EAST AFRICAN COMMUNITY

TRAINERS MANUAL

MILLED RICE SPECIFICATIONS
The East Africa Trade Hub (EATH) has produced a series of training tools to promote broad awareness, understanding and application of the regional harmonized staple foods quality standards which were approved and declared by the East Africa Standards Committee in July 2013. This trainer’s guide was created with stakeholder input and is intended to assist national and regional stakeholders facilitate widespread uptake of the regional standards along all segments of the staple foods value chains. EATH encourages stakeholders to update the trainers guide as needed so that it remains a relevant tool for all users.
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1. Introduction

1.1 Objective of the Trainers Guide
This trainer’s guide was created to assist rice millers, traders, and graders to understand and apply the EAS 128:2013 correctly in the determination of milled rice quality. It aims at ensuring that rice farmers, traders, handlers, and millers meet relevant standards, reduce post-harvest wastage and provide safe, appropriate quality rice to consumers.

Specific Objectives:
• To explain to rice farmers, traders, grain handlers, and millers the meaning of the term quality, emphasizing that quality has two dimensions: “must-be quality” and “attractive quality”.
• To demonstrate to farmers, traders, millers and buyers that the quality of rice is measurable.
• To acquaint the farmers, traders, and millers with the common physical defects in rice that can hinder market access and profitability.
• To demonstrate how physical defects are assessed in meeting standards requirements.

1.2 Basis of the Trainers Guide
• This is a training product for anyone working with rice farmers, traders, handlers and rice millers.
• It is based on the fact that the trainer has more technical knowledge than the trainees.
• This manual outlines grading based on the EAS 128:2013 - Milled Rice specifications.

1.3 Uses of Rice
Before the rice grain is consumed, the silica-rich husk (hull, chaff) must be removed. The remaining kernel is the caryopsis or brown rice. Rice consumers, however, generally prefer to eat milled rice, which is the product after the bran (embryo and various layers of seed coat) is removed by milling. Milled rice is, invariably, the white, starchy endosperm, despite pigments present in the hull (straw, gold, brown, red, purple or black) and in the seed coat (red or purple).

Parboiled rice is another form of milled rice in which the starch is gelatinized after the grain is precooked by soaking and heating (boiling, steaming, or dry heating), followed by drying and milling. Milled rice may also be ground into a powder (flour), which enters the food industry in the form of cakes, noodles, baked products, pudding, snack foods, infant formula, fermented items, and other industrial products. Fermentation of milled glutinous rice or over milled non-glutinous rice produces rice wine (sake). Vinegar is made from milled and broken rice, and beer from broken rice and malt.
Brown rice is difficult to digest due to its high fibre content, and it tends to become rancid during extended storage. Cooking of all categories of rice is done by applying heat (boiling or steaming) to soaked rice until the kernels are fully gelatinized and excess water is expelled from the cooked product. Cooked rice can be lightly fried in oil to make fried rice. People of the Middle East prefer to fry the rice lightly before boiling. Americans often add salt and butter or margarine to soaked rice prior to boiling. The peoples of Southeast Asia eat boiled rice three times a day, including breakfast, whereas peoples of China, Japan, and Korea prepare their breakfast by boiling rice with excess water, resulting in porridge (thick gruel) or congee (thin soup).
2. Grain Quality Standards

2.1 Overview
This section is the basis for the remainder of the handbook. It is intended to explain the importance of rice quality assurance starting from farm level. Farmers should know that rice quality assurance involves prevention of defects from the earliest stages of cultivation. This includes proper land preparation and using the right inputs.

2.2 Quality
The term “quality” as applied to food material refers to those attributes of the food which make it agreeable to those who consume it. Attributes of quality involve colour, flavour, texture, nutritional value and the absence of harmful substances such as microorganisms, insects, pest and their metabolic products, chemical residue and noxious seeds.

Grain quality is generally assessed based on general aspects (characteristics that give value to the user) and safety aspects (characteristics that pose a hazard to the end user). For example, broken rice, chalky rice, red or red-streaked rice only affects the aesthetics. On the other hand, mycotoxins and pesticide residue could harm the consumer. Therefore, any grain that does not meet safety requirements is rejected despite looking physically appealing or meeting the general quality characteristics.

Grain quality may have different meanings to different people and may depend on the grain type and its end use. Since the requirements of farmers, traders, millers and consumers are not necessarily compatible; Quality Standards have to be established to even the playing field.

