



Memorandum of Understanding

Between

BUHLER INDIA PVT. LTD

Attibele, Bangalore-562107

And

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY

(Unit of Alva's Education Foundation (R), Moodbidri)

Affiliated to Visvesvaraya Technological University, Belagavi & Approved by AICTE, New Delhi.

Recognized by Government of Karnataka.

A+, Accredited by NAAC & NBA (ECE & CSE)

Shobhavana Campus, MIJAR-574225, Moodbidri, D.K., Karnataka

This Memorandum of Understanding (here in after referred to as MoU) is made on **01/06/2023** between the **BUHLER INDIA PVT. LTD**, 13-D,12 D,13 C and 13-B KIADB Industrial Area, Attibele, Bangalore – 562107, Karnataka, India (hereinafter referred to as BUHLER INDIA) and the **ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY**, Shobhavana campus, Mijar-574225, Moodabidre, Mangalore.(herein after referred to as AIET)

WHEREAS AIET AND BUHLER INDIA desire to enter into an agreement in which AIET AND BUHLER INDIA will work together to conduct various collaborative activities.

AND WHEREAS AIET AND BUHLER INDIA are desirous to enter into a **Memorandum of Understanding** between them, setting out the working arrangement that each of the Partners agree are necessary to conduct various collaborative activities.

PRINCIPAL

Alva's Institute of Engg. & Technology,
Mijar. MOODSIDRI - 574 225, D.K



Purpose

The purpose of this Memorandum is to provide the framework for organizing any future collaborative activities such as training, internship, technical talks, workshop, conferences, R & D activities and certification course on rice milling technology between AIET AND BUHLER INDIA.

Obligations of the partners

The partners acknowledge that no contractual relationship is created between them by this Memorandum, but agree to work together in the true spirit of partnership to ensure that there is a united visible and responsive leadership to conduct various collaborative activities like training, internship, technical talks, workshop, conferences and certification course on rice milling technology by both the partners in favor of student community.

Cooperation

The collaborative activities and services for the benefit of students shall include,

a. Services to be rendered by AIET include:

- i. Provide publicity among students of AIET regarding the training and certification courses offered by BUHLER INDIA on Rice milling technology
- ii. Arrange technical talks, workshops for students to undergo rice milling technologies related training by BUHLER INDIA.
- iii. Provide platforms for BUHLER INDIA to interact with AIET student community regarding
advanced food processing technologies during AIET Tech Fest and other collegiate events.
- iv. Encourage faculty members to seek services of BUHLER INDIA for their research requirements pertaining to food processing.

b. Services to be rendered by BUHLER INDIA include:

- i. Depute personnel as resource persons to engage in technical talks, workshops on rice milling technologies for students of AIET.
- ii. Provide technical assistance in academic projects of students from AIET.
- iii. Facilitate industrial visits and training for students and faculty members of AIET.



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- iv. Depute resource persons to engage in classroom teaching for students of AIET on topics related to rice milling technologies.
- v. Extend technical guidance to students pursuing projects / research by students

Resources

The partners will endeavor to have final approval and secure resources necessary to fulfill their individual contributions at the start of the planning for the collaborative activities.

- a. AIET agrees to provide the following financial, material and lab our resources like;
 - i. Honorarium and allowances in accordance to the norms of the institution (AIET) will be provided to the resource persons engaging in technical talks, workshops, training and classroom teaching at AIET campus.
 - ii. Arrangements to display promotional materials of BUHLER INDIA in AIET campus during Tech Fest and other college events.
- b. BUHLER INDIA agrees to provide the following financial, material and lab our resources like.
 - i. BUHLER INDIA will depute resource person to engage in training, workshops, and classroom teaching of food processing technologies for students of AIET.
 - ii. BUHLER INDIA permit industrial visits for students and faculty of AIET at mutually agreed upon schedule.
 - iii. BUHLER INDIA will provide concessions for AIET students and faculty seeking food processing technology related services, for their academic purposes only, in accordance to the norms of BUHLER INDIA.

Liability

No liability will arise or be assumed between the partners as a result of this Memorandum.

Term

The arrangements made by the partners by this Memorandum shall remain in place from **June 01, 2023 TO May 31, 2028**, at the end of which on review, term can be extended only by agreement of both the partners.


PRINCIPAL
AIET's Institute of Engg. & Technology,
Mijar. MOODBIDRI - 574 225, D.K



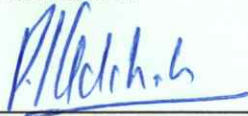
Understanding

It is mutually agreed upon and understood by and among the Partners of this Memorandum that:

- a. Each Partner will work together in a coordinated fashion for the successful conduction of the collaborative activities.
- b. In no way does this agreement restrict involved Partners from participating in similar agreements with other public or private agencies, organizations and individuals.
- c. This memorandum is not intended to and does not create any right, benefit, or trust responsibility.
- d. This memorandum will be effective upon the signature of both partners.
- e. Any partners may terminate its participation in this memorandum by providing 60 days clear written notice to other partner.

The following Partners support the goals and objectives of the training and certification courses on food processing technologies.

This agreement shall be signed on behalf of AIET by Dr. Peter Fernandes, Principal, AIET, at Shobhavan campus, Mijar, and on behalf of Mr. Prashant S Gokhale, Managing Director, Buhler India, Attibele, Bangalore. This agreement shall be effective as of the date first written above.



Prashant S Gokhale
Managing Director
BUHLER INDIA PVT. LTD
KIADB Industrial Area, Attibele,
BANGALORE, Karnataka-562107



Dr. Peter Fernandes
Principal

Alva's Institute of Engineering & Technology,
Shobhavana Campus, MIJAR-574225,
PRINCIPAL

**Alva's Institute of Engg. & Technology,
Mijar, MOODSIDRI - 574 225, D.K**



**Alva's Institute of Engg. & Technology,
Mijar, MOODSIDRI - 574 225, D.K**

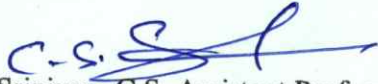
Witness on behalf of Alva's Institute of Engineering & Technology



1. Dr. Shashikumar, Associate Professor and Head, Dept. of Agricultural Engineering, AIET



2. Prof. Deepak Kumar Kolake, Assistant Professor, Dept. of Agricultural Engineering, AIET



3. Prof. Srinivasa C S, Assistant Professor, Dept. of Mechanical Engineering, AIET

Witness on behalf of BUHLER INDIA



1. A V Venkatesh Kumar, Head of HR & Admin

7th December, 2023

To whomsoever it may concern

Sub: Internship Completion Certificate

This is to certify that **Mr. Kiran V (USN – 4AL21AG018)**, a student of BE in Agriculture Engineering from Alva's Institute of Engineering & Technology, Moodbidri, has successfully completed his internship in our organisation from **02.11.2023** until **07.12.2023**.

During the period of internship, he was found punctual, hardworking, inquisitive and has high learning orientation.

We wish a good luck for his future.

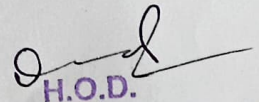
For Buhler (India) Pvt. Ltd.



A V Venkatesh Kumar
Head of HR & Admin



Ravindra R A
Sr. Manager – Tech. Training


H.O.D.

