Weight

The pack must clearly indicate the net weight of the product and must be clearly and easily identifiable and readable.

It must be in the form of metric units printed or written in the English language.

It must be adjacent to or close to, and in the same direction/plane as any name or brand.

Character sizes

The characters must be clear and printed in a colour which is in a distinct contrast to any background colour. The minimum character height must comply with specific requirements in terms of pack size.

Handwritten measurement marking is permitted

- i. when the package is produced on the premises;
- ii. when the package contains a product which is unit priced.

Unit price marking _ retail sales

In the case of prepacked items in rigid containers e.g. case/shelf ready the package containing the product must be marked with the total price **and the** price per kilogram in addition to being marked with measurement of the product.

However this can be waived when the total price and the price per kilogram are clearly displayed on the or immediately next to the shelf or container in which the article is offered for sale in distinctive characters and in such a way as to be readily visible and easily read.

Alternatively the goods may be packed in predetermined constant quantities in which case the packer has identified all the packages of being of the same minimum quantity. In such cases the quantities are in the case of meat 100g. 125g. 150g. 200g. 250g. 500g. 1kg., and integral multiples of 1 kg.

Accredited AUS-MEAT suppliers have a well developed label system which uses objective descriptions and a common meat language. It is advisable that the legislative requirements should be checked carefully with the relevant State or Territory authority and the foregoing should only be taken as a guide.

Export

In the case of products to be exported there are a number of sources of information on export requirements viz;

- i. AQIS
- ii. Dept. of Trade
- iii. Individual consulates
- iv. Australian Trade commissioners in each country
- v. Institute of Export

Environmental legislation

Environmental legislation is now a common feature of many countries and there are over twenty countries with specific requirements in relation to packaging. The European Union is very large and complex with EU Directives which are then translated into specific regulations and requirements in each of the member countries. In 1994 the Directive on Packaging and Packaging Waste was adopted in the EU. Within the Appendix of that Directive are the Essential Waste Requirements for Packaging. Three requirements are identified:

- i. packaging weight and volume should be minimised to the amount needed for safety and acceptance of the packaged product.
- ii. Any noxious and other hazardous constituents in discarded packaging should have minimum impact on the environment.
- iii. Packaging should be suitable for reuse or for material recycling, energy recovery or composting

The current move is towards Extended Producer Responsibility particularly in the OECD countries. If introduced, and this seems likely, it will result in more stringent conditions for importers and their suppliers. It is always advisable if supplying an overseas agency to ensure of your obligations in respect to the packaging materials.

National Packaging Covenant

The National Packaging Covenant is now in its second version and together with the expanded guidelines needs to be considered if you are a manufacturer or supplier of processed product.

In the case of fresh meat it is clear that such packaging material which may come into contact with the product either intentionally or unintentionally would not be considered suitable for recovery or recycling. Whilst the Covenant is mute on this particular point the concern would clearly be of the risk of microbial contamination. In the case of processed products the packaging material **MAY** be considered suitable for recovery/recycling particularly in the case of cured products and authoritative advice should be sought if there is any doubt.

Distribution Requirements

The supply chain has a major influence on packaging selection and design and in the case of perishable products such as fresh meat the emphasis is not merely on protection against physical damage but also on the immediate environmental requirements. Secondary and tertiary packaging will have to endure humidity and low temperatures. In the case of chilled meat destined for export the requirements are laid down in the Australian Standard AS 3724-1994 (Amendment Jan. 1997) Fibreboard Boxes for the Export of Meat, Meat Products and Offal.

Reference should be made to Fibreboard Cartons for Chilled Meat in Packaging PPI MLA Publication.