2.2.1 Quality Standards
Standards refer to the measures that serve as a basis for making comparisons or judging the accuracy of unknown samples. Standards are established for a variety of purposes including facilitating smooth and fair trading and protection of consumers. An example of a quality standard is the EAS 128:2013 Milled Rice – specification which was developed in order to harmonize milled rice quality requirements in East Africa.

Standards are developed by national, regional and international standards institutions often to enforce legislation. These bodies issue specifications for commodities as well as methods of testing. Examples of these bodies include Kenya Bureau of Standards (KEBS), East African Community (EAC), American Association of Cereal Chemists (AACC), Association of Analytical Chemists (AOAC), and International Standards Organization (ISO).

It is common for standards bodies to adopt standards issued by another body. For example, the EAS 128:2013 (Milled Rice specifications) has adopted ISO 605 test methods to determine impurities, size, foreign odours, insects, other grains. All adopted Standards appear under “normative references”. When testing under a particular standard, all the standards referred to under “Normative references” have to be followed as well.

For proper grading of grain to be done to determine the quality of milled rice, the grader has to use:
1) The correct standard for the particular grain and market e.g. EAS 128:2013 Milled rice – specifications
2) The correct standard test method i.e. sampling and using the right procedure to grade
3) The correct standard test equipment e.g. using a 1.4 mm round sieve to determine chips in rice.

![Diagram](image)

*Figure 2: These elements are essential for the reliable grading of grain*

### 2.2.2 Quality Control

Quality control refers to a system of maintaining standards in products by testing a sample to see if it meets the required standards. It involves use of a particular standard, test method and equipment to detect defects and assess the quantity of certain physical, sanitary or chemical quality parameters.

Grain grading is a process of categorising grain based on certain quality parameters. This informs decisions such as storage of the grain, uses of the grain, the purchase price and so on.
3. Milled Rice Grain Characteristics
This Trainers manual is based on the EAS 128:2013 milled rice specifications, a rice standard that was passed by EAC and adopted by member countries for implementation in their respective countries.

Rice grain quality represents a summary of the physical and chemical characteristics that may be genetic or acquired properties.

The **genetic properties** include:

- chemical characteristics (gelatinization temperature, apparent amylase content, gel consistency, alkali spreading value and aroma)
- shape
- size
- color of grain
- chalkiness
- bulk density
- thermal conductivity
- equilibrium moisture content, and
- flowability

The **acquired properties or environmental factors** are either additional to the normal complement of genetic qualities or are the consequence of certain genetic qualities being lost or modified. The important **acquired** properties are:

- moisture content,
- grain purity,
- physical and pest damage, cracked grains,
- presence of immature grains and
- milling-related characteristics (milling and head rice recoveries, grain dimensions, whiteness, milling degree and chalkiness) will likewise be included.

Milling-related characteristics are relevant measures of value because these are the major concern of consumers. The quality characteristics of paddy and milled rice can be considered separately.
3.1 Categories of Rice

3.1.1 Aromatic milled rice
Special varieties of rice (*Oryza sativa* L. *scented*) that have a distinctive and characteristic aroma. Varieties of aromatic rice include: basmati, jasmine, Texmati, Tulapinanji, Wehani, and wild pecan rice.

3.1.2 Glutinous rice
Glutinous rice is a variety of rice (*Oryza sativa* var. *glutinosa*) also called sticky rice, sweet rice or waxy rice. It has opaque grains, very low amylose content, and is especially sticky when cooked. It is called glutinous in the sense of being glue-like or sticky, and not in the sense of containing gluten. Cultivars of glutinous rice include japonica, indica, and tropical japonica strains.

Rice is considered glutinous milled rice if it contains more than 50 percent chalky kernels.

3.2 Rice Grain Classification
There are four classes of milled rice depending on the percentage of whole kernels, and types of rice:

- Long Grain Milled Rice
- Medium Grain Milled Rice
- Short Grain Milled Rice
- Mixed Milled Rice

![Figure 3: Short, Medium and Long Grain Rice](image)

3.2.1 Long grain milled rice
These are kernels which have a length/width ratio of 3.0 or more; or, have a kernel length of 6.6mm or more; or, have a kernel length of more than 6.0mm and a length/width ratio of more than 2.
Rice is categorized as long grain milled rice if it contains more than 25.0 percent of whole long grain kernels of milled rice and, in Grades 1 through 4, not more than 10.0 percent of whole or broken kernels of medium or short grain milled rice.