Dept. of Agricultural Engineering
Alva's Institute of Engg. & Technology
Mijar, Moodubidire - 574225

7th December, 2023

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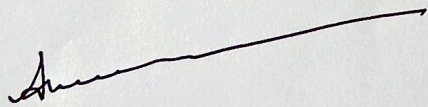
Sub: Internship Completion Certificate

This is to certify that **Ms. Navya K (USN – 4AL21AG023)**, a student of BE in Agriculture Engineering from Alva's Institute of Engineering & Technology, Moodbidri, has successfully completed her internship in our organisation from **02.11.2023 until 07.12.2023**.

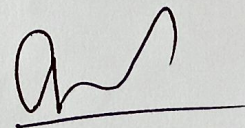
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We wish a good luck for her future.

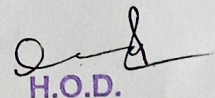
For Buhler (India) Pvt. Ltd.



A V Venkatesh Kumar
Head of HR & Admin



Ravindra R A
Sr. Manager – Tech. Training


H.O.D.

7th December, 2023

To whomsoever it may concern

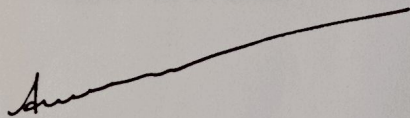
Sub: Internship Completion Certificate

This is to certify that **Ms. Sahana M Gowda (USN – 4AL21AG027)**, a student of BE in Agriculture Engineering from Alva's Institute of Engineering & Technology, Moodbidri, has successfully completed her internship in our organisation from **02.11.2023 until 07.12.2023**.

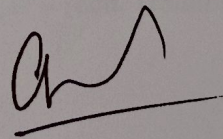
During the period of internship, she was found punctual, hardworking, inquisitive and has high learning orientation.

We wish a good luck for her future.

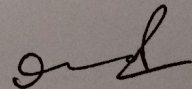
For Buhler (India) Pvt. Ltd.



A V Venkatesh Kumar
Head of HR & Admin



Ravindra R A
Sr. Manager – Tech. Training



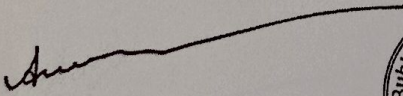
7th December, 2023To whomsoever it may concern**Sub: Internship Completion Certificate**

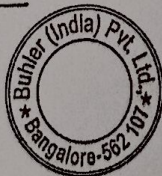
This is to certify that **Ms. Monisha S** (USN – 4AL21AG021), a student of BE in Agriculture Engineering from Alva's Institute of Engineering & Technology, Moodbidri, has successfully completed her internship in our organisation from 02.11.2023 until 07.12.2023.

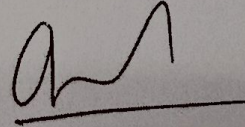
During the period of internship, she was found punctual, hardworking, inquisitive and has high learning orientation.

We wish a good luck for her future.

For Buhler (India) Pvt. Ltd.


A V Venkatesh Kumar
Head of HR & Admin




Ravindra R A
Sr. Manager – Tech. Training

7th December, 2023

To whomsoever it may concern

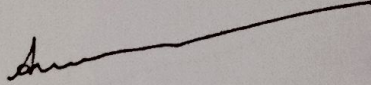
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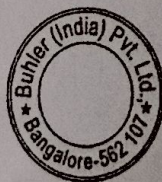
This is to certify that **Ms. Sneha M** (USN – 4AL21AG031), a student of BE in Agriculture Engineering from Alva's Institute of Engineering & Technology, Moodbidri, has successfully completed her internship in our organisation from 02.11.2023 until 07.12.2023.

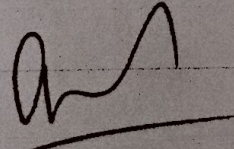
During the period of internship, she was found punctual, hardworking, inquisitive and has high learning orientation.

We wish a good luck for her future.

For Buhler (India) Pvt. Ltd.


A V Venkatesh Kumar
Head of HR & Admin




Ravindra R A
Sr. Manager – Tech. Training

7th December, 2023

To whomsoever it may concern

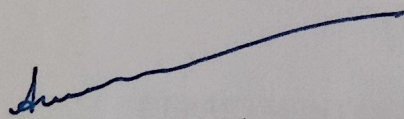
Sub: Internship Completion Certificate

This is to certify that **Mr. Shreeharsha K S** (USN – 4AL21AG030), a student of BE in Agriculture Engineering from Alva's Institute of Engineering & Technology, Moodbidri, has successfully completed his internship in our organisation from **02.11.2023 until 07.12.2023**.

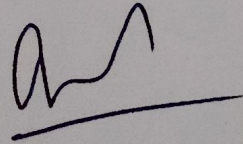
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We wish a good luck for his future.

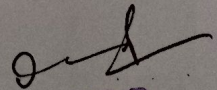
For Buhler (India) Pvt. Ltd.



A V Venkatesh Kumar
Head of HR & Admin



Ravindra R A
Sr. Manager – Tech. Training



VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JNANA SANGAMA CAMPUS, BELGAVI - 590018



INTERNSHIP REPORT ON “BUHLER INDIA”

Submitted by

KIRAN V	4AL21AG018
MONISHA S	4AL21AG021
NAVYA K	4AL21AG023
SAHANA M GOWDA	4AL21AG027
SHREE HARSHA K	4AL21AG030
SNEHA M	4AL21AG031

(Bachelor of Engineering in Agricultural Engineering)

Under the guidance of

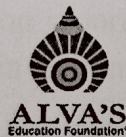
Dr. SHASHIKUMAR

(Associate Professor and Head of Department, AIET, Mijar)

Under the supervision of

Mr. K RAJU YADAV

(Assistant Senior professor and class coordinator)



DEPARTMENT OF AGRICULTURE ENGINEERING
ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY
MIJAR, MOODBIDRI, D.K-574225

H.O.D.
Dept. of Agricultural Engineering
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ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY

MIJAR, MOODBIDRI, D.K-574225

A UNIT OF ALVA 'S EDUCATION FOUNDATION (R)

Affiliated To Visvesvaraya Technological University Belagavi Approved By AICTE, New Delhi

Shobhavana Campus, Mijar, Moodbidri (Accredited By NAAC With A+ Grade)



CERTIFICATE

This is to certify that **AGRICULTURE STUDENTS** submitted Internship report on **BUHLER INDIA** at, Attibele Bangalore for 4th semester B.E in Agriculture Engineering during the Academic year 2022-23. The Internship report has been approved as it satisfies the academic requirements in respect of Internship program prescribed for the Bachelor of Engineering Degree.

Dr. SHASHIKUMAR

Head of the Department

Mr. K RAJU YADAV

Class Co-ordinator

ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY

MIJAR, MOODBIDRI, D.K-574225

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Shobhavana Campus, Mijar, Moodbidri (Accredited By NAAC With A+ Grade)



DECLARATION

I hereby declare that our One month Internship program in Buhler India in Bangalore is completed and report is written by me under the guidance of **Dr. Shashikumar** HOD, Department of Agriculture Engineering, Alva's Institute of Engineering And Technology, Moodbidri, in partial fulfilment of the requirements for the award of the degree **Bachelor of Engineering in Department of Agriculture Engineering of Visvesvaraya Technological University, Belagavi** during the academic year **2022-2023**. The dissertation report is original and it has not been submitted for any other degree in any university.