With regard to the requirements for domestic consumption account has to be taken of the distribution network and of the customer's requirements. In the case of single bulk consignments for supermarkets these may not be as stringent as smaller outlets where more multiple manual handling may be involved. Distance is a significant factor and long distances can lead to compression of boxes particularly when in conjunction with high moisture levels. The effect of moisture increase on box compression strength, bending stiffness and edge crush can be considerable. These factors need to be taken into account in the design stages, fortunately box manufacturers are well versed in these requirements. It is important however not to cut corners in this important area and to ensure that the specification details the requirements and the testing procedures which are used in cases of dispute.

In developing the package requirements it is critical to have as much information as possible of the likely distribution network particularly in the case of a new line. In the case of large customers it is likely that their requirements will already be defined. With the move towards robotic handling the configuration and dimensions of unit packs is likely to be defined.

Pack Identification

The identification of packs is well established with the EAN system and bar coding. As this is a line-of-sight process the placement of the code etc will be very specific.

However **RFID (Radio Frequency Identification)** is now widely established and there are a growing number of commercial systems in use. RFID tags (transponder) are comprised of an integrated circuit which is linked to an antenna. The data is stored on the IC chip and is transmitted through the antenna.. There are two basic types of tag; passive or active in which they incorporate a small battery. Tags can be 'read only' or 'read and write'. They can be selective in which some information can be permanently embedded.

In the passive systems an RFID interrogator unit transmits a signal or generates an energy field which switches on the tag and provides power for the chip to transmit data. In the case of active systems a small battery helps to extend the transmitting range of the tag.

A more recent development is the 'smart label' which incorporates an RFID transponder with the antenna incorporated in the print which contains finely divided metallic particles.

Trays and Crates.

In the U.K Marks and Spencer introduced plastic returnable crates in 2001 with rewriteable tags attached supplied by Texas Instruments and for which a ten year life is claimed. These are backed up by Portal Multiscanners to Production Line Writing equipment which encodes the tags. Contents, display dates and other information is incorporated.

The micro chip has a number of advantages namely

- i. does not require line-of-sight scanning;
- ii. can carry a large amount of information;
- iii. can accept and give instructions

The range of RFID system standards are:

- i. Low Frequency- operating at 12-134 kHz with a reading range up to 500 mms;
- ii. High Frequency - operating at 13.56MHz with a reading range up to 1 meter;
- iii. Ultra High Frequency operate at several frequencies. In Europe 868 MHz in a band centred at 915 MHz and also 2.45 GHz. The read range is 1-3 metres
- iv. Dual Frequency- operating at 125 KHz and 7 MHz.

Power levels determine the read range.

- i. Europe- currently 5 watts but will change to 2 watts
- ii. USA and New Zealand - 4 watts
- iii. Australia currently 1 watt but may change to 4 watts
- iv. India -16 watts

N.B. Standing in a field of 4 watts a person will gradually get warmer

Factors to be aware of :

- i. RFID does not function well near water or metal (e.g. cans)
- ii. Readers are specific for RFID tags. Only two systems will read each others tags ALIEN and MATRIX
- iii. Barcodes can be read in conjunction with RFID systems

At this stage UHF is proving to be the most effective for pallets Tags are available in a variety of formats; as part of a label (smart label), ticket or be embedded in the packaging material.

RFID is supported by ISO 15693 and ISO 18000-3 standards together with the Electronic Product Code (EPC).

One of the principal benefits is the ability to read an entire make-up of pallets whilst facilitating at the other extreme the recall of product.

With regard to the use in retail environments e.g. supermarkets there are a number of issues which need to be considered:

- The need to avoid reading discarded tags
- Avoiding reading tags for goods from other shops
- Avoid the tags getting into food and being consumed
- Avoid shielding of tags and bypassing the checkout
- The need to read a number of tags simultaneously
- Public reaction to tags

Smart Labels

The move to smart labels RFID has been stimulated by the use of smaller and ultra thin antennas known as inlays. The next generation tags developed by Texas Instruments operate at 13.56 MHz.