3.2.2 Medium grain milled rice
Medium grain rice kernels are those that have a length/width ratio of 2.0-2.9; or, have kernel length of 6.2 mm or more but less than 6.6mm; or, have kernel length of more than 5.2 mm but not more than 6.0mm and a length/width ratio of less than 3.

Rice will be categorized as medium grain milled rice if it contains more than 25.0 percent of whole medium grain kernels of milled rice and, in Grades 1 through 4, not more than 10.0 percent of whole or broken kernels of long grain rice or whole kernels of short milled grain rice.

3.2.3 Short grain milled rice
Short grain rice kernels are those that have a length/width ratio of 1.9 or less; or, have kernel length of less than 6.2 mm; or, have kernel length of 5.2 mm or less and a length/weight ratio of less than 2.

Rice will be graded as short grain milled rice if it contains more than 25.0 percent of whole kernels of short milled rice and, in Grades 1 through 4, not more than 10.0 percent of whole or broken kernels of long grain rice or whole kernels of medium grain milled rice.

3.2.4 Mixed milled rice
Mixed milled rice consists of milled rice with more than 25.0 percent of whole kernels of milled rice and more than 10.0 percent of "other types" defined above.
3.3 Rice Products

3.3.1 Paddy kernels
Whole or broken un-hulled kernels of rice; whole or broken kernels of brown rice, and whole or broken kernels of milled rice having a portion or portions of the hull remaining which cover 12.5% or more of the whole or broken kernel.

3.3.2 Brown rice
Whole or broken kernels of paddy rice from which the hulls have been removed.

3.3.3 Bran
This is a by-product from milling consisting of the outer (pericarp) layers of the kernel with part of the germ.

3.3.4 Milled rice
Whole or broken kernels of rice (Oryza spp.) from which the hulls and at least the outer bran layers have been removed.
3.3.5 Granulated brewers milled rice
Granulated brewers milled rice shall be milled rice which has been crushed or granulated so that 95.0 percent or more will pass through a 5 sieve, 70.0 percent or more will pass through a 4 sieve, and not more than 15.0 percent will pass through a 2 1/2 sieve.

3.3.6 Parboiled milled rice
Milled rice in which the starch has been gelatinized by soaking, steaming, and drying. The maximum limits for "Chalky kernels," "Heat-damaged kernels," "Kernels damaged by heat," and the "Colour requirements" are not applicable to the special grade "Parboiled milled rice."
If the rice is:

- Not distinctly coloured by the parboiling process, it shall be considered "Parboiled Light";
- Distinctly but not materially coloured by the parboiling process, it shall be considered "Parboiled";
- Materially coloured by the parboiling process, it shall be considered "Parboiled Dark."
- The colour levels for "Parboiled Light", "Parboiled", and "Parboiled Dark" shall be in accordance with the interpretive line samples for parboiled rice.
3.4 Milling Degree
Milling degree is one of several inspection criteria used to determine the quality of milled rice. The degree of milling is a measure of the percent bran removed from the brown rice kernel. Milling degree affects milling recovery and influences consumer acceptance. Apart from the amount of white rice recovered, milling degree influences the colour and also the cooking behaviour of rice. Un-milled brown rice absorbs water poorly and does not cook as quickly as milled rice.

3.4.1 Under-milled rice
Under-milled rice grain is rice from which the hull, a part of the germ and all or part of the outer bran layers but not the inner bran layers have been removed.

3.4.2 Well-milled kernels
Whole or broken kernels of rice from which the hulls and practically all of the germs and the bran layers have been removed.

3.4.3 Extra-well-milled rice
Rice obtained by milling husked rice in such a way that all of the bran and almost the entire embryo have been removed.
3.5 Rice Grain Defects

3.5.1 Chalky kernels

Head rice or broken kernel of non-parboiled rice, except wax rice, whose whole surface has an opaque and floury appearance.