KIRAN
MONISHA S
NAVYA K
SAHANA M GOWDA
SHREE HARSHA K
SNEHA M

4AL21AG018
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ACKNOWLEDGEMENT

I extend my heartfelt gratitude to **Dr. Shashikumar**, Head of the Department, for his unwavering support and guidance throughout our internship at **BUHLER INDIA**. His wisdom and encouragement have been instrumental in shaping our learning experience.

I would also like to express my sincere thanks to **Mr. K Raju Yadav**, our class coordinator, for his continuous support and meticulous coordination that ensured a smooth and organized flow of the internship program.

A special appreciation goes to the Principal and Managing Trustee for providing us with the opportunity to engage in this enriching internship experience. Their vision and commitment to fostering practical learning have significantly contributed to our growth.

I extend my gratitude to the dedicated staff and trainers at Buhler India, H.R Ravindra, Mr. Karthik, K . Rajushakar and V. Rajshekar, whose expertise and enthusiasm have made our learning journey both enjoyable and enlightening. Their commitment to imparting knowledge and practical skills has been invaluable.

KIRAN
MONISHA S
NAVYA K
SAHANA M GOWDA
SHREE HARSHA K
SNEHA M

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SL.NO	CONTENT	PAGE NO
1.	INTRODUCTION TO BUHLER	1
2.	WHY BUHLER?	2
3.	BUHLER IN EVERYDAY LIFE	5
4.	PADDY AND PADDY ANATOMY	6
5.	METHOD OF RICE MILLING	7-8
6.	MODERN RICE MILLING PROCESS COMPLETE EXPLANATION	9-17
7.	RESEARCH AND DEVELOPMENT	17
8.	HULLING MACHINE	18-20
9.	SENSORS AND ITS TYPES	21-22
10.	SENSORS ARE CRUCIAL FOR MODERN MANUFACTURING	22-23
11.	SENSORS THAT MIGHT BE IMPLEMENTED IN HULLER	23-24
12.	QUESTION AND ANSWERS	24-25
13.	CONCLUSION	25

INTERNSHIP REPORT

BUHLER INDIA COMPANY, BANGALORE

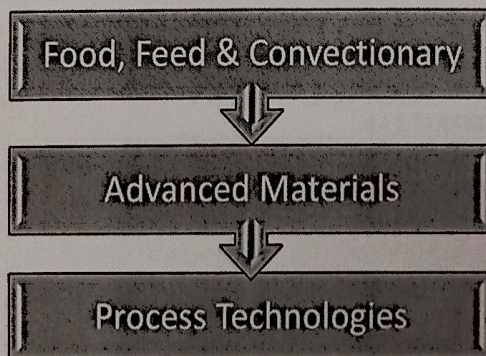
Billions of people come into contact with Bühler technologies to cover their basic needs for food and mobility every day. For this, we develop the best process solutions along complete value chains. Two billion people each day enjoy foods produced on Bühler equipment; and one billion people travel in vehicles manufactured with parts produced with our machinery. Having this global relevance, we are in a unique position to turn today's global challenges into sustainable and good business.



Fig.1 Buhler India company, Bangalore

Leading Processes Solutions and Sustainable Value Chains:

Bühler has two business pillars: Grains & Food solutions ensure safe and healthy food and feed. Advanced Materials contributes to the production of energy-efficient vehicles and buildings.



Why Buhler?

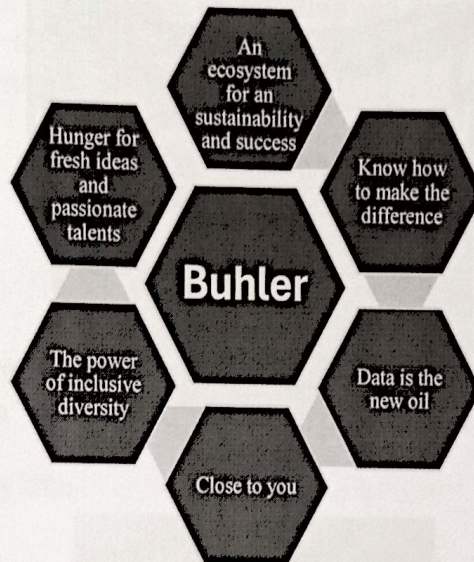


Fig.2 From value to impact

- **An Ecosystem for sustainability and success:**

The challenges me face today on the global market and in the environment to wash to solve alone the solutions we need them and collaborative ecosystems were groups from science to industry to startups work together bullet has followed a collaborative innovation approach for a decade and cubic campus will help reach new levels.



Fig 2.1 Sustainability and success

- **Know-how to make the difference:**

Buhler has been a pioneer in training and education since its foundation. Today our business offer training courses for our customers; for example, we run milling schools on all the continents.

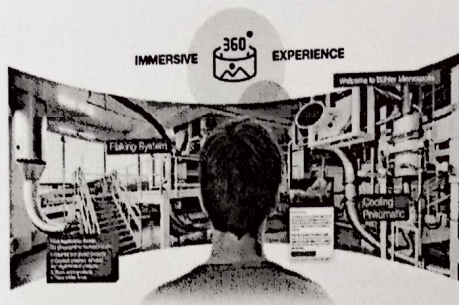


Fig 2.2 To make the difference

- **Data is the new oil:**

We are all in the midst of digital transformation, and Bühler has taken a leading role to unleash its full potential to the benefit of our customers, the world, and ourselves.

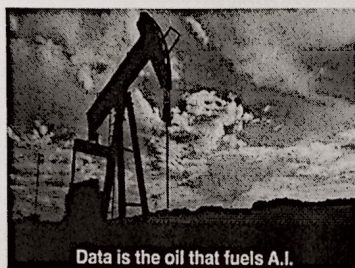


Fig 2.3 Data is the new oil

- **Close to you:**

We are close to our customers and partners. With 100 service stations, over 30 manufacturing sites, and 25 application centres, Bühler operates in a truly global network.

- **The power of inclusive diversity:**

We want every Bühler employee to have the same opportunities for personal development. We want to access and leverage the best skill sets available internally and externally, independent of individual attributes.

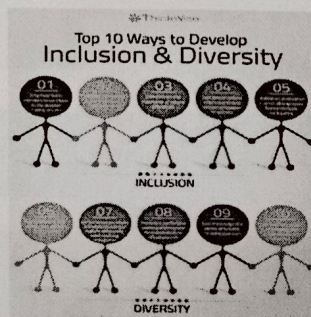


Fig 2.4 Power of inclusive diversity

- **Hunger for fresh ideas and passionate talents:**

If you are looking not for a job but for a purposeful assignment which requires passion, ambition, and dedication, you should take a closer look at Bühler. We offer an environment in which you can develop and grow your competencies. We know that it takes the best people to change our industries, the world, and ourselves for the better.