Etched copper which is highly conductive is used for High Frequency tags whilst at Ultra High Frequencies antennas which are less conductive allow for the use of printed antennas made up of thin metal particles. The metal is carried in printing fluid. The next stage is to link the antenna to the chip.

In Japan fruit and vegetables are tagged and the consumer can use their mobile phone with an RFID reader to access the information about the produce.

Recall Requirements

An important feature which must not be overlooked is the need to trace packs in case of recall. It is a legal requirement under Chapter 3 of the Food Standards Code, Volume 2 (Food Standards Code) to have in place a written recall plan. The objective of the requirement is self explanatory but it should be considered carefully considered at an early stage of development.

Recalls can be very expensive and it is worth noting that insurance specifically covering recalls can be taken out. Normal product liability insurance in itself is not usually sufficient and it is prudent to seek specialist advice.

Pack Graphic Design

In considering the pack as in a case/shelf ready development the graphics need to be considered in conjunction with the above factors. Is the pack a new design or a redesign/updating?

As a product range extends, the opportunity to review the whole family of products is presented and this factor may need to be taken into account.

In looking at graphics the range of print opportunities is extensive. Flexography has now reached a sophisticated level and can be used in conjunction with a number of films. Computer to Plate and digital printing

Other factors to be taken into account include:

- i. size of available print area
- ii. no. of colours
- iii. print system ,e.g. digital, flexography etc.
- iv. promotional flashes
- v. space for price /weight details
- vi. bar code area
- vii. nutritional data
- viii. name & address

ix. multi-language requirements

It is important that other factors such as scuff resistance, ink bleed and the use of odour free materials are taken into account.

In the case of labels an additional requirement is the use of the correct adhesives for the environment in which the label will be located.

Project Timetable

In the introduction of a new system it is crucial from the time of inception to give due consideration to all the contributors to the project. Some components of the program can be easily developed whilst other items, often insignificant at first sight, can cause delays. The clearance of a site and the disruption to existing production needs to be properly programmed into the project. From a product aspect, continuity of supply of other products must not be hindered or impeded. These matters can only be effectively resolved by ensuring that everyone who should be involved is enlisted as part of the team.

The project can be logged on a simple Gant Chart used in conjunction with a Check list and which are given in the following pages. An example of the Gant chart is given at the end of the Check List

PRODUCT/PACK CONCEPT**Commercial Data**

<u>ITEM</u>	<u>REPORTED BY</u>	<u>TARGET DATE</u>
The Market		
Total Size –Volume and Value		
Brand Share Fragmentation		
Consumer Profile		

Product Brief

<u>ITEM</u>	<u>REPORTED BY</u>	<u>TARGET DATE</u>
New or existing product?		
If new, what is the competition?		
Distribution-local, regional, national?		
What advertising/ promotion is planned?		
If so, when will the results be known?		
Sales projections/patterns		

2.TECHNICAL CONSIDERATIONS**Product Characteristics**

<u>ITEM</u>	<u>REPORTED BY</u>	<u>TARGET DATE</u>
Product range of size/weights		
Shelf/case ready pack		
Returnable Crates		
Secondary packaging transit packs		
Tertiary packaging e.g bulk ,motherpacks		
Export, national, regional distribution		

Bulk Pack Requirements

<u>ITEM</u>	<u>REPORTED BY</u>	<u>TARGET DATE</u>
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Export or Home distribution.
Shrink or Vacuum pack?
Barrier properties
 Bone protection
Secondary pack
 Carton
 Motherbag

Retail Pack Requirements

ITEM	REPORTED BY	TARGET DATE
Retail packs-sizes ,weights, portions Shrink or vacuum pack? Post-Pack Pasteurisation Retort pouch Shelf/case ready Tray material, plastic, board? Ovenable/microwaveable? Absorbent pad required? Closure Vacuum/gas flush MAP? Sealing method Film characteristics Printed/clear film Opening features, peel tear? Storage-frozen/chilled? Environmental considerations Disposability Recyclable material Overpackaging Shelf life Projected shelf life		

Pack Design

ITEM	REPORTED BY	TARGET DATE
Pack design- new/existing/modified? Pack structure – dimensions, material(s).		

