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All ages

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Unit operations in food manufacture

About the company

Evesham Foods started life in the 1940s as Richmond Sausage Company. It was later bought by the Lever group as part of Walls and, at that time, manufactured sausages, sausage rolls, pasties and pork pies.

Evesham foods have been part of the Northern Foods group since 1988. 93% of its products are made for Marks and Spencer (it is one of their dedicated factories) and 7% for Pork Farms. The company is expanding with major new product launches. It employs nearly 400 people which expanded to approximately 600 by December 2000 because Evesham produces fifteen product lines associated with winter party foods. Evesham is situated in a rural community, people care about the company they work for and the products they produce. Many have worked for Evesham for a long time and have considerable experience in making the products there.

Evesham Food's main areas of expertise are:

- Puff pastry
- Specialist pastries
- Top quality pastry fillings
- Quality, flexibility and value

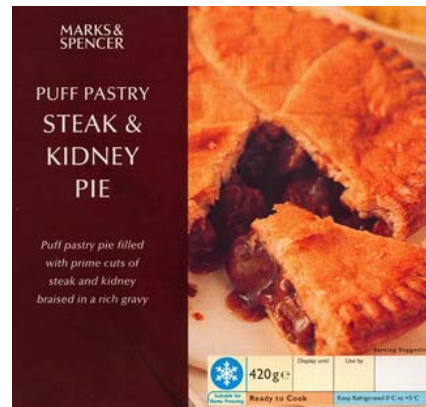
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About the product

Puff Pastry Steak and Kidney Pie

Evesham Foods is famous for its puff pastry and specialist pastries. Some products they make are produced in high volume by mainly automated processes. Other specialist products are made in lower volumes on flexible production lines, for example regional pies such as Butchers' style Scottish beef pies, Teviot pies, Devonshire pies.

Evesham Foods manufacture puff pastry Steak and Kidney Pies sold by Marks and Spencer. These are round pies filled with prime cuts of steak and kidney with rich gravy. These are sold as ready to bake pies in the chilled section.



The Pastry

The Steak and Kidney Pie is made using the Fritsch Pastry line. This is a fully automated batch laminating line for specialist rolls, pastries, party foods and puff pie pastry lids. They use it to produce French and Scottish methods pastries, to produce pastry pins or decorative lids. It gives a consistent crisp texture.

The Filling

Getting the right quality meat for the pie filling is very important. Evesham was the first company to supply beef to Marks and Spencer with full traceability back to the farm. Maturation is used to enhance the eating quality. The people who prepare and cook the meat fillings are very experienced and skilled in this area.

INGREDIENTS		
Water · Wheatflour · Beef (23%) · Vegetable Margarine (contains Emulsifier: E471) · Vegetable Shortening · Pork Kidney (11%) · Onion · Maize Starch · Salt · Pasteurised Egg Yolk · Gelling Agent: Gelatine · Tomato Puree · Vegetable Oil · Pepper · Malt Extract.		
CONTAINS		
Eggs, Wheat, Gluten.		
NUTRITION		
Typical Values	Per 100g	Per 210g 1/2 Pack
Energy	1130 kJ 270 kcal	2375 kJ 570 kcal
Protein	9.8 g	20.6 g
Carbohydrate of which sugars	22.2 g 1.9 g	46.6 g 4.0 g
Fat of which saturates	15.9 g 6.9 g	33.4 g 14.5 g
Fibre	1.1 g	2.3 g
Sodium	0.44 g	0.92 g
Equivalent as salt	1.1 g	2.3 g

COOKING, CARE & STORAGE			
Preheat oven. Remove carton. Remove product from foil. Place on a preheated baking tray.			
Oven	180°C Fan 160°C 350 F Gas 4		
	35 min		
Frozen	180°C Fan 160°C 350 F Gas 4		
	50 min		
Do not reheat.			
	Freeze on day of purchase. Use within one month.		
GUIDELINE DAILY AMOUNTS			
Recommended by nutrition professionals for average adults			
	Per 210g 1/2 Pack	Woman	Man
Calories	570	2000	2500
Fat g	33.4	70	95
Salt g	2.3	5	7

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About unit operations

A unit operation is a simple, specific, identifiable step, or stage, in the manufacture of a food product, egs. peeling, shredding, slicing, mixing, baking. Unit operations are grouped together to form the process, or system, by which the product will be manufactured. This represents a logical, sequential systematic. All food processing requires a combination of procedures to change raw materials into the final product. The combination and sequence of unit operations determines the final product.