Fig 2.5 Hunger in people

Buhler in everyday life:



Market leadership in the industries we are active in

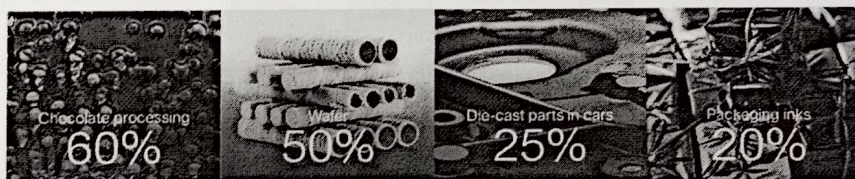


Fig. 3 Bühler productions

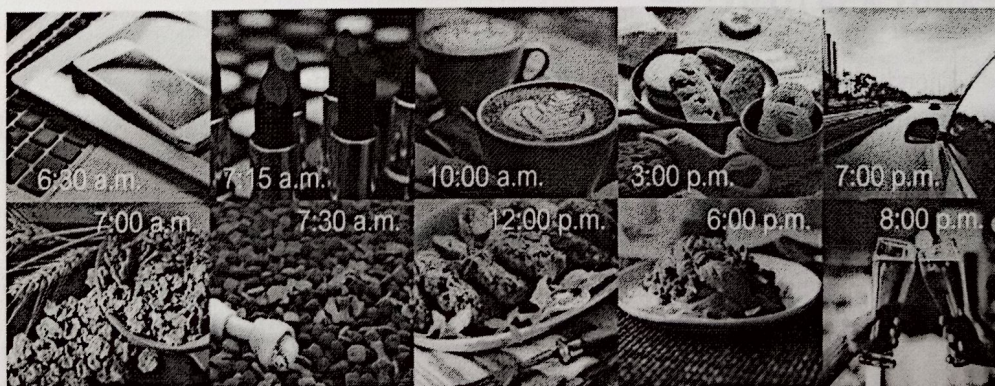


Fig.4 Bühler in Everyday life

PADDY

- Paddy is basically a tropical crop.
- India is one of the major producers of **rice** in the world, accounting for one-fifth of the world production, ranking next only to China.
- About 23 per cent of the total cropped area in the country is under this crop. Paddy is grown in **Kharif season**.



Fig.5 Paddy

- Paddy is ideally grown in rainfed areas where annual rainfall is more than 125 cm. It requires high temperature (20° - 25° C).
- Deep fertile loamy or clayey soils are considered ideal for this crop.
- Although paddy crop is grown in almost all states of India, the leading producing states are West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu, Bihar, Orissa and Assam.



Fig.6 Paddy Harvesting

PADDY ANATOMY:

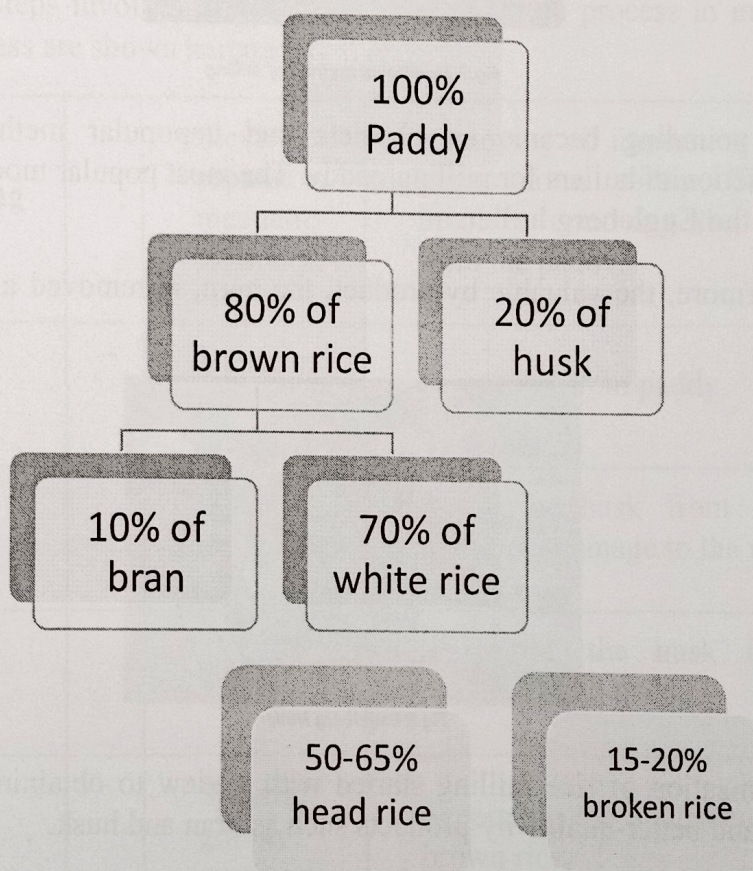
- Rice botanically belongs to *Oryza sativa* L. of Gramineae family.
- Paddy is a self-pollinated crop. A complete seed of rice is called paddy and contains one rice kernel.
- Outer layer of rice shell is called husk.
- The next layer is called rice bran and the innermost part is called rice kernel.
- A paddy grain approximately contains 20 % by weight of husk, 5 to 7 % by weight of bran layers and about 3 % by weight of embryo.

Composition of rough rice grain and its fractions:

Husk: The rice husk, also called rice hull, is the coating on a seed or grain of rice. It is formed from hard materials, including silica and lignin, to protect the seed during the growing season.

The rice hull represents about 20 -22% of the rice grain and is composed of approximately about 20% silica. Silica along with lignin (9-20%) provides physical protection of the grain against insect and fungal attack. Cutin a water repellent material covers the outer layer of the hull.

Rice bran: One hundred kilogram (100 kg) of paddy rice will generate approximately 5–10 kg of bran. Rice bran is a mixture of substances, including protein, fat, ash, and crude fibre. In many cases, bran contains tiny fractions of rice hull, which increases the ash content of bran.



Method of Rice Milling

- **Traditionally**, for milling hand pounding method was common. In a hand pound method, paddy is pounded in a traditional stone or wooden pestle and mortar.

- These operations are cumbersome, time consuming and require heavy labour input. By hand pounding husk and a small portion of bran are removed from the paddy. The resulting brown rice was nutritionally sound because of the bran layers.

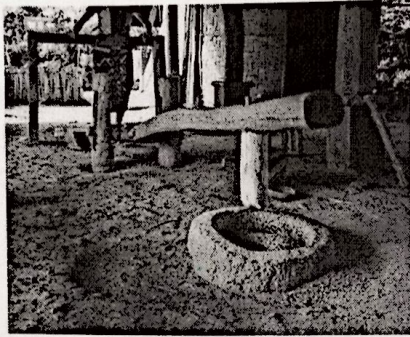


Fig.7 Traditional method of milling

- Hand pounding became an obsolete and unpopular method after the introduction of hullers for milling paddy. The most popular model of a huller mill is the **Engleberg huller**.
- Furthermore, the valuable by-product, the barn, is removed along with the husk.

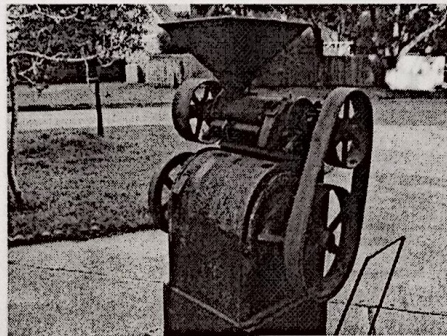


Fig.8 Engelberg Huller

- Modernization of rice milling started with a view to obtaining higher rice yields and better-quality by-products such as bran and husk.
- The ultimate goal of the rice industry is to produce a maximum amount of whole grain rice because market value of whole kernels. It is therefore important in processing to avoid conditions that may promote breakage.