Material specifications
Decoration/printing/colour(s)
Legal requirements
Label- requirements/system
Suppliers-quotes
Availability/delivery dates
Pack proof rec'd & approved

Pack Graphics

ITEM	REPORTED BY	TARGET DATE
Legal requirements checked		
Proof checked & approved		
Prepress		
Final approval		

Production Facilities

ITEM	REPORTED BY	TARGET DATE
New or existing production line?		
Will existing line require additional equipment or modification?		
Any major alteration to building?		
What effect on current production?		
Projected layout		
Identification of equipment required		
Conveyors		
Tray/bag filling		
Filling –manual		
/automatic		
Vacuum/gas flushing		
Sealing system		
Check weighing		
Label printing/application		
Metal/bone detection		
Pack collation		
Secondary packaging		
Palletisation		
Access for pallet trucks or conveyors		
Ancillary equipment		
Tray/bag supply to machine		
Vacuum/ gas supply equipment		
Label printer/label supply		

Secondary pack supply	
Services	
Electricity	
Steam	
Compressed air	
Water	
Cleaning equipment	

Equipment selection & availability

ITEM	REPORTED BY	TARGET DATE
Review, recommend equipment/ supplier(s)		
Availability, delivery.		
Operator training.		

Equipment installation and plant modifications

ITEM	REPORTED BY	TARGET DATE
Site preparation		
Equipment installation/commissioning		

Distribution Requirements

ITEM	REPORTED BY	TARGET DATE
Regional, national, overseas		
Own transport, contracted		
Loading/unloading requirements		
Supermarket/ wholesaler delivery		

Project Review

ITEM	REPORTED BY	TARGET DATE
Progress Report		
Final review		

PACKAGING MATERIALS

PLASTICS

In considering the plastic materials used in packaging it is necessary to understand some of the terminology used.

Plastic films

Film thickness: this is an area in which different terminology is in use.

Mils

1 mil = 0.001 inch

Gauge

“Gauge “ is used for very thin films

100 gauge = 1 mil.

Micron (micrometer)

1 mil = 25.4µm.

The use of these terms varies from company to company.

Permeability: this is the rate at which various gases (oxygen, carbon dioxide) and water vapour will pass through a film of given thickness and area in a specified time (24hrs) and standard temperature and pressure. In the testing process there is a pressure differential across the film of 1 atmosphere (101.3 kPa).

It is easy to become confused over permeability's and to make comparisons particularly when suppliers may use slightly different terminology.

General properties: other properties are often cited in technical literature and are largely self explanatory. These include tensile and yield strength; burst strength; impact strength; tear strength; stiffness; flex resistance etc. Films used for vacuum and shrink packaging for example, need to have mechanical toughness, excellent gas barrier properties and paramount, a resistance to abrasion and puncture. These latter requirements are essential where the meat contains a bone.

Other factors which may be important in respect to packs are resistance to cold, light, heat and water absorption. It is important to be clear in defining the purpose for which the film is required and the conditions to which it will be exposed

Heat sealing and sealability: Heat Sealing is a process which produces hermetic seal which is critical if the product is to be vacuum packed or a modified gas atmosphere is to be introduced. Heat sealing gives a pleasing appearance to the pack and confers integrity. The pack itself can be used as the cooking vessel as in the case of Home Meal Replacements (HMR) The materials used for trays which are to be heat sealed are as follows :

PP	Polypropylene
C-PET	Crystallized polyester terephthalate
A-PET	Amorphous polyester terephthalate

PVC	Polyvinyl chloride
PS	Polystyrene
HIPS	High impact polystyrene
HDPE	High density polyethylene
	Aluminium foil
	Boards, ovenable, etc.