Examples of groups of unit operations are:

- storage of raw materials
- sorting and grading
- mixing/combining
- heat transfer
- packing and labelling
- assembling, depositing
- storing and despatch of products



storing and transporting raw materials



weighing, sorting and grading



cooking (heat transfer)



assembling



mixing and combining



depositing

A sequence of unit operations is usually presented in the form of a flow chart to show the production process from delivery of raw materials to distribution of the finished product.

On a production line, food materials pass through a number of processes in sequence. Ingredients are introduced into the line at appropriate points and processed by machines or humans in a variety of ways egs. cooking, shaping, drying, and chilling. The product is then finished, assembled and packaged. During processing, food is treated in such a way that its nature and properties change according to what is being produced.

These treatments may:

- improve its eating quality
- create useful ingredients
- shape and form it
- preserve it

The following chart provides a general overview of different unit operations

Method of processing	Unit operations	Examples
Ambient Temperature Processing	Handling raw materials	Preparation of raw materials - sorting, grading, cleaning, peeling, shelling,
	Size reduction	Trimming, slicing, chopping, grinding, pulping
	Mixing, blending and combining	egs mixing ingredients for bread or biscuit dough, mixing diced vegetables
	Forming	egs shaping foods - such as chocolate, sweets, pasta
	Separating	Separating foods - egs squeezing juice, filtering, pressing
	Fermenting	Lactic acid fermentation - egs yoghurt production, pickles, cottage cheese

Processing by Applying Heat	Heat processing using steam or water	Alcohol fermentation - dough, drinks Pasteurising- milk, juices, syrups, bottling Sterilising - canned foods, UHT cartons Extrusion - snack foods, breakfast cereals Blanching - frozen vegetable production Concentrating - tomato puree, jamming, sauces syrups
	Heat processing using hot air	Baking - biscuits, cakes, bread Roasting - nuts Sun drying - tomatoes, apricots Artificial drying - onion rings, pears, herbs
	Heating by irradiated energy	Thawing out, defrosting fish, meat, butter and other fats Drying - crispbreads
	Heat processing using hot oil	Shallow frying - burgers Deep frying - snack foods, chips, samosas, doughnuts
Processing by Removing Heat	Chilling	Used for fresh foods - meat, fish, dairy products Cook-chill dishes or meals
	Controlled Atmosphere Storage (CAP) Modified Atmosphere Packaging (MAP)	Fruit and vegetables, salads, pasta, meat
	Freezing	Fresh produce - meat, fish, fruit and vegetables, ice cream Ready prepared produce - pastry, sausages, breaded fish, 3 rolls Cooked produce - pies, pastries
Post-processing Operations	Freeze drying and freeze concentration	Coffee and fruit juices
	Food finishing	Coating in cereal crumbs - Scotch eggs Enrobing in batters - fish, mushrooms, vegetables
	Packaging food	Protecting food Promoting food
	Finished product handling	Ordering, moving and storing

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About the manufacture

The production of Steak and Kidney Pie Filling

The following flow chart describes the unit operations for making the filling for a Puff Pastry Steak and Kidney Pie. This complex process is broken down into small steps, or unit operations. for each ingredient. The process starts with each ingredient arriving and being checked (intake), then stored, unpacked (de-boxed or de-bagged), prepared, cooked, blast chilled and stored ready for despatch.

The ingredients that you can follow step by step through the flow chart are:

- beef (muscle)
- tomato Puree
- seasoning
- kidney
- onion

Diced A muscle intake	Tomato puree intake	Seasoning bag intake	Diced kidney intake	Onion intake
A muscle storage 0-4 degrees C	transported	seasoning bag storage (ambient)	kidney storage 0-4 degrees C	diced onion storage 0-4 degrees C
transported to cookhouse	tomato puree storage (ambient)	transported to factory	transported to cookhouse	transported to cookhouse
debagged as required	de-boxed and de-bagged weighed as required	storage at ambient de-bagging	de-bagged as required	de-bagged as required
	transported to factory	water, seasonings & tomato puree added to cookpot and brought to boil		beef, onions and water cooked in separate copper until broken down
		ingredients combined beef and kidney added to cookpot and cooked until tender bulk reduced as required and starch cooked out decanted		
		blast chilled to 0-5 degrees C in 6 hours packaged and labelled		

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About issues and values

Foods have to be processed to make them into products, dishes or meals. This is the case whether food is prepared on a small scale in the home, or manufactured on a larger scale in industry. The processes used will

be, in most cases, quite similar. What differs is the scale of production.

