

GUIDELINES FOR SETTING UP A SMALL MILLET PROCESSING UNIT

DHAN Foundation;

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Guidelines for setting up a small millet processing unit

**Scaling up Small Millet Post-harvest
and Nutritious Food Products Project**

**Small Millet Foundation &
DHAN Foundation**



Small Millet Processing Units



Lamp Society, Jamunamarathur



Balan Millet Export, Salem



Balaji VPO, Sengapadai



CIKS Seramarathur, Jawathuhills

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Guidelines for setting up a small millet processing unit

1. Introduction

The market for healthful foods is increasing rapidly in India, as there is increasing health and nutrition awareness across the different sections of the society. As part of this growing market for healthful foods, the market for small millet foods is also on the rise. To capture this business opportunity, there is an increasing interest among the entrepreneurs to enter into the small millet processing sector in the recent past. This booklet on the 'Guidelines for setting up a small millet processing unit' has been prepared by DHAN Foundation as part of Scaling up Small Millet Post-harvest and Nutritious Food Products Project, keeping in mind the needs of new entrants to small millet processing sector. DHAN Foundation has been involved in setting up community scale small millet processing units (SMPU) and has been working with equipment manufacturers and regional level processors since 2011. This booklet has been prepared based on the learning gained during this period. The booklet covers the following:

1. Processing of small millets
2. Choosing set of equipment based on the planned scale of operation
3. Spares, accessories and tools
4. Testing the ordered equipment at the manufacturer's workshop/site
5. Installation

It also shares the support offered by DHAN Foundation for new entrants and existing small millet processing units.

2. Processing of small millets

Hulling is the process of removing the outer hull/husk from the grains, which are not human edible. It is a vital process for obtaining grain-rice and for further processing of grains for consumption. Small millets other than finger millet are well protected in glume encasements, hence the conversion of their grain to rice involve hulling

Traditionally, small millets were hulled manually by women in the production regions using pestle and mortar and/or wooden/stone grinders, as there is little-to no local processing infrastructure in the villages. This process involves significant drudgery and time. Due to this reason, the consumption of small millets has drastically declined in the production regions.

The major challenges in processing of small millets are:

1. The small size of the grains
2. Variations in the raw materials due to variation in varieties, cultivation practices and microclimate, across production regions and across the years and variations across the crops
3. Low shelf life of the processed rice and grits due to pest infestation and rancidity

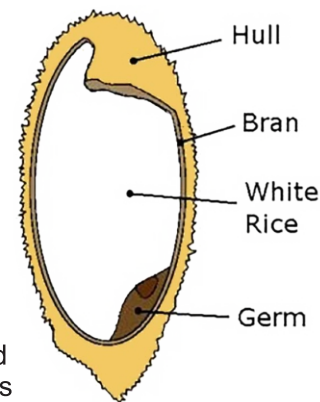
Most of the small millet processing work that was done manually earlier can now be done by using equipment. But, in order to make best use of machines, correct process flow needs to be followed.

Process flow

The flow chart given in page no.3 explains about the steps in small millet processing to be followed in order to get optimum rice recovery and quality of output. The principles followed in the process flow are given below

Pre-hulling

1. Separation of Materials Other Than Grains (MOTG) namely, straw, small sticks, dust, sand, mud, pebbles and weed seeds from the grains as much as possible before hulling
2. Segregation of unfilled grains from the grains as much as possible before hulling
3. Segregation of filled grains into different size and weight fractions before hulling, as hulling of same size/weight grains is more effective