<table>
<thead>
<tr>
<th>Large broken kernel</th>
<th>Medium broken kernel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part of kernel with a length less than ¾ but greater than ½ of the average length of the test sample kernels.</td>
<td>Part of kernel with a length less than or equal to ½ but greater than ¼ of the average length of the test sample kernels.</td>
</tr>
</tbody>
</table>

Figure 11: Extra-well-milled rice: rice becomes pure white starch as the milling increases

Figure 12: Chalky rice above a non-chalky one
iii. Small Broken kernels
Fragment of kernel, the length of which is less than or equal to \( \frac{1}{4} \) of the average length of the corresponding whole kernel but which does not pass through a metal sieve with round perforations 1.4 mm in diameter.

3.5.3 Whole kernels
Whole kernels are un-broken kernels and broken kernels of rice which are at least three-fourths (\( \frac{3}{4} \)) of an un-broken kernel.

3.5.4 Head rice
Whole kernel or part of the kernel with a length greater than or equal to 75% of the average length of the test sample kernels.

3.5.5 Chip
A chip is the part of a rice kernel which passes through a metal sieve with round perforations 1.4 mm in diameter.

3.5.6 Damaged kernels/defective kernels
Kernels, pieces of rice kernels, and other grains that are badly ground-damaged, badly weather damaged, diseased, frost-damaged, germ-damaged, heat-damaged, injured-by-heat, insect-bored,
field fungi, skinned, mould-damaged, shot or sprout-damaged, dark tipped, pink-stained, over-dried damaged, bin burnt, storage mould affected or rotted, smut, stained or otherwise materially damaged.

Figure 14: damaged/defective kernels

3.5.7 Foreign matter

All organic and inorganic material other than white rice, broken kernels, other grains and filth.

<table>
<thead>
<tr>
<th>Alligator Heads</th>
<th>Morning Glory</th>
<th>Turtle Back</th>
<th>Sudan Grass</th>
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</thead>
<tbody>
<tr>
<td>Water Parsley</td>
<td>Louseae (ochre pod)</td>
<td>Curley Indigo</td>
<td>Millet</td>
</tr>
<tr>
<td>Kings Head (ragweed)</td>
<td>Velvet Leaf</td>
<td>Tail Indigo</td>
<td>Pennycress</td>
</tr>
<tr>
<td>Jimson Weed</td>
<td>Johnson Grass</td>
<td>Spearhead</td>
<td></td>
</tr>
</tbody>
</table>

Figure 15: Organic matter

Figure 16: Inorganic matter

3.5.8 Heat-damaged kernels

Whole or broken kernels of rice which are materially discoloured and damaged as a result of heating and parboiled kernels in non-parboiled rice which are as dark as, or darker in colour than, the interpretive line for heat-damaged kernels.

Figure 17: Heat damaged rice kernels

3.5.9 Immature kernel/malformed kernel

Head rice or broken kernel which is unripe and/or badly developed.
3.5.10 Insect/pest damaged
Grains eaten in part by stored grain insects and any field pests of grains including *Heliothis* spp.
Grains may have a hole (commonly referred to as bored) or have a chewed appearance on any part of the grain.

![Figure 18: Immature Rice Kernels](image)

3.5.11 Partly gelatinized kernel
This is a head rice kernel or whole kernel of parboiled rice which is not fully gelatinized and shows a distinct white opaque area.

![Figure 19: Pest damaged rice](image)

3.5.12 Peck
Head rice or broken kernel of parboiled rice of which more than 25% of the surface is dark brown or black in colour due to the parboiling process.

![Figure 20: Pecky Rice](image)

3.5.13 Poisonous, toxic and/or harmful seeds
Any seed which if present in quantities above permissible limit may have damaging or dangerous effect on health, organoleptic properties or technological performance such as Jimson weed —
datura (*D. fastuosa* Linn and *D. stramonium* Linn.) corn cokle (*Agrostemma githago* L., *Machai Lallium remulenum* Linn.) Akra (Vicia species), *Argemone mexicana*, Khesari and other seeds that are commonly recognized as harmful to health.

![Figure 21: Datura](image1)

![Figure 22: Corn Cokle](image2)

3.5.14 **Red milled rice**

Head rice or broken kernel having red bran covering more than 25% of its surface.

![Figure 23: Red milled rice](image3)

3.5.15 **Red-streaked kernel**

Head rice or broken kernel with red bran streaks of length greater than or equal to 50% of that whole kernel, but where the surface covered by these red streaks is less than 25% of the total surface.

3.5.16 **Rotten kernels**

Kernels that is discoloured, swollen and soft as a result of decomposition by fungi or bacteria. They may feel spongy under pressure. There is a single tolerance for the total of binburnt, severely mildewed, mouldy, and rotten kernels.