Convenience is important to people in a society that values its spare time. This lifestyle change is the major factor that has led to the increase of mass-produced food. Manufacturing processes have improved greatly in recent years with the advancement of technology, resulting in products that may be close in quality to the 'home produced' equivalent. They may be nutritionally equivalent, or even superior, to the 'home made' version against which they may be judged.

However, there may also be a price to pay for convenience. Whilst a wide choice of processed foods brings many advantages to the consumer, it also introduces potential problems. For example, it is possible that a diet that relies heavily on highly processed foods and that is not balanced with plenty of high fibre foods, fruits and vegetables will have detrimental consequences for people's health. Some processed foods rely on the use of salt, sugar, fat and artificial additives to enhance flavour, texture or colour and to meet with the consumer's expectations.

It is, therefore, important for individuals to maintain a balanced diet overall, eg. over a week. Convenience and mass-produced foods can play a role in maintaining healthy lifestyles, so long as the diet also contains a good variety of fresh fruit and vegetables and is not over-reliant on foods high in fat, salt, refined sugar and low in fibre.

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Making use of the case study - things to think about and do

Using this case study for the following tasks will help to develop your understanding about:

- industrial practices - manufacturing and unit operations
 - food manufacture - techniques, processes and systems
 - values issues - the role of mass-produced foods in a balanced diet
- For a product that you are currently studying or developing, identify the unit operations from the delivery of the raw materials to distribution of the finished product. This could be presented as a flow chart making use of ICT.
 - Find out about one group of unit operations, such as cleaning, mixing and blending, or heat transfer. Describe the range of techniques used and explain why they are used for specific products.
 - Observe a range of frozen food products in a supermarket. Estimate the time taken to transport home, consider thawing, re-freezing and the effects on the eating qualities of the product. Find out about storage after manufacture egs. during distribution and at the supermarket.
 - Compare different types from one group of processed foods, eg, soups (fresh, dried and canned). Describe the different processing and evaluate the effects on the product's qualities.
 - Look at the table in the 'About unit operations' section of this case study. The chart is divided into four different types of unit operation.
 - ambient temperature processing
 - processing by applying heat
 - processing by removing heat
 - post processing operations

Choose one unit operation from each section, find out more about it and produce a summary with diagrams to explain this unit operation (approximately one side of A4).

- Find out what is meant by:
 - enrobing
 - extruding
 - conduction, convection and radiation
 - aeration
 - rotary moulding
 - grading

In each case provide examples of foods processed in these ways and illustrate to show the process and products. Use information sources including magazines, food packages or images from CD-ROM's or the Internet.

- Do mass-produced foods get a fair press? Investigate this issue and present a report of your findings from (a) the consumer's perspective and (b) the manufacturer's perspective.

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Further useful resources

'Design & Make it: Food Technology', Stanley Thornes, 1997, p52-53, p114-115
 'D&T Routes: Food', RCA, Hodder & Stoughton, 1997, p61
 'Advanced Manufacturing Design and Technology', Hodder and Stoughton, 2000, p67-170, p146-159,
 'Food Technology' Unit, British Nutrition Foundation, 1998, MAFF and www.nutrition.org.uk
 'Interactive CD-ROM' from BNF, Autumn 2000
 'Examining Food Technology', Anne Barnett, Heinemann, 1996, p18-20, p41-50
 'Food Technology', Collins Real World Technology series, Inglis, Plews & Chapman, p77-107
 'The Science & Technology of Foods', RK Proudlove, Forbes, 1994, p185-245
 'Mass Production of Food', Classroom Videos, 1998
www.Northern-Foods.co.uk
www.double-d.co.uk
www.ift.org
www.rimag.com/21/ops_ckch.htm
www.chilledfood.org

www.readymealsinfo.com
www.rbkc.gov.uk/foodhygieneandstandards

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