TRAY MATERIAL CHARACTERISTICS

MATERIAL	MICROWAVE OVENABLE	FREEZER	MAP	SURFACE PRINTING	COST ¹	OTHER FACTORS
<i>PP</i>	YES	YES	YES	YES	LOW	
<i>C-PET</i>	YES	YES	YES	NO	HIGH	
<i>A-PET</i>	NO	YES	YES	YES	MEDIUM	
<i>PVC</i>	NO	NO	YES*	YES	LOW	* Improved with PE coating
<i>PS</i>	NO	NO	NO	N/A	LOW	Wide colour range
<i>HIPS</i>	NO	YES	NO	YES	HIGH	Wide colour range
<i>HDPE</i>	NO	YES	YES	YES	HIGH	Limited colours
<i>AL FOIL CRINKLE WALL</i>	NO	YES	NO	NO	LOW	
<i>AL-FOIL SMOOTH WALL</i>	YES	YES	YES	NO	HIGH	Difficult to seal unless lacquered
<i>BOARD</i>	YES	YES	NO	YES	LOW	

Notes

1. Cost should be taken as a guide only

MATERIAL SELECTION

Microwaveable meals	PP; C-PET; Board
Ovenable Ready Meals	C-PET; Foil –smooth wall; Foil crinkle wall; Board
Meat	-A-PET; PVC; Foil-smoothwall.

LIDDING MATERIALS

Lidding materials can be either single films or laminates in their construction. In the case of single films an adhesive layer is necessary. Various adhesives are available including A-PET (used for high temperatures as in cooking); EVA (ethyl vinyl acetate) which is used solely for microwaveable products and PE.

Laminates are also used for lidding purposes.

The type of seal dictates the sealant layer that is whether it is weld or peel.

MATERIAL	ATTRIBUTES
PET	<i>Commonly used material and has maximum heat resistance</i>
	<i>Excellent clarity can be printed</i>
NYLON OPA Oriented polyamide	<i>Heat resistant up to 190 °C but has to be laminated to PE. It is resistant to tear, marginally opaque and can be printed</i>
OPP Oriented polypropylene	<i>Heat resistant up to 160 °C but has to be laminated to cast polypropylene. Can be printed.</i>
AL FOIL	<i>Available on a reel and/or pre-cut to the right size and shape.</i>
BOARD	<i>Normally pre-cut to the required size and shape.</i>

The sealability process itself is critical to the whole operation and care needs to be taken to make sure that the materials used are compatible and that the sealing unit is properly regulated and maintained. The following factors are critical to good quality seals:

- i. the temperature range of the heat sealing layer or the film;
- ii. the amount of hot tack (initial adhesion in a molten state);
- iii. the ease of release of the film from the sealing jaws;
- iv. the melt point/viscosity of the material;
- v. percentage shrinkage of the film during heat sealing;
- vi. the seal strength

The seal strengths can be achieved by modifying the sealant layer

Or

by varying the time , temperature and seal pressure during the sealing process.

Various seal strength include

Weld strength - the film cannot be peeled from the tray

Cold Peel - can be peeled away when film is cold

Cold weld/hot peel - film peels easily when then the tray has been heated

Machine behaviour: the behaviour of materials in different packaging machines needs to be kept in mind. Whilst this is not a widespread problem some materials do not run well on certain types or makes of packaging machine. It is always worthwhile trialing films if possible on the machine for which the film is intended.

Laminates; laminates are two or more films joined together either by dry bonding, adhesive or co-extrusion (fusion). The process results in a structure which combines the properties of each of the films and provides an optimal material for specific purposes. The range of laminates is extensive and it is important to be clear as to the protection and purpose for which the laminate is required

Coated films; coatings on films confer specific properties in the same way as laminates. They are used to provide heat sealing or barriers to oxygen and water vapour. The coatings are applied by spray, roller or dipping and can be as thin as 2 microns.