3.5.17 **Un-gelatinized kernels**

These are whole or broken kernels of parboiled rice with distinct white or chalky areas due to incomplete gelatinization of the starch.
4. Quality Requirements

4.1 General Requirements

White (Milled) rice shall meet the following general quality requirements:

1. Shall be the dried mature grains of edible Oryza spp;
2. Be, clean, wholesome, uniform in size, colour and shape;
3. Shall be safe and suitable for human consumption;
4. Shall be free from abnormal flavours, musty, sour or other undesirable odour, obnoxious smell and discolouration;
5. Shall be free from micro-organisms and substances originating from micro-organisms, fungi or other poisonous or deleterious substances in amounts that may constitute a hazard to human health.

4.2 Specific Requirements

4.2.1 Grades

Milled rice grains for human consumption shall be graded into three grades on the basis of the tolerable limits established in Table 1 which shall be additional to the general requirements set out in the relevant standard.

Table 1: Specific Requirements

<table>
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<tr>
<th>Characteristics</th>
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<th>Grade 2</th>
<th>Grade 3</th>
<th>Method of Test</th>
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<tr>
<td>Broken, %</td>
<td></td>
<td>5</td>
<td>15</td>
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<td>Heat Damaged Rice, %</td>
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<td>Chalky, %</td>
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<td>4</td>
<td>10</td>
<td>ISO 605</td>
</tr>
<tr>
<td>Red or Red Streaked, %</td>
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<td>2</td>
<td>6</td>
<td>10</td>
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</tr>
<tr>
<td>Immature Grains, %</td>
<td></td>
<td>1</td>
<td>1.5</td>
<td>2</td>
<td>ISO 605</td>
</tr>
<tr>
<td>Other Contrasting Varieties, %</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>ISO 605</td>
</tr>
<tr>
<td>Organic Matter, %</td>
<td></td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
<td>ISO 605</td>
</tr>
<tr>
<td>Inorganic Matter, %</td>
<td></td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>ISO 605</td>
</tr>
<tr>
<td>Paddy Grains,%</td>
<td></td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>ISO 605</td>
</tr>
<tr>
<td>Live Weevils/Kg</td>
<td></td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>ISO 605</td>
</tr>
<tr>
<td>Filth, %, m/m</td>
<td></td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>ISO 605</td>
</tr>
<tr>
<td>Moisture Contents, %</td>
<td></td>
<td>14.0</td>
<td>14.0</td>
<td>14.0</td>
<td>ISO 605</td>
</tr>
<tr>
<td>Total Aflatoxin (AFB1+AFB2+AFG1+AFG2), ppb max</td>
<td>10</td>
<td>ISO 16050</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aflatoxin B1 only, ppb max</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fumonisn ppm max</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>AOAC 2001.04</td>
</tr>
</tbody>
</table>
4.2.2 Contaminants

i. Heavy metals
Milled rice shall comply with those maximum limits for heavy metals established by the Codex Alimentarius Commission for this commodity.

ii. Pesticide residues
Milled rice shall comply with those maximum pesticide residue limits established by the Codex Alimentarius Commission for this commodity.

Note: where the use of certain pesticides is prohibited by some Partner States, then it shall be notified to all Partner States accordingly.

4.2.3 Hygiene
Milled rice shall be produced, prepared and handled in accordance with the provisions of appropriate sections of EAS 39.

When tested by appropriate standards of sampling and examination, the products:

- Shall be free from microorganisms in amounts which may represent a hazard to health and shall not exceed the limits stipulated in Table 2;
- Shall be free from parasites which may represent a hazard to health; and
- Shall not contain any substance originating from microorganisms in amounts which may represent a hazard to health.

Table 2: Microbiological Limits

<table>
<thead>
<tr>
<th>Type of micro-organism</th>
<th>Limits</th>
<th>Test Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Yeasts and moulds, max. per g</td>
<td>$10^5$</td>
<td>EAS 217</td>
</tr>
<tr>
<td>ii) S. aureus per 25 g</td>
<td>Not detectable</td>
<td></td>
</tr>
<tr>
<td>iii) E. Coli, max. per g</td>
<td>Not detectable</td>
<td></td>
</tr>
<tr>
<td>iv) Salmonella, max. per 25 g</td>
<td>Not detectable</td>
<td></td>
</tr>
</tbody>
</table>
5. Determination of Grain Quality Parameters

5.1 Objective Methods (Standard Test Methods)

5.1.1 Grading Procedure

1. **Sampling**
   Obtain a 1,500 grams sample using an appropriate sampling procedure.

