ENVIRONMENTAL
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BEST PRACTICE
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How to improve packing line efficiency in the food and drink industry

Could your company increase its profits by improving the efficiency of its packing lines?

This Information Leaflet outlines a step-by-step approach to improving packing line efficiency that can help companies make substantial savings by reducing waste on their packing lines.

This leaflet describes the significant cost savings and other benefits achieved by six UK companies that have investigated and improved the performance of their packing lines, by following a systematic method of improving packing line efficiency.

Inefficient packing lines cause many companies to lose as much as 4% of their product and packaging - a loss worth tens or hundreds of thousands of pounds a year depending on the product.

The benefits highlighted in the case studies featured in this leaflet include:

- savings of over £137 000/year from reduced operating costs and less wasted product;
- packing line stoppages reduced by 40%;
- savings of over £40 000/year from reduced reject rates and less packaging waste;
- savings of over £150 000/year from reduced reject rates;
- efficiency savings of £120 000/year;
- line availability increased by up to 10%.

If your company would like to discover how it could achieve similar savings, use the form on the back page to apply for the free Good Practice Guide that describes in detail how to make packing line savings.

Savings from Improved Packing Line Efficiency

Packing line efficiency is an important aspect of cost control in the food and drink industry. Poor design and operation of packing lines result in:

- waste of product and packing materials;
- lines operating well below capacity;
- excessive reworking of off-specification product;
- reduced production efficiency.

This waste of effort and materials costs money and reduces profits.

In some cases, companies may invest in new equipment to meet increasing product demand even when their existing equipment could have done the job if its efficiency had been improved.

Increasing packing line efficiency saves over £137 000/year

Poor packing line efficiency at a large brewery was limiting production capacity and creating high levels of rework. To reduce costs and increase capacity, teams were set up to measure packing line performance and identify problem areas.

Data obtained from monitoring keg and cask filling on a shift basis were used to compare the performance of individual packing lines and examine how different products and keg sizes affected efficiency. The teams then studied each line to identify the root causes of poor performance.

Actions to reduce planned and unplanned stoppages, and to reduce breakdowns became part of the brewery's continuous improvement programme and, eventually, normal working practice.

Increasing the efficiency of the packing line produced total savings of over £137 000/year from reduced operating costs of £90 000/year and less wasted product worth around £47 000/year. These savings made it easy to justify the management time spent setting up the performance monitoring systems.

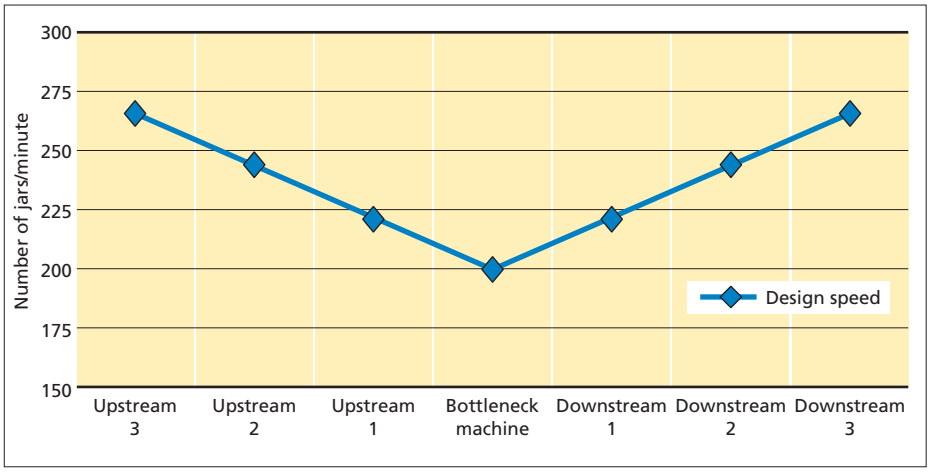
PRINCIPLES OF PACKING LINE DESIGN

A packing line is made up of individual machines performing specific operations to deliver the final packed product. Rather than just considering the line as the sum of its parts, it is important to ensure that individual machines are correctly specified so that they work together as part of an efficient overall design.