Barrier Properties of plastic materials typically used in the packaging of meat.

ROBERTS, R.A. (1990). An overview of packaging materials for MAP. Proc. Int. Conf. on Modified atmosphere Packaging, Stratford-upon Avon, UK.

MATERIAL (25 micron)	*OXYGEN TRANSMISSION	**WATER VAPOUR TRANSMISSION
EVA (ethyl vinyl acetate)	12,000	110-160
LPDE (low density polyethylene)	7,100	16-24
PC (polycarbonate)	4,300	180
PP (polypropylene)	3,000	10
PS (polystyrene)	2,500-5,000	110-160
HDPE (high density polyethylene)	2,100	6-8
Nylon 11 (polyamide)	350	60
PET (polyester terephthalate)	80	200
PVDC extrusion (Polyvinylidene chloride)	40	0.8-3.2
EVOH (ethyl vinyl alcohol)	0.8-3.4	24-120

*O₂ transmission rate (cc.m².day⁻¹.atm.O₂) 23°C; dry

**Water vapour transmission rate (g.m².day⁻¹) 38°C; 90% RH

RIGID, SEMI RIGID PLASTICS

With an increase in thickness plastics take on a different role as their structural properties become the main feature. The question of when a film becomes a sheet is largely academic as it varies between the different plastics, unplasticised PVC and polystyrene for example become rigid at thicknesses between 150-200 microns. Other plastics have to reach 250 microns before being classed as sheet materials.

Rigid/ semi rigid plastics; trays used in case/shelf ready situations are produced in a range of materials such as polypropylene, PS, EPS, PET, PVC, etc. Various combinations are used to meet specialist requirements such as PS/EVOH/PE used for Modified Atmosphere packaging.

BOARD

Board weight :

measured by weight per unit area, grammage g/m^2 or lbs/1000 ft^2

Board thickness: thickness can be expressed in gauge or caliper in microns or
mil (points) 1mil= 25.4 μm .

General properties: tensile strength stiffness, bending stiffness, compression strength and burst strength are all properties of board and/or corrugated board.

Boards may be coated or uncoated according to their intended use.

Boards can also be laminated and coated for use in freezer cabinets. Board is also available as ovenable container material.

Reference should be made to Fibreboard Cartons for Chilled Meat in Packaging PPI MLA Publication.

Australian Standard AS 3724-1994 (Amendment Jan. 1997) Fibreboard Boxes for the Export of Meat, Meat Products and Offal.