2. **General inspection**
   Note if an odour, particular of foreign to rice is detected in the sample, as well as the presence of abnormalities. Verify the presence of living and dead insects using the procedure in 5.1.2 below.

3. **Preparation of test sample**
   i. Carefully mix the laboratory sample to make it as uniform as possible.
ii. Reduce it using a divider or quartering method to obtain three test portions of 100 grams and test for moisture content using the procedure in 5.1.3 below.

iii. Reduce the remaining using a divider or quartering method to obtain 800 grams

iv. Divide the sample into equal test portions of about 400 grams using the divider.

4. **Average Length**

On one of the two test portions:

i. Separate two sets of 100 kernels without any broken part, by random sampling

ii. Measure the length of the kernels using a micrometer and calculate the arithmetic means of the length of both sets of kernels \( L_1 \) and \( L_2 \)

iii. Calculate the average length of the two sets of kernels:

\[
\text{Average length (L)} = \frac{L_1 + L_2}{2}
\]

iv. If the value of \( \frac{100(L_1 - L_2)}{L} > 2 \), return all the kernels to the tray and repeat from step i. above.

5.1.2 **Presence of live insect pests**

White rice may have live insect pests and this may lead to rejection. To test for live infestation:

i. Obtain a representative sample

ii. Mix and sub-divide the sample to obtain 100 grams.

iii. Spread the 100 grams of the sample on a warm plate (at 40 °C).

iv. Cover the plate with a glass jar (bell glass jar if possible) to prevent the insects from escaping

v. After 15 minutes, sieve the grain through an appropriate sieve, e.g. 1.4 mm sound sieve

vi. Check for living insects, dead insects and insect larvae.

vii. Reject the grain if it has one or more live insects.

5.1.3 **Moisture content**

Mix and subdivide the sample to obtain
a) Air Oven Method
   i. Set oven at 130˚C
   ii. Weigh three 100 g samples and place them inside the oven for 16 hours.
   iii. Compute the moisture content using the following formula, for percentage wet basis and dry basis moisture content.

\[
\text{MC}_{\text{wb}} = \frac{\text{Initial Weight} - \text{Final Weight}}{\text{Initial Weight}} \times 100
\]

\[
\text{MC}_{\text{db}} = \frac{\text{Initial Weight} - \text{Final Weight}}{\text{Final Weight}} \times 100
\]

iv. Compute the average moisture

b) Moisture meters
   In the field moisture meters can be used for the estimation of moisture, just follow the manufacturers’ instructions.

5.1.4 Foreign matter
   This may be done by use of typical laboratory sieve of 1.4mm round hole.

Place a clean basin in place to receive any materials that may go through the sieve.
   i. Weigh 100 g of rice sample (Weight₁)
   ii. Put the white rice grains in the 1.4mm round-hole sieve.
   iii. Shake the sieve horizontally 40 times.
   iv. Collect all the foreign matter that has passed through the sieve.
   v. Hand-pick all the foreign matter left on the sieve.
   vi. Separate the organic and inorganic foreign matter
   vii. Weigh organic matter separately (Weight₂)
viii. Weigh Inorganic matter separately (Weight$_2$)

ix. Calculate the percentage weight

\[
\% \text{ Organic Matter} = \frac{\text{Weight}_2}{\text{Weight}_1} \times 100
\]

\[
\% \text{ Inorganic Matter} = \frac{\text{Weight}_2}{\text{Weight}_1} \times 100
\]

### 5.1.5 Paddy grains

i. From the 100 g (Weight$_1$) used in 5.1.4 above

ii. Select all the paddy grains, and weigh (Weight$_2$)

iii. Express the percentage of paddy grains as:

\[
\% \text{ Paddy grains} = \frac{\text{Weight}_2}{\text{Weight}_1} \times 100
\]

### 5.1.6 Heat damaged grains

This refers to white milled rice grains which are damaged by heat.

i. Weigh 100 grams from one of the two portions of 400 grams indicated in 5.1.1 (iii) above (Weight$_1$)

ii. Pour the grains on a tray and select all heat damaged grains.