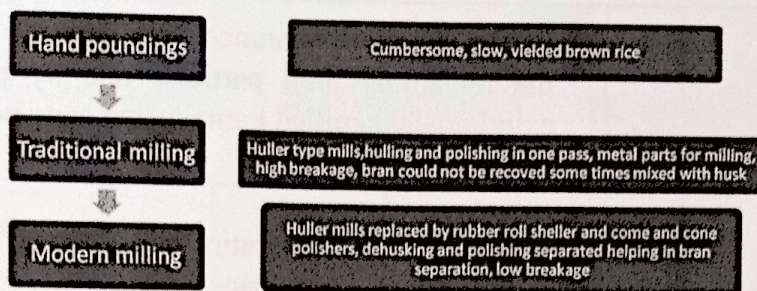


Fig. 9 Types of Milling

Modern rice milling processes

The major steps involved and the definitions of each process in modern rice milling process are shown hereunder.

Pre cleaning	:	Sieve separator, magnetic separator.	Removing all impurities and unfilled grains from paddy. This is also involves removing the metal parts from the paddy.
De-stoning	:	Vibratory separator	Separating from paddy.
Dehusking	:	Rubber roll sheller	Removing husk from paddy with minimum damage to the rice grain.
Husk aspiration	:	Aspirator	Separating the husk from brown rice/unhusked paddy.
Paddy separation	:	Specific gravity separator	Separating the unhusked paddy from brown rice.
Whitening	:	Cone polisher	Removing all or parts of the bran layer and germ from brown rice using cone polishers.

Polishing	:	Improving the appearance of milled rice by removing the remaining bran particles and by polishing the exterior of the milled kernel using cone polishers.	
Grading	:	Vibratory sieve grader	Separating small – large brokens from head rice.
Colour sorting	:	Colour sorter	Removing the discoloured rice from the white rice.
Bagging	:	Preparing the milled rice for transport to the customer.	

✱ **Paddy processing** also known as rice processing is crucial after harvesting for several reasons:

Paddy processing is a crucial step after harvesting to make rice suitable for consumption, improve its shelf life, enhance nutritional quality, and meet market preferences.

The specific methods of processing may vary, and some regions may also produce and consume rice in its less processed forms, such as brown rice or parboiled rice.

1. Removal of Husk
2. Obtaining White Rice
3. Improvement of Shelf Life
4. Enhanced Nutritional Quality
5. Reduction of Contaminants
6. Improved Cooking Characteristics
7. Marketability
8. Ease of Storage and Transportation.

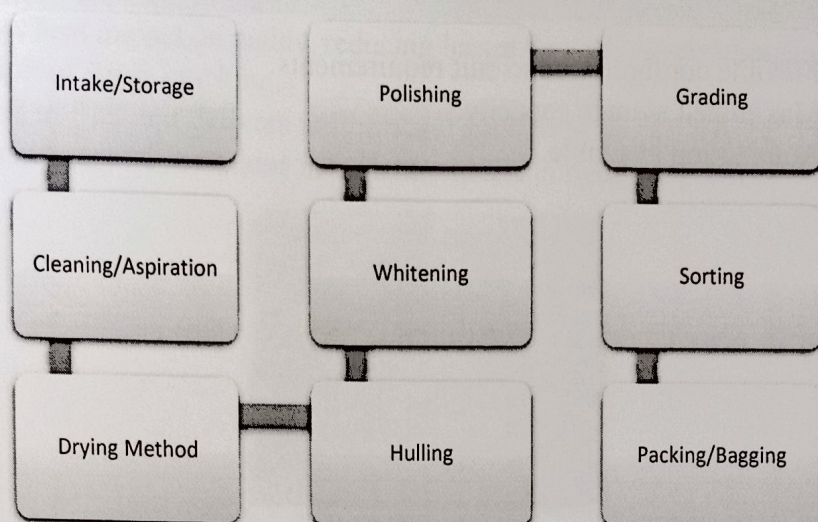


Fig.10 Step involved in paddy processing

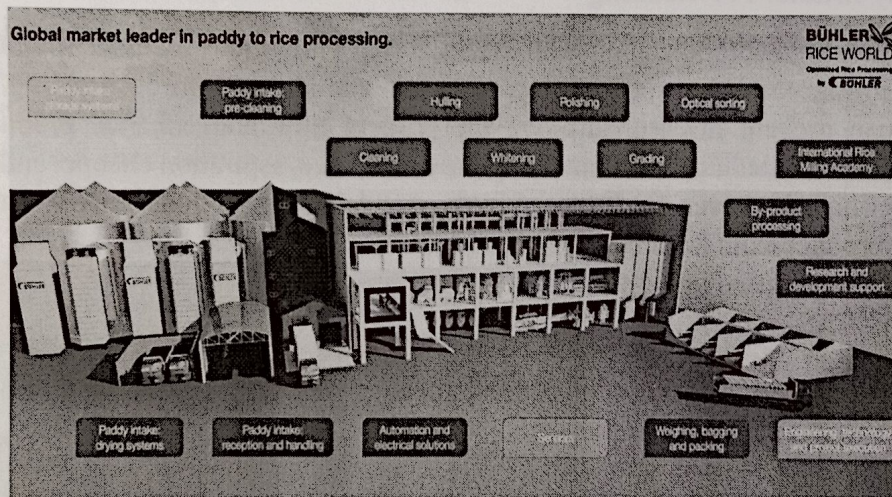


Fig.11 Paddy processing in Buhler

Paddy Intake: Storage Systems

Bühler lines are suited for all customers depending on capacity requirements. The following segments are available based on paddy input capacities

- Smart Line: 3-5 tons per hour
- Topline 8-10 tons per hour
- Superliner: 10-12 tons per hour
- Ultra Line: Upto 16 tons per hour

Bühler can supply a range of storage systems to suit individual requirements. Choose between steel alos and flat storages in different sizes All our equipment is developed for high productivity and to preserve excellent grain quality-to help reduce the 30 % of food we waste between field and fork.

- Flexible configuration to suit requirements.
- Maximized storage capacity.
- Automation available.



Fig 11.1 Storage Systems

Paddy Intake: Pre-cleaning

Conditioning and/or cleaning is an essential step at any rice processing plant. The aim is to increase the storage life of the grain and improve product quality. This step can prevent disease, improve the process flow and enhance production reliability. Bühler machines including the drum sieve, aspiration channel and TAS cleaner have a proven track record in thousands of applications, ensuring that a clean product exits from the end of process.

The machines used under this process are:

- TAS
- LALA
- LAIA
- LAKA
- MPSN
- LCGA

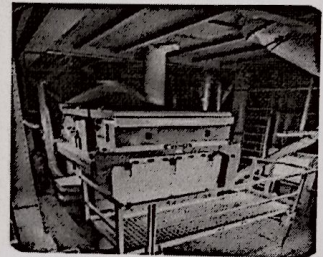


Fig 11.2 Pre-cleaning Systems

Paddy Intake: Drying Systems

Proper conservation safeguards product quality and with it, the value of rice for the producer. In addition to thorough cleaning and the method of storage, the ideal drying process plays a key role in conservation. Bühler's top quality drying systems ensure optimum product conservation and are also employed in process technology in the production of parboiled rice.