Each machine has a design speed, but the overall speed of the line cannot exceed the speed of the slowest machine - called the **bottleneck** machine for obvious reasons. The bottleneck machine should be the one considered for reasons of production, quality, cost, etc to be the most important to keep running as close to its maximum capacity as possible. To make sure the desired machine is the bottleneck, you need to deliberately specify a higher design speed for all the others. You also need to design the rest of the line to service the bottleneck machine and keep it running as constantly as possible - ideally it should never be starved of feedstock and never be stopped because of build-back. This means specifying the design speeds of each machine in the packing line in a 'v-shape' (as shown in a 'v-graph') and building in appropriate buffer capacity. Fig 1 shows the **v-graph** of design speeds for an example packing line.

The v-shape means that the conveyors between upstream machines have a tendency to fill up with items and those between downstream machines have a tendency to be relatively empty. Conveyors provide a limited amount of buffer capacity to help keep the bottleneck machine running if a breakdown or stoppage occurs elsewhere on the line. Some packing lines are designed with storage areas for materials - known as accumulators - between machines to give additional buffer capacity. Fig 2 shows a typical arrangement. However, accumulators will only keep the bottleneck machine supplied if the packing line has the correct v-shape, ie the upstream machine can run faster than the bottleneck machine.

Fig 1 Example v-graph



V-graph reveals problem with coding machine

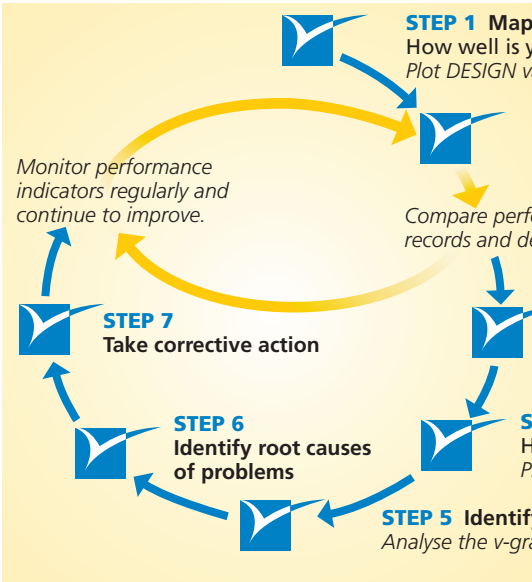
To minimise the additional time needed to meet product demand, the plant engineer at a packaging company in the Midlands investigated ways of improving the operating efficiency of the packing line. His completed v-graph highlighted the poor availability of the coding machine. Closer examination revealed that it was regularly sitting idle with no containers to process due to the way the flow of containers from the weigher was controlled. Moving the position of the photocell sensor controlling container release from the weigher solved this problem. This simple, low-cost modification resulted in an immediate 10% increase in line efficiency and reduced costs by over £120 000/year. The increase in packing line capacity has also allowed the company to delay expenditure on new equipment.

ARE YOUR PACKING LINES OPERATING AT OPTIMUM EFFICIENCY?

Poor design and operation of packing lines leads to waste product, waste packaging, excessive reworking and increased labour costs.

All of these can be reduced or avoided by adopting the step-by-step approach described in Good Practice Guide (GG243) *Packing Line Savings in the Food and Drink Industry*. The Guide explains these steps in detail - with a worked example illustrating use of the v-graph. GG243 discusses how packing line performance is reduced because of lost time, reduced speed and poor quality, and explains how to calculate key performance indicators to quantify these effects. The steps described by the Guide are shown in Fig 3.