iii. Weigh the selected heat damaged grains (Weight$_2$)

iv. Express the percentage of the heat damaged grains as:

\[
\% \text{ Heat damaged grain} = \frac{\text{Weight}_2}{\text{Weight}_1} \times 100
\]
5.1.7 Chalky grains

i. From the 100 g in 5.1.6 above (Weight\textsubscript{1})
ii. Pick all the chalky grains by hand
iii. Weigh the selected chalky grains (Weight\textsubscript{2})
iv. Express the percentage

$$\% \text{ Chalky Grain} = \frac{\text{Weight}_{2}}{\text{Weight}_{1}} \times 100$$

5.1.8 Damaged grains

This refers to kernels, whole or broken, showing obvious deterioration due to moisture, pests, disease or other causes e.g. ground-damaged, weather-damaged, diseased, frost-damaged, germ-damaged, insect-damaged, mouldy, dark-tipped, smut, etc.

i. From the 100 g in 5.1.6 above (Weight\textsubscript{1})
ii. Pick all damaged grains by hand (diseased, discoloured, stained, pest damaged, frost damaged, mouldy, dark-tipped, smut, etc.)
iii. Weigh all the picked damaged grains (Weight\textsubscript{2})
iv. Express the percentage defective grains as:

$$\% \text{ Defective Grains} = \frac{\text{Weight}_{2}}{\text{Weight}_{1}} \times 100$$

5.1.9 Contrasting varieties

This refers to other varieties of the white rice which are not desired.

i. From the 100 g in 5.1.6 above (Weight\textsubscript{1})
ii. Select all contrasting variety grains.
iii. Weigh the selected grains (Weight\textsubscript{2})
iv. Express the percentage of the contrasting varieties grains as:

$$\% \text{ Contrasting Varieties} = \frac{\text{Weight}_{2}}{\text{Weight}_{1}} \times 100$$
% Contrasting Varieties = \( \frac{Weight_2}{Weight_1} \times 100 \)

5.1.10 Immature/Shrivelled grains
This refers to unripe or underdeveloped rice kernels.

i. From the 100 g in 5.1.6 above (Weight\(_1\))
ii. Select all immature/shrivelled grains.
iii. Weigh the selected grains (Weight\(_2\))
iv. Express the percentage of the contrasting varieties grains as:

% Immature/Shrivelled Grains = \( \frac{Weight_2}{Weight_1} \times 100 \)

5.1.11 Red or red streaked
This refers to rice kernels with red bran or red streaks.

i. From the 100 g in 5.1.6 above (Weight\(_1\))
ii. Select all red or red streaked kernels.
iii. Weigh the selected grains (Weight\(_2\))
iv. Express the percentage of the contrasting varieties grains as:

% Immature/Shrivelled Grains = \( \frac{Weight_2}{Weight_1} \times 100 \)

5.1.12 Broken white rice grains
This refers to pieces of rice kernels that are less than ¾ of the whole kernel. To quantify these:

i. Weigh 100 grams from one of the two portions of 400 grams indicated in 5.1.1 (iii above (Weight\(_1\))
ii. Put the train on a 1.4mm round sieve and separate all chips
iii. Spread out what is retained on the sieve and select all broken white rice grains using diagram in 3.5.2 above. (Depending on the standard, you may have to separate large broken, medium broken and small broken).
iv. Weigh the selected grains (Weight$_2$)

v. Express the percentage of the broken grains as:

\[
\% \text{ Broken Grains} = \frac{\text{Weight}_2}{\text{Weight}_1} \times 100
\]

5.1.13 Filth

Refers to materials of animal origin e.g. fur, hair, droppings, etc.

i. From the 100 g in 5.1.12 above (Weigh$_1$)

ii. Pick by hand all the filth from the sample

iii. Weigh the sample and express as a percentage (Weight$_2$)

\[
\% \text{ Filth} = \frac{\text{Weight}_2}{\text{Weight}_1} \times 100
\]

5.1.14 Aflatoxins

Aflatoxins are a group of chemicals produced by certain mould fungi. These fungi, *Aspergillus flavus* and *Aspergillus parasiticus*, can be recognized by their yellow-green or grey-green, or pink colours.

The presence of Aflatoxins is tested by thin layer chromatography, High performance Liquid Chromatography or absorbance meters e.g. Elisa readers.