Product Highlight: Eco Dry

- Extremely gentle handling, significantly reduces thermal stresses to paddy.
- High capacity and reduced drying time through an optimized multiple-stage process.

- Low heat impact on paddy, reducing losses through product breakages as a result of stress cracking.
- First in-First out delivers uniform and consistent drying results.
- Elimination of variations in moisture levels in tempering bins.

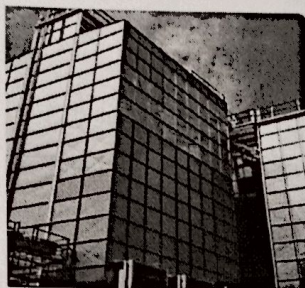


Fig 11.3 Drying Systems

Paddy Intake: Reception and Handling

Reliable high-performance bulk and bagged paddy reception plus conveying systems are a key contributor to success in production, Bühler conveyors can handle any type of grain, feed or seed safely and gently. The product portfolio ranges from chain conveyors, belt and bucket elevators, belt and screw conveyors up to tubular push conveyors.

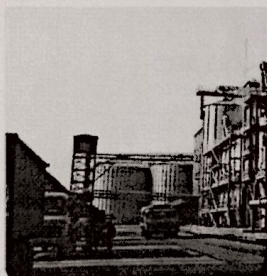


Fig 11.4 Reception and Handling

Cleaning:

During the process of cleaning, both coarse and fine impurities, for example straw, wood, stones, soil and sand, are removed. An aspiration channel is fitted to remove low-density particles such as dust and loose husk. This step is important and essential, as it protects all other equipment further along the nice milling process. Bühler's range of cleaning solutions range from separators, magnets and destoners.

The machines used under this are:

- MTRA
- LAGA
- MTSC
- MTSD

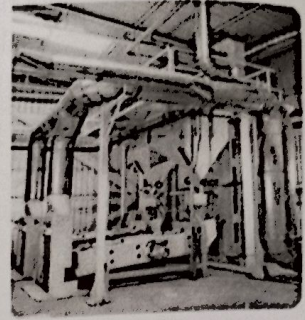


Fig 11.5 Cleaning Systems

Hulling:

- Huling is the process of removing husk from paddy. This is achieved by the gentle action of rubber rolls applied to the paddy after which the husk aspirator separates the husk from the rice by air aspiration.
- The brown rice then passes into the paddy separator which separates any unhulled kernels from the brown rice and recycles then into the huller.
- The hulling process in a Buhler mill is carried out by the huller and husk separator which hulls paddy with great care and efficiency. The Roto sort sizes rice by thickness.
- The rice grains are gravity-fed into the screen drums at a continuous rate. The smaller fractions (immature grain) pass through the screen while the overalls are delivered to the outlet.

The machines used in this process are:

- DRHL
- AVHE
- DRHE
- DRSD

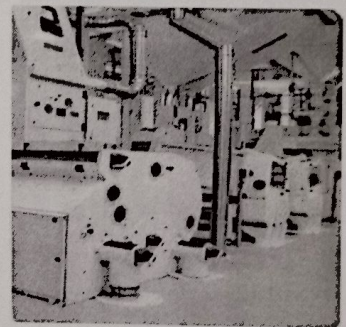


Fig 11.6 Hulling Systems

Whitening:

During whitening, bran layers are removed from the brown rice. This not only enhances the appearance of the rice but also increases its shelf life, since the lipids contained in the embryo and the bran layers are highly susceptible to enzymatic and non- enzymatic oxidation. The bran removal is best achieved in several steps to ensure evenly milled rice grains with minimum broken and optimum uniformity.

The machines used in this process are:

- BSPB
- DRCA
- DRWA
- DRWB
- DRWC
- DRWD
- DRWE

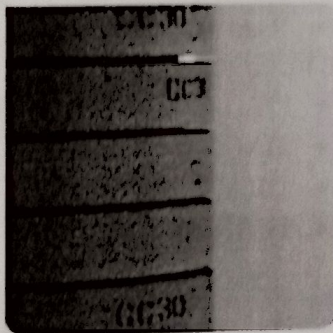


Fig 11.7 Whitening Equipment

Polishing:

The polishing of the whitened rice is achieved using a polisher which polishes rice by gentle rubbing of rice kernels against each other, giving it a dust free surface and silky luster. This makes the product highly visible and attractive on market shelves.

The machines used in this process are:

- DRPR
- DRPN
- AVPH
- DRPQ
- DRPP
- DRPG

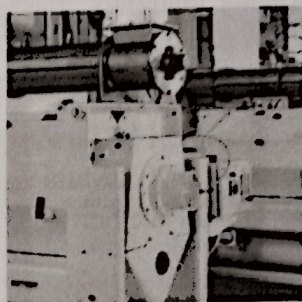


Fig 11.8 Bran polishing machine

Grading:

Grading is the process of removing the brokens from head rice and sorting them into well-defined fractions of different length. The grading process in a Bühler met is achieved by using plansifter, classifier separator and indent cylinder machines. The Plansifter separates the rice into head rice, a mixed fraction (including head rice and brokens) and tips. It also removes bran jumps from the product. The traction of the product out of the plansifter being a mixture of head rice and brokens is guided to the Indent Cylinders. They grade the rice by length into fractions of different broken sizes and head rice. The number of fractions depends on the market requirement.

Product Highlight - Indent Cylinders:

Machine delivers high precision of separating brokens by size fraction, even at very high-capacity processing Available in different sizes and configurations, other serial or parallel drums to meet plant requirements.

- Capacity range of up to 7 tons per drum per hour.
- Most efficient Indent Cylinder available in the industry.

- Pure fractions.

The machines used in this process are:

- DRGA
- DAGB
- DRAC
- DRTA

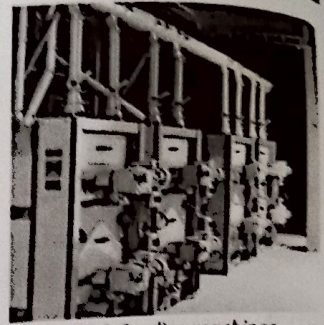


Fig 11.9 Grading machines

Optical Sorting:

Optical sorting is the final quality and food safety control and enhancement process in the rice mill. It is used to remove all discolored grains from subtle to bold, yellows, purple and gray, red and bran streaks, pecks, black tips, immature and rotten grains, white belly, chalky and various foreign materials such as packaging materials, glass, plastics, stones and foreign seeds/ grains. Bühler's range of rice optical sorters meet any capacity and end-product requirements and can sort a wide range of varieties from raw rice, parboiled and steamed.

- SORTEX S UltraVision™
- SORTEX B MultiVision™
- DS-C Rice Sorter



Fig 11.10 Optical sorting

Automation and Electric Solutions:

Bühler Automation Systems deliver ease of operation in processing plants. Processors can opt to incorporate a modular or fully automated system to control and monitor production, improve plant processes including its efficiency and machine performance.