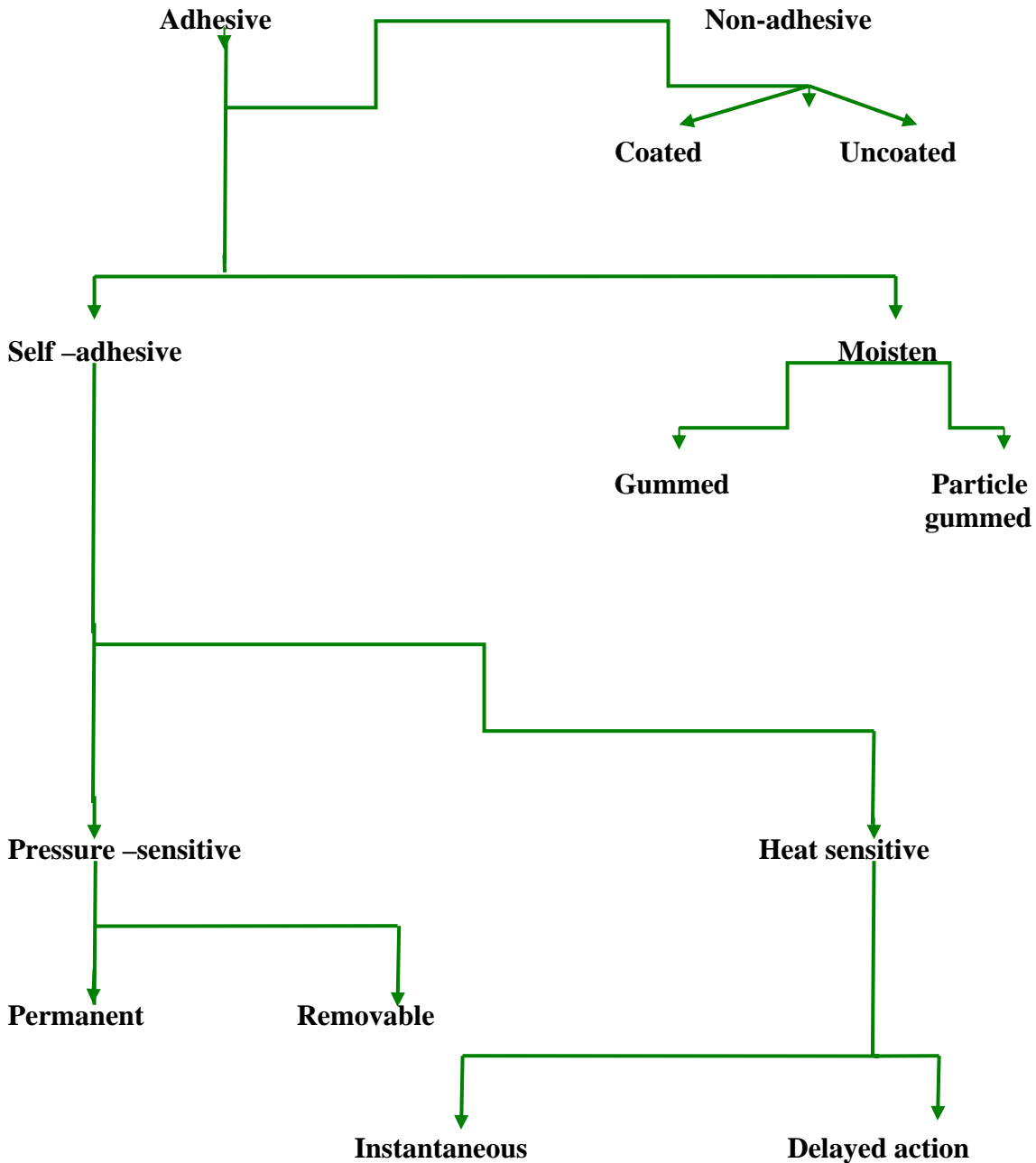
ALUMINIUM FOIL

Aluminium foil containers are used for Home Meal Replacements (HMR) and can be used both in conventional ovens as well as microwave ovens.

(Explanatory note: care needs to be taken to ensure that containers are placed in the centre of microwave ovens and that the volume of food is large in comparison to the container, in which case no arcing should occur)

General properties; aluminium can withstand extremes of temperature, have excellent heat transfer properties; high resistance to fats and mildly acidic products; can be coated; easily formed, and widely accepted. Can also be used in a paperboard/foil/plastic/laminate structure.

Label Types



In addition to the above shrink labels for rigid and semi-rigid containers are, in-mould embossing, tampon transfer, direct printing are all options to the basic label concept.

Labelling Machinery

There is a wide range of labelling machinery depending on the scale of the operation and the type of labels that are to be applied. These can range from small hand operated systems to in-line units which print and apply to the pack. With modern adhesives the emphasis is on pressure sensitive labels which facilitate application. The adhesives can ensure that the label cannot be removed without damage thus giving some support to tamper evidence.

AUSTRALIAN STANDARDS -PACKAGING

As 2400.6 1986 Paper and paperboard

AS 2400.14 1985 Adhesives

AS 2400.16 1986 Flexible packaging

AS 2400.17 1984 . Packaging in plastics containers

AS 2400.23.1 1984 Films for shrink wrapping

AS 2400.23.2 1984 Films for stretch wrapping

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