Malting Diploma Exams
Learning Material

Exam Technique

Contents **Page**

Aims of the exam

To assess your knowledge of topics associated with the production of malt. These topics will include: raw materials; agronomics; planning processes; the design and operation of plant and equipment; project management; cost control; operational efficiency; biochemistry; maintenance and engineering; food safety; health and safety; environment.

Anyone who has passed the Malting Diploma should be sufficiently qualified to manage all aspects of running a maltings site.

Preparation for the exam

Gaining the appropriate experience

Candidates preparing themselves for this examination must acquire a basic theoretical and practical knowledge of all aspects of malting. They will be expected to demonstrate understanding and practical experience of the malting process and related operations; they will also be expected to possess a basic understanding of the commercial, scientific and engineering aspects of malting. It is recommended that this experience should include a minimum time in the following departments:-

Barley purchasing	1 month
Barley intake	2 months
Barley handling and management	3 months
Malt processing	6 months
Malt handling and despatch	2 months
Quality control and laboratory	3 months
Engineering services	3 months

In addition, some experience should be gained at a brewery and distillery. If you are a Brewer or Distiller Maltster you must be familiar with the techniques, practices, quality requirements and analytical methods of the Sales Maltster and vice-versa.

Make a plan with your Sponsor to spend time in different departments. Be demanding of your sponsor and other key figures in your organisation that can help with your preparation. Question everything you do not understand. Visit other sites to look at different plant and equipment. Map out a detailed flow diagram of your own plant. Study your HACCP plan and sit in on customer audits.

Revision

Make full use of journals, industry publications and machinery specifications. Candidates are advised to become members of the Institute of Brewing and Distilling which will give them access to a bank of useful on-line articles and subscription to the Brewer and Distiller magazine.

The MAGB website has material available and further publications can be requested from MAGB once you have registered to take the exam. The MAGB runs various relevant courses and seminars during the year – the timetable of which can be found on the website www.ukmalt.com

Practise writing answers to a variety of questions on a regular basis. You can request mock exam papers from MAGB which will then be marked by an MD Examiner and results relayed to the candidate. There will be a charge for providing this service. Past examination questions are available on the MAGB website. It is strongly recommended that candidates use these as practice questions.

Format and structure of the exam

The exam is split into three modules: Raw Materials; Processing; and Health, Safety, Environment, Quality and Food Safety. You can choose to sit one, two or all three modules. Passing all three modules within a five year period gains a Malting Diploma qualification.

Time allowed for each paper is three hours. There is always a compulsory question for which 25% of the marks are available, and a further seven question from which you choose five. Each of these five questions is worth 15% of the total marks.

Once you have passed the Malting Diploma you can progress to the Master Maltster qualification. This requires completion of a malting specific project, a further three hour essay style exam in the form of a case study, and an oral exam that will cover the project and the case study.

Time Allocation

As the compulsory question holds 25% of the total marks available it makes sense to spend 25% of the time (around 45 minutes) on this question. Plan out a time map for the questions you intend to answer. The remaining five questions should be allocated around 27 minutes each. However, be aware, these timings do not allow for reading the paper through first (see 'Choosing the right questions' below). It may help to start by answering the question you know the most about as this will help to settle any nerves. Do give yourself enough time to answer the required number of questions. You will automatically lose 15% of the potential marks if you fail to answer one of your five optional questions.

Choosing the right questions

Read through the paper, more than once, and make sure you understand each question. Don't rush and don't fall into the trap of answering the question you wish had been asked! Make a note of the questions you feel confident to answer and those you definitely don't want to answer.

Understanding the scope of the question

Consider carefully the scope of your answer. Remember to think beyond the immediate and obvious route. If the question has more than one element structure your answers as per the question and be sure to identify each section clearly as there will be separate marks awarded. But avoid duplication – Examiners don't award the same mark twice.

Planning your answers

Be sure to allocate the right amount of time to each question. There are only so many marks you can achieve even if you know a lot about the subject, so stick to the point. Take a couple of minutes to plan your answer – you can use the left hand side of the answer book for mapping out the order, rough workings, bullet points etc. The Examiners will not see this when marking your paper. Use a style you are comfortable with.

Always start each answer with an introduction and, where appropriate, end it with a summary or conclusion. Some questions may lend themselves to the use of bullet points or spider graphs. If you use bullet points you may need to explain their meaning. If you include a drawing or a graph give it a title and neatly label up as much of it as you can to demonstrate your knowledge. Only include relevant and factual information.