Representative samples have to be taken to a laboratory that is capable of carrying out Aflatoxin test.

5.1.15 Ungraded milled rice

Shall be milled rice which does not fall within the requirements of Grades 1, 2, and 3 of this standard but is not rejected rice grains.
5.1.16 Reject grade milled rice
This comprises milled rice which has objectionable odour, off flavours, living insects or which do not possess the quality characteristics specified in Table 1. It cannot satisfy the conditions of ungraded milled rice and shall be graded as reject milled rice and shall be regarded as unfit for human consumption.
6. Packaging
   1. Milled rice shall be packed in suitable packages which shall be clean, sound, and free
      from insect, fungal infestation and the packing material shall be of food grade quality.
   2. Milled rice shall be packed in containers which will safeguard the hygienic, nutritional,
      technological and organoleptic qualities of the products.
   3. The containers, including packaging material, shall be made of substances which are safe
      and suitable for their intended use. They shall not impart any toxic substance or
      undesirable odour or flavours to the product.
   4. Each package shall contain rice of the same type and of the same grade designation.
   5. If milled rice is presented in bags, the bags shall also be free of pests and contaminants.
   6. Each package shall be securely closed and sealed.

7. Labelling

In addition to the requirements in EAS 38, each package shall be legibly and indelibly marked
with the following:

i. Product name as “Milled Rice”;
ii. Variety;
   ❖ Long grain milled rice
   ❖ Medium grain milled rice
   ❖ Short grain milled rice
   ❖ Mixed milled rice
iii. Grade;
iv. Name, address and physical location of the manufacturer/ packer/importer;
v. Lot/batch/code number;
vi. Net weight, in kg;

Note: EAC partner states are signatory to the International Labour Organizations (ILO) for
maximum package weight of 50kg where human loading and offloading is involved

vii. The declaration “Food for Human Consumption’’
viii. Storage instruction as “Store in a cool dry place away from any contaminants’’;
ix. Crop year;
x. Packing date;
xi. Instructions on disposal of used package;
xii. Country of origin;
xiii. A declaration on whether the milled rice was genetically modified or not.
8. Sampling methods

Sampling shall be done in accordance with the EAS 79/ISO 13690.

9. Milled rice sieve types

   a. **5 plate** — A laminated metal plate 0.14209 inch thick, with a top lamina, 0.05109-inch thick, perforated with rows of round holes 0.0781 (5/64) inch in diameter, 5/32 inch from centre to centre, with each row staggered in relation to the adjacent rows, and a bottom lamina 0.091-inch thick, without perforations.

   b. **6 plate** — A laminated metal plate 0.142-inch thick, with a top lamina 0.051-inch thick, perforated with rows of round holes 0.0938 (6/64) inch in diameter, 5/32 inch from centre to centre, with each row staggered in relation to the adjacent rows, and a bottom lamina 0.09109-inch thick, without perforations.

   c. **2 1/2 sieve** — A metal sieve 0.032-inch thick, perforated with rows of round holes 0.0391 (21/2/64) inch in diameter, 0.075-inch from centre to centre, with each row staggered in relation to the adjacent rows.

   d. **4 sieve** — A metal sieve 0.032-inch thick, perforated with rows of round holes 0.0625 (4/64) inch in diameter, 1/8 inch from centre to centre, with each row staggered in relation to the adjacent rows.

   e. **5 sieve** — A metal sieve 0.032-inch thick, perforated with rows of round holes 0.0781 (5/64) inch in diameter, 5/32 inch from centre to centre, with each row staggered in relation to the adjacent rows.

   f. **5 1/2 sieve** — A metal sieve 0.032-inch thick, perforated with rows of round holes 0.0859 (51/2/64) inch in diameter, 9/64 inch from centre to centre, with each row staggered in relation to the adjacent rows.

   g. **6 sieve** — A metal sieve 0.032-inch thick, perforated with rows of round holes 0.0938 (6/64) inch in diameter, 5/32 inch from centre to centre, with each row staggered in relation to the adjacent rows.

   h. **6 1/2 sieve** — A metal sieve 0.032-inch thick, perforated with rows of round holes 0.1016 (61/2/64) inch in diameter, 5/32 inch from centre to centre, with each row staggered in relation to the adjacent rows.
i. **30 sieve** — A woven wire cloth sieve having 0.0234-inch openings, with a wire diameter of 0.0153 inch.