- Maximum flexibility-choice of modular or fully automated plant.
- Choice of features include preventive maintenance and quick fault diagnosis for minimum downtime, product traceability and energy monitoring.

- Easy-to understand system with alarm management and remote access.
- Worldwide 24/7 service support with various choice of service packages.

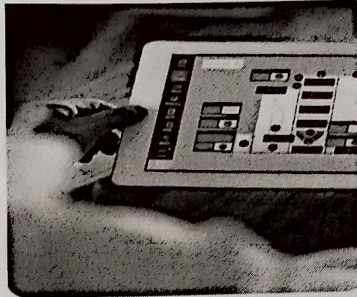


Fig 11.11 Automation & electric solutions

By-product processing:

Bühler's research and development programs work to deliver new applications and cutting-edge technologies. By-product processing is one such example. A complete range of solutions for stabilizing bran and processing broken rice into rice four, reconstituted rice and fortified rice, developed by Buhler offer customers maximized returns from raw product.

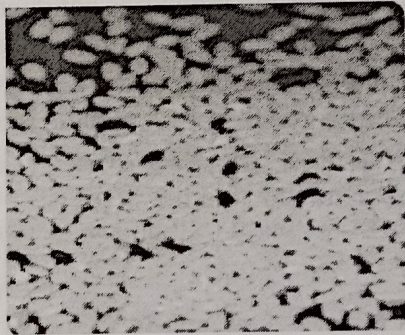


Fig 11.12 By products

Research and Development Support:

Buhler's leadership in rice processing stems from our continuous research, development, equipment technology and consultation services. We invest in the future, developing the latest solutions from our world-class research facilities to give our customers the competitive edge.

- Worldwide food and nutrition technologists.
- Bühler research facilities are located in major rice processing countries.
- Bühler Competence Centers offer application trials and customer visits.
- Research and Development in cutting-edge technologies.

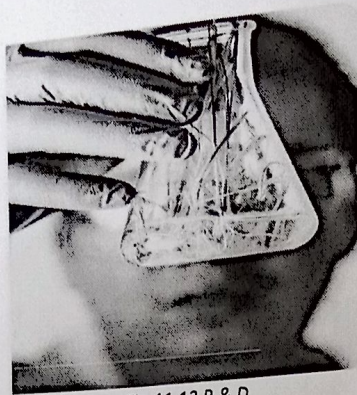


Fig 11.13 R & D

Importance of R and D:

- Research and development represent the activities companies undertake to innovate and introduce new products and services or to improve their existing offerings.
- R&D allows a company to stay ahead of its competition by catering to new wants or needs in the market.
- Companies in different sectors and industries conduct R&D pharmaceuticals, semiconductors, and technology companies generally spend the most.
- R&D is often a broad approach to exploratory advancement, while applied research is more geared towards researching a more narrow scope.
- The accounting for treatment for R&D costs can materially impact a company's income statement and balance sheet.

HULLING:

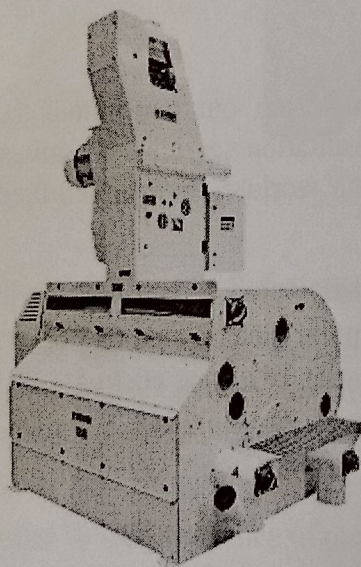


Fig.12 DRHE/DRHK

- ✓ High head rice yield
- ✓ High hulling degree
- ✓ High capacity
- ✓ Accurate husk separation
- ✓ Consistent product quality

TopHusk: DRHE / DRHK: (SHEARING FORCE)

Designed to be powerful & reliable – DRHE/DRHK compact huller is a perfect fit in modern rice mills. The TopHusk hulls paddy rice with highest care and efficiency. The huller adjusts its pressure appropriately to adapt to different types of paddy. The aspiration air blows around the rolls for intensive cooling.

- TopHusk DRHK is equipped with Bühler universal control unit MEAG. This means that it contains an automatic feed point control to compensate for the roll wear.
- Contains user friendly touch pad to control feed rate, hulling degree and manual discharge
- Product pre-acceleration via chute assures minimum breakage at high capacity
- Accurate setting of high hulling degree ensures perfect & constant hulling at high capacity.

Function:

A feed point connected to a chute with a vibro feeder guides each grain at optimal speed accurately between the rubber rolls. The huller adjusts its pressure appropriately to adapt to different types of paddy. The aspiration air blows around the rolls for intensive cooling. The generously sized husk separator works with optimised flow of grains in a closed air circuit to separate the husk from the brown rice accurately. This modern technology finally generates two clean fractions.

Accurate husk separation:

This design eliminates a cumbersome third fraction and achieves accurate husk separation. The process can be easily inspected through the large sight windows and adjusted accurately with the ergonomic levers.

Powerful - Constant high hulling action	Reliable - High operating performance	Compact - Sturdy and Streamline design	Modern - Easy to operate and maintain
1. Accurate setting of high hulling degree ensures perfect and constant hulling in high capacity.	1. Vibro feeder helps in precise feeding without choking. 2. Product pre-acceleration via chute assures	1. Motor position at the centre of the swivel arm. 2. Even product distribution across separating zone.	1. High-performance Hybrid belt as a standard fitment to provide long service life. 2. User friendly touch pad to control feed

<p>2. In spite of wear on rubber rollers with corresponding change in ratio, hulling degree remains constant, thus ensuring high head rice yield.</p> <p>3. Automatic hulling pressure control maintains constant hulling degree even under changing roller temperature. This results in steady constant power consumption and longer roller life</p>	<p>minimum breakage at high capacity.</p> <p>3. Automatic feed point control compensates for the roll wear.</p> <p>4. Paddle plates made of high wear-resistant steel.</p> <p>5. Consistent product quality.</p> <p>6. Platform on operation side for better access.</p>	<p>3. Compact hull separator unit with closed circuit airflow.</p> <p>4. Connection to efficient aspiration system.</p> <p>5. Extra wide machine housing of separator for low specific load of air stream.</p> <p>6. Minimum breakage at high capacity.</p> <p>7. Longer chute length to improve the feeding</p>	<p>rate, hulling degree and manual discharge of vibro feeder.</p> <p>3. Automatic disengaging at product flow interruptions.</p> <p>4. Control system with display that shows status and error messages</p>
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Dimensions, air and power requirements:

Capacity rice input (t/h): 3-7

Motor (kW): 7.5/4.75

Aspiration pressure (mbar): 13-18

Air volume (m³ /min): 7/-

Approx. weight kg: Unpacked 650/960

Approx. weight kg: Rail worthy packing 720/1060

Approx. weight kg: Sea worthy packing 790/1360

Volume m³ packing: 3/7

SENSORS:

Sensors are devices or components often integrated into larger, complex systems that detect and respond to physical inputs or stimuli from the environment and convert them into measurable signals or data.