Wherever possible include a rate of flow, capacity of unit, power requirement, energy consumption, size of unit etc.

Where a question is not directly associated with malting, try to relate your answer to show its significance to the industry. Answers should reveal facts that are relevant to the practical solution or understanding of a problem and their significance to the industry should be explained.

Number your answers appropriately and start each new answer on a fresh page.

Marks will be deducted for poor standards of writing and presentation.

Example question

Module 1

What do the initials GN stand for when referring to malting barley? Why do some customers specify the use of non-GN varieties? List 3 barley varieties with non-GN potential.

Marking Notes

GN - Glycosidic Nitrile, Formerly known as Measurable Cyanide (MC) and also Ethyl Carbamate.
Factors relating to High GN production: formation linked to the acrospire,
Precursor in malt is Epihepidendron.

In certain varieties of barley, known as 'producers', a glycosidic nitrile (GN) compound epiheterodendrin (EPH), is present at high levels in malt.

During fermentation, EPH is hydrolysed by yeast β-glucosidase to produce isobutyraldehyde cyanohydrin (IBAC)

Subsequent heating during distillation results the breakdown of IBAC and the formation of hydrogen cyanide (HCN).

A reaction within the distillate between HCN and ethanol, in the presence of oxygen and catalysed by the copper within the still, leads to trace, but significant levels of the potentially carcinogenic compound ethyl carbamate (EC).

This affects different distilleries to varying degrees depending on still design. Levels of EC in finished whisky are not injurious to health, but the distillers concern is focused on possible future legislative control.

Conditions if reducing acrospire formation favours the control of GN
eg Low cast GA / No sprinkling / Recovered barleys / reduced Germination time.
In the malting barley sector, distillers have recently requested varieties with low levels of a compound called glycosidic nitrile (low-GN varieties). This is in response to concerns that under certain conditions, a breakdown product of glycosidic nitrile can react with ethanol, catalysed by copper in the stills used for whisky distilling, to produce traces of a potentially harmful substance known as ethyl carbamate.
Thanks to improved varieties, the distilling industry is now able to reduce GN levels even further to meet the ever more stringent quality demands of the largest export markets such as the USA.
Varieties are already available showing a five-fold reduction on previous GN levels,
and breeding effort continues to focus on the development of high-yielding
varieties with non-producing levels of glycosidic nitrile.

Barleys with Non GN Production:

Concerto
Odyssey
Oxbridge
Moonshine
Belgravia
Shuffle
Overture

~~ ******* ~~**

Example question

Module 2

Question

Use diagrams to compare and contrast the features of a modern day conical steep against the alternative of a flat bottom steep. Include in the diagrams all relevant dimensions, capacities and a full description of all the connected services including flow rates relevant to each of the process facilities.

Notes

A general note should be made of the fact that often conical steeps are used in multiple numbers as opposed to the flat bottomed steep where usually only one would be used for each batch.

The diagram of a conical steep should include the following:

- Typical dimensions of depth and width and grain capacity of each unit
- Materials of construction
- Barley transfer method to fill the steep
- Dust suppression if relevant
- Level control mechanism for grain, weighed amount or ultra-sonic/proximity probe
- Water fill point including rate of fill, volume of stored water should be considered where multiple units have to be filled, water transfer rates in M^3/h
- Provision for temperature control of water fill
- Any provision made for overflowing during the wet phases
- Expected total use of water for each batch dependant of number of wet cycles used
- Drain facilities and rate of discharge
- Aeration facilities and positioning, below plenum, fixed pipes, centre lift tube etc.
- CO_2 removal, fan type, air volumes (in the region of100 to 150 M^3/t/h), position of fan and air ducts and isolation valves where appropriate for low level installations -
- Positioning of other temperature monitoring equipment, water, air on and off
- Any provision made for air conditioning, temperature control and recirculation
- Access for cleaning behind the plenum area
- Fixed CIP equipment, spray balls, fixed peripheral nozzles
- Method of discharge into conveying equipment
- Provision for control and automation, staggered filling emptying and control to minimise turnaround times between batches
- H&S precautions, permit for safe access to confined spaces for maintenance or internal cleaning

The diagram of a flat bottom steep could refer to a conventional design or the more modern Eco-steep alternative but would consider the following points:

- Typical dimensions of depth and width and batch size
- Materials of construction
- Barley transfer method to fill the steep
- Dust suppression if relevant
- Level control mechanism for grain, weighed amount or ultra-sonic/proximity probe
- Water fill point including rate of fill in M^3/h