Fig 3 Step-by-step approach to improving your packing

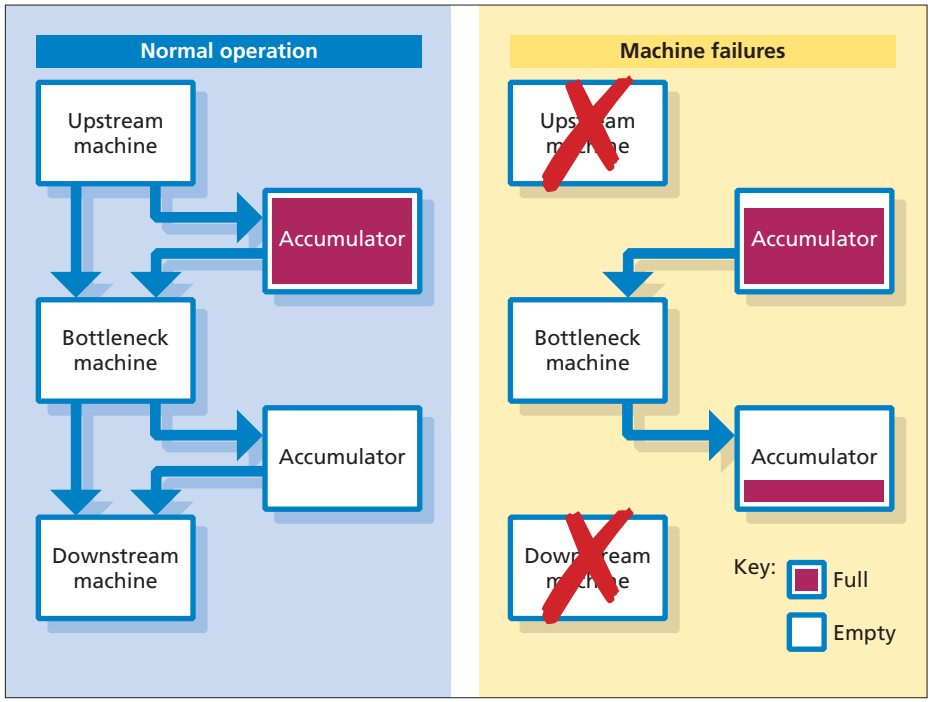


Following this path to continuous improvement will help you to:

- make practical measurements of the performance of your packing lines;
- recognise the symptoms of poor packing line performance;
- identify where problems occur on your packing lines;
- focus your efforts to improve efficiency in the right areas;
- reduce product and packaging wastes and improve profits.

This structured approach has two themes. Regular measurements of the overall performance of the line as a whole - say weekly - will help you identify when your line is not performing well. If your measurements of **key performance indicators** suggest you have a problem, then you need to take a more detailed look at the individual machines in the line.

Fig 2 Arrangement of accumulators on a packing line



line efficiency

the process
your packing line designed?
alues on the v-graph.

STEP 2 Calculate performance indicators
Do you have a problem with your packing line?
Identify factors affecting performance.

ormance indicators with historical
ecide if further investigation is needed.

STEP 3 Investigate individual machine 'speed'
Are plant items performing to design?
Plot OBSERVED values on the v-graph.

TEP 4 Investigate individual machine availability
low reliable are plant items?
lot EFFECTIVE values on the v-graph.

y key problem areas
aph.

Studying the performance of individual machines will help you to identify the real causes of poor line performance and to determine cost-effective solutions. The core of this specific investigation is the **v-graph**. Plotting the speeds of each machine as three curves on the v-graph will indicate problems in specific areas of the packing line. The ***design*** values curve shows whether individual machines in the packing line have been correctly specified, while the ***observed*** values curve shows whether they are operating at specification. The ***effective*** values curve shows whether individual machines are operating reliably, and how this affects overall line performance. Building up a v-graph will also give you a base-line from which to investigate individual machines when subsequent measurements of key performance indicators show there is a problem.

Packaging modification increases packing line efficiency

One of the packing lines at a manufacturer of preserves and peanut butter was subject to frequent stoppages. Investigations revealed that static electricity associated with the sleeve film affected the availability of the automated tamper-proofing sleeve machine. Following discussions with the machine manufacturer, film supplier and employees, it was decided to increase the film thickness by 20 µm and thus maintain the machine speed at 250 jars/minute. Improving the efficiency of the packing line has reduced line stoppages by 40% and produced net cost savings of £25 000/year from reduced film waste.

CONTINUE TO IMPROVE

To maintain improved efficiency and to continue to make savings:

- Monitor key performance indicators for the line as a whole every week. Collect information on external factors, downtime and rejects during a shift or a working day.
- Use your key performance indicators to build up a historical record to monitor changes as part of a continuous improvement process. A computer spreadsheet will help you record your data, calculate key performance indicators and plot trends on a graph.
- Prepare regular summary reports to provide feedback to senior managers and operators.