They are used in various fields and applications, including science, engineering, manufacturing, and everyday consumer electronics.

Different Types of Sensors:

Sensors come in a variety of shapes and sizes, ranging from small chips with sensors integrated inside them to large bulky sensors that require an external power source.

They can also be classified based on their application, such as measuring temperature, pressure, humidity, acceleration, motion, direction, and more.

Some examples of these types of sensors include:

- ✓ **Temperature sensor:** Measures temperature changes and provides output in the form of electrical signals or temperature values.
- ✓ **Pressure sensor:** Measures changes in pressure or force and converts them into electrical signals or pressure values.
- ✓ **Light sensor:** Detects the presence or intensity of light and can be used for various purposes, such as automatic brightness adjustment in displays or triggering actions in response to light levels.

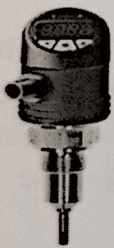


Fig.13 Temperature Sensor



Fig.14 Proximity sensor

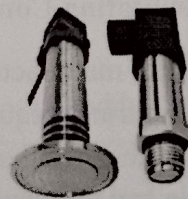


Fig.15 Moisture sensor

- ✓ **Proximity sensor:** Detects the presence or proximity of an object without physical contact and is often used in touchless technology, such as automatic faucets.
- ✓ **Accelerometer:** Measures acceleration or changes in velocity and is commonly found in smartphones, gaming controllers, and vehicles for various applications, including orientation detection.

- ✓ **LiDAR (Light Detection and Ranging):** Measures distances and creates detailed 3D maps of the surrounding environment using laser beams and is often used for operating autonomous vehicles and robotics.
- ✓ **Hygrometer:** Measures humidity, or the amount of moisture or water vapor present in the air, within any gaseous environment.

WHY SENSORS ARE CRUCIAL FOR MODERN MANUFACTURING:

1. Monitoring Equipment:

Monitoring equipment is no longer a matter of routine checks and reactive maintenance. With sensors, we've moved into the realm of predictive and even prescriptive maintenance. Vibration sensors, temperature monitors, and acoustic sensors can predict mechanical wear and tear, allowing you to schedule maintenance before a catastrophic failure occurs.

2. Quality Control:

Quality control has evolved from a post-production activity to an integrated part of the manufacturing process. With real-time sensors like vision systems, laser scanners, and spectrometers, you can achieve near-perfect inspection rates.

These sensors can identify defects ranging from dimensional inaccuracies to material inconsistencies. For example, vision systems use high-resolution cameras coupled with machine learning algorithms to identify even the most minute defects.

3. Facilitating Complex Tasks:

Complex manufacturing tasks, such as multi-axis machining or additive manufacturing, require a level of precision that's humanly impossible. Sensors provide the feedback loop for real-time adjustments, making these tasks feasible and efficient.

4. Safety Measures:

Safety in manufacturing has evolved from being reactive to proactive, and we owe that to sensors in many ways. Reactive safety measures require manufacturers to respond to incidents after they occur, while proactive safety measures aim to prevent incidents from happening in the first place through predictive analysis and monitoring.

SENSORS THAT MIGHT BE IMPLEMENTED IN HULLER:

1. TEMPERATURE SENSORS:

Benefits: 1. Monitors the temperature during hulling to prevent overheating.
2. Helps in preventing damage to the rice grains and the machine itself.

Placement: Install near the hulling mechanism or at critical points where heat buildup is likely.

The working procedure of a temperature sensor in the huller machine is quite straightforward. The sensor is designed to measure the temperature of the machine's components, such as the motor or the hulling chamber. It does this by detecting temperature changes in the hulling chamber. This information is then sent to a control system, which can use it to regulate the temperature and ensure optimal performance of the huller machine. Temperature sensors are crucial for maintaining the efficiency and safety of the machine.

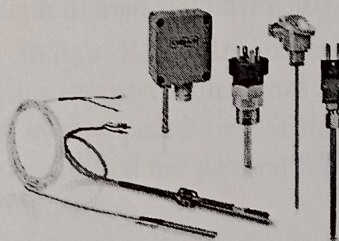


Fig.16 Temperature sensors

2. MOISTURE SENSOR:

Benefits: 1. Enables real-time monitoring of moisture content in paddy.
2. Helps optimize the hulling process for different moisture levels, improving overall efficiency.

Placement: Ideally placed at the input or intake section of the huller machine to assess incoming paddy moisture content.

The working procedure of a moisture sensor for this purpose involves measuring the moisture content of the grains as they pass through the machine. Immature grains tend to have higher moisture content compared to mature grains. The moisture sensor utilizes technologies like capacitance, resistance, or infrared to measure the moisture level. If the sensor detects a higher moisture

content than the desired threshold, it can trigger an alert or make adjustments to the hulling process to ensure that only mature grains are processed further. This helps in maintaining the quality and efficiency of the huller machine.

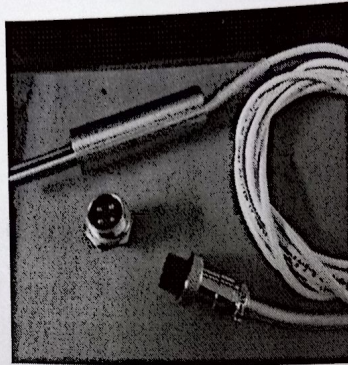


Fig.17 Moisture detecting sensor

QUESTION AND ANSWERS:

1. Why don't we eat husk?

Due to the presence of silica which is hard to digest which is necessary to mill the paddy.

2. What is husk?

Outer layer of the paddy.

3. Uses of husk?

- As a fuel in energy production.
- For making bricks.
- In the form of ash used in cement industry.

4. What is the output of huller?

Mixture of paddy, brown rice and husk.

5. How does the huller works?

Due to rollers running at different rpm at different levels helps in loosening the husk from the paddy.

6. What is degree of hulling?

Amount of paddy that is hulled.

7. What is the bulk density of paddy?

500-550 kg per cubic meter.

8. What is the bulk density of husk?

100-110 kg per cubic meter.

9. What is the bulk density of brown rice?

700-750 kg per cubic meter.

10. Length, width, thickness of paddy?

Length-7.5mm (approx)

Width - 2mm (approx)

Thickness – 1.5mm (approx)

11. A paddy of 250gm was hulled in a rice mill with the output as husk= 50gm, brown rice= 168gm, paddy=24gm. Find the hulling degree?

Hulling degree = $(1 - 24/250) = 92.1\%$

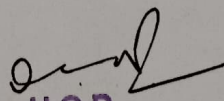
12. What factor will affect the hulling efficiency?

Uncleaned paddy (debris and impurities may affect the rollers)

CONCLUSION:

My internship at Bühler India's R&D department has been an enriching experience. Working alongside industry experts has deepened my understanding of innovative technologies in rice processing. This opportunity has not only enhanced my skills but also solidified my passion for pursuing a career in R&D within the food processing industry.

Internships in this field can provide valuable hands-on experience in research and development activities related to food processing. It's a great opportunity to learn about new technologies, optimize processes, and contribute to the development of machines. Additionally, interns can gain insights into quality control, food safety, and regulatory compliance. Overall, an internship in the R&D department of food processing industries can be a stepping stone towards a rewarding career in the field.


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