- Any provision made for overflowing during the wet phases
- Provision for temperature control of water fill
- Expected total use of water for each batch dependant of number of wet cycles used with specific mention made where there is a significant volume of water required to fill the area beneath the plenum (often 500mm) in a conventional flat bottomed steep
- Drain facilities and rate of discharge
- Aeration facilities, single or multiple units, positioning, below plenum or multiple array of fixed pipes in the case of an Eco-steep
- CO_2 removal, fan type, number of units, air volumes (in the region of 250 to 500 M^3/t/h), position of fans and air ducts and isolation valves where appropriate for low level installations
- Positioning of other temperature monitoring equipment, water, air on and off
- Any provision made for air conditioning, humidification, temperature control and the recirculation of air
- Access for cleaning below the plenum area in more conventional designs by the ability to lift sections of floor plates
- Any fixed CIP equipment, spray balls, fixed nozzles on internal mechanical transfer equipment
- Method of discharge onto conveying equipment, centre or side discharge options
- Provision for control and automation
- H&S precautions, permit for safe access to confined spaces for maintenance or internal cleaning

A contrast should be drawn against the conical and flat bottomed steeps highlighting the capability of a flat bottomed steep to control grain temperatures due to the higher airflows achievable particularly prior to casting but also where extended air break periods are required between water immersions.

Another general point that should be considered is the amount of space that is required to install a flat bottomed steep against a similar batch size that could be achieved using a group of conical steeps.

Provision for effluent buffering capacity should also be considered as conical steeps' discharges are usually staggered but the use of flat bottomed steeps with large batch sizes have to be handled within a relatively short period of time (1 hour typically)
The availability of stored water relative to replenishment volumes available should also be considered to ensure that the demands that flat bottomed steeping would impose can be met.

Consideration should be given to noise emissions from ventilation and extraction equipment that could have an adverse impact on employees working in those areas and also neighbouring properties.

Expanding the scope of your answer to the question to cover elements of good management practice, health and safety, environmental compliance for example will help to demonstrate a broader understanding of the subject matter and will receive credit during the marking process.

~~ ******* ~~**

Example question

Module 3

You are planning to install a 20m-tall belt and bucket malt elevator within your plant. Describe how you would manage this project from a safety perspective, from design to commissioning.

Marking Notes

Elevator specification
What duty is required for the plant
What environment is it in, i.e. what material does it need to be constructed from

What are the issues with the old elevator, is there anything that requires designing out, on-going problems that need addressing
What does the site DSEAR (Dangerous Substances & Explosive Atmosphere Regulations) risk assessment state?
What zone is it installed in?
Does the risk assessment state that belt alignment, bearing temperature sensors, rotation sensors should be fitted.

Design a lift plan for the installation of the new equipment taking into account any overhead cables, any traffic routes, areas of personnel access
Carry out a full risk assessment to cover the complete installation project
Consider local weather conditions during installation if a tall crane is to be used

Consider in the design the positioning of explosion relief ducts to avoid areas where personnel will be present, vents should be directed outside the building

Design out elevator pits below ground where possible
Ensure all new equipment to be installed meets CE standards
Consider access for maintenance in the whole design process of the newly installed equipment

Consider the need for access to the area for workers during the installation phase
Ensure open floor areas are properly guarded off and restrictions to all work areas are controlled

Control any hot work with a permitting system if it cannot be avoided
Verify the competence of the installation contractor

Ensure chosen contractor is competent to install the elevator
Are they on the preferred supplier or contractor list
Installation Contractor should supply method statements and risk assessments to cover all aspects of the installation
Check the installation contractor’s insurance cover meets company standards

All contractors must be wearing appropriate PPE, Hard hat, hi vis, safety boots, overalls, safety glasses for drilling and grinding, gloves and ear protection if the risk assessment states it is required.
Work Equipment
All hand tools used by the contractor must be in good condition
All portable electrical tools must have an up to date PAT
All ladders and step ladders must be inspected and tagged
Any portable scaffold must be inspected and tagged
Contractors must be trained to erect scaffolding

Test run equipment to ensure that belt speeds match specified values
Ensure belt is properly aligned and that any belt alignment monitoring equipment is connected and tested

Ensure that all access and inspection panels on the equipment are interlocked or accessible by tool entry only

Test all rotation sensors and blockage switches to ensure they operate as specified
Test the airflow of all connected dust aspiration equipment to ensure it meets design specifications

Test run a small amount of product through the system and ensure flows in and out of the elevator are as designed

~~ ******* ~~**