Root cause analysis leads to savings of over £40 000/year

A dairy discovered that up to 20 000 bottles/week were being rejected during capping. Although most of the milk could be recovered, the polybottles could not be re-used and the problem limited bottling capacity. Closer investigation found that the root cause of the problem was that the sensors on the cap shoot were too close to the base of the filler and became splattered with milk froth.

Since they were unable to detect cap blockages in the cap shoot, uncapped bottles were allowed to pass along the packing line, resulting in a high rejection rate. The line also had to be shut down while the sensors were cleaned. Repositioning the cap sensors solved the problem and reduced reject rates. This minor modification allowed the company to save around £35 000/year from reduced disposal costs for spoilt polybottles and to save a further £5 000/year from lower milk waste and reprocessing costs. Packaging waste has fallen by up to 1 million polybottles/year and the company has been able to increase production.

Remember:

If you don't measure it, you can't manage it.

Rejects are a symptom of packing line efficiency problems and are a source of waste.

Baby food manufacturer reduces downtime

When a baby food manufacturer investigated downtime on a new packing line, it found performance was significantly reduced due to non-optimal procedures during the 500 product changeovers each year. The tasks carried out during product changeover were listed and the production team was observed performing these duties. To improve efficiency, tasks that did not overlap were assigned to different members of the team.

With the new working method, average downtime for a product changeover has fallen from typically two hours to less than 20 minutes - thus increasing the line's availability by up to 10% and allowing the company to increase production to meet product demand.

Could you improve the performance of your packing line?

Find out by measuring the line's overall performance regularly and, if you have a problem, take a more detailed look at individual machines.

Good Practice Guide (GG243) *Packing Line Savings in the Food and Drink Industry* is intended to help companies of all sizes save money by improving their packing line efficiency. Gaining a better understanding of the performance of your packing lines will help you increase your profits by:

- reducing the waste of product and packaging on your packing lines;
- improving the productivity of your equipment;
- allowing you to avoid, or at least delay, the need to invest in new packing line equipment to increase your production capacity.

Use the form on the back page to apply for a **free** copy of this Guide and other useful publications that will help your company increase its competitiveness and improve its environmental performance.

Adjusting machine speed produces savings of over £150 000/year

Weekly monitoring revealed a large variation in the efficiency of a packing line used to bag product at a UK sweet manufacturer. When the line's performance was analysed, the machine speed was found to cause inaccurate weighing of product and failure of heat-sealing equipment. These problems led to the rejection of over 11 million partially filled bags of sweets each year. Adjusting the machine speed reduced reject rates significantly. This enabled the company to save product, packaging and waste disposal costs worth over £120 000/year and to avoid rework costs worth a further £30 000/year. Production has increased and some 500 tonnes/year of waste are no longer sent to landfill.

This Information Leaflet was produced by the Environmental Technology Best Practice Programme.
Prepared with assistance from Enviros March.

If you want to:

- **improve your packing line efficiency**
- **reduce waste**
- **increase your profits**

phone the Environment and Energy Helpline on 0800 585794.

GG243 is available from the

world wide web: **http://www.etbpp.gov.uk**

e-mail address: **etbppenvhelp@aeat.co.uk**

Alternatively, you can post the form below to:

ETBPP Publications,
ETSU, Harwell, Didcot,
Oxfordshire OX11 0RA

or fax this page to 01235 463804

FAX BACK FORM

PLEASE FAX THIS PAGE TO 01235 463804

Please send me a free copy of:

Good Practice Guide (GG243) *Packing Line Savings in the Food and Drink Industry* ..... ☐

and other related publications:

Good Practice Guide (GG140) *Cutting Costs and Waste by Reducing Packaging Use* ..... ☐

Good Practice Guide (GG141) *Choosing and Managing Re-usable Transit Packaging* ..... ☐

Good Practice Guide (GG157) *Reducing the Cost of Packaging in the Food and Drink Industry* ..... ☐

Name: ..... Position: .....

Company name: ..... Number of employees: .....

Nature of business: .....

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Postcode: ..... e-mail: .....

Tel:..... Fax: .....

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IS A GOVERNMENT PROGRAMME MANAGED BY AEA TECHNOLOGY PLC