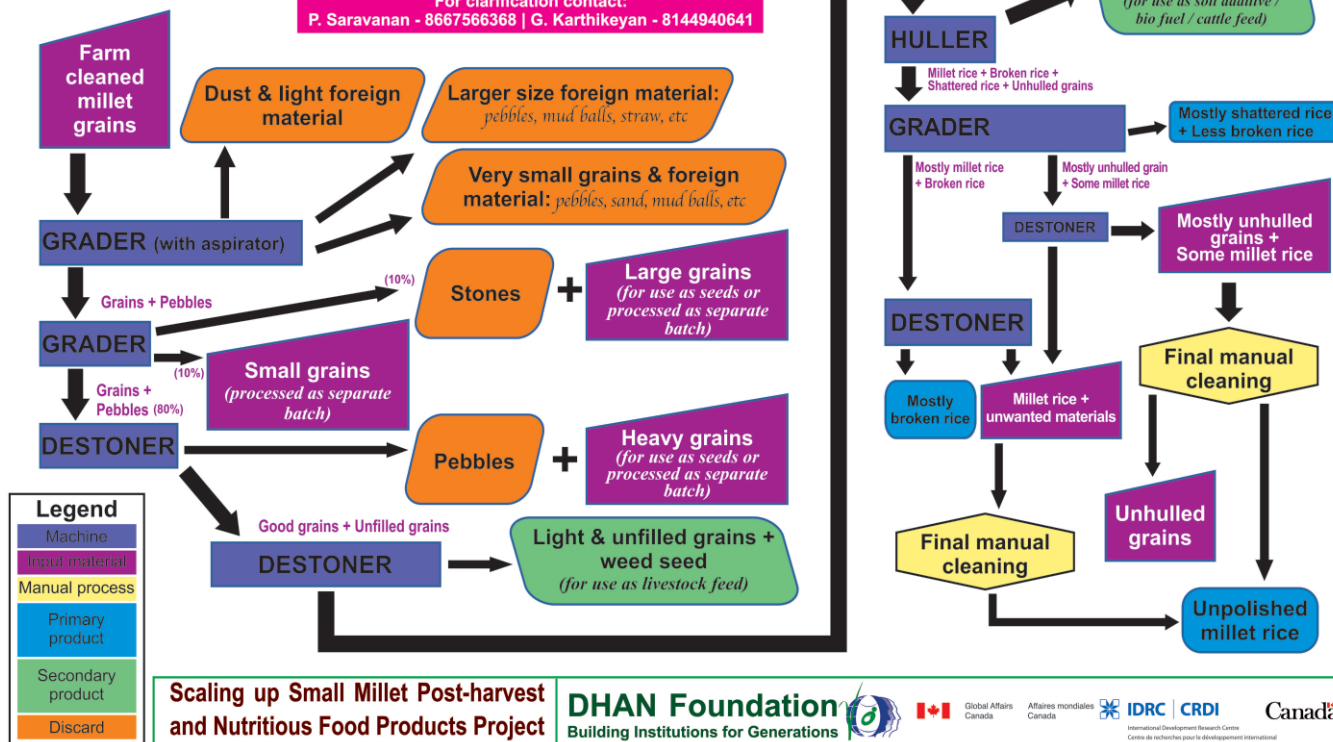


Community Scale Small Millet Processing

Process Flow for improving quantity and quality of output



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For clarification contact:
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Post-hulling

1. Segregation of unhulled grains from the hulled fractions (grain, rice & grits)
2. Segregation of sand particles and dust from rice and grits
3. Segregation of rice and grits to use them separately

For ensuring quality output, the following machines are needed in the process line: i) Grader/Shaker with aspirator, ii) Destoner and iii) Huller. Choosing the right set of equipment is critical for optimising the investment and for effective operation.

3. Choosing set of equipment based on the planned scale of operation

This section will help the new entrant to assess his/her requirement of machines and other requirements for setting up SMPU. It will also give him/her information on the equipment available in the market with contact details of manufacturers.

a. Requirement of equipment for SMPU at different levels

Description of requirement	Village/community scale	Small scale enterprise	Medium scale enterprise
1. Capacity	50 kg/hr	100 kg/hr	500 -1000 kg/hr
2. Manpower	2 persons	2 to 10 persons depending on the volume of operations	15 to 30 persons depending on the volume of operations
3. Infrastructure	200 sq ft floor area	<ul style="list-style-type: none">• 1200 sq ft floor area• Godown to stock 2 to 4 tonnes of materials	<ul style="list-style-type: none">• 5000 to 10000 sq ft floor area• Godown to stock 10-20 tonnes of materials• Pick-up vehicle• Open yard for drying, sorting and cleaning grains• A small office room

Description of requirement	Village/community scale	Small scale enterprise	Medium scale enterprise
4. Equipment	Decided based on locally grown small millet crops	Decided based on actual small millet crops to be processed	Decided based on actual small millet crops to be processed
4.1 Suggested basic equipment	<ul style="list-style-type: none"> • Destoner-1 • Grader-1with aspirator • Huller-1 	<ul style="list-style-type: none"> • Destoner-1 to 2 • Grader-1 to 2 • Huller-1 to 2 	<ul style="list-style-type: none"> • Destoner-4 to 8 • Grader-4 to 8 • Huller-2 to 4 • Pulveriser-1 • Semolina making machine-1 • Elevators
4.2 Additional equipment		<ul style="list-style-type: none"> • Pulveriser-1 	<ul style="list-style-type: none"> • Polisher-1
4.3 Investment required (approximately)	<ul style="list-style-type: none"> • Rs.1.5 lakhs 	<ul style="list-style-type: none"> • Rs.2.5 to 3.5 lakhs 	<ul style="list-style-type: none"> • Rs.10 to 30 lakhs
5. Accessories	<ul style="list-style-type: none"> • Weighing scale-100 kg • Weighing scale-50 gm to 5 kg • Air blower 	<ul style="list-style-type: none"> • Weighing scale-100 kg • Weighing scale-50 gm to 5 kg • Packing & sealing machines - both gunny & polythene • Air blower 	<ul style="list-style-type: none"> • Weighing scale- 100 kg • Weighing scale- 50 gm to 5 kg • Packing & sealing machines - both gunny & polythene • Hydraulic trolley • Air blower
6. Power requirement	Single or 3 phase; 5 to 10 HP	3 phase; 10 to 20 HP	3 phase; 30 to 50 HP
7. Specialised functions to be performed		Purchase, record keeping & marketing	Management, purchase, record keeping, marketing & management vehicle

b. Manufacturers of small millet processing equipment

Name & address	Contact details	Equipment supplied
1. AVM ENGINEERING INDUSTRIES, No. 1/191, Vanniyar Nagar, Meyyanoor main road, Salem, Tamil Nadu - 636 005.	Mr. Rajasekar - 9443633131 Mr. Jagadeesh - 7867018582 0427-2442335 avmengineeringindustries@gmail.com www.avmenginering.com	Destoners- 250 kg/hr to 500 kg/hr Graders - 3' to 12' Length(L) and 1' to 3' Breadth(B) Hullers- 50 kg/hr to 500 kg/hr Pulverisers- 30 kg/hr to 100 kg/hr Elevators as per requirement
2. VICTOR AGRO SALES, No. 162-A, Chinneri Vayalkadu, Backside New Bus Stand, P.B.No.907, Salem, Tamil Nadu - 636 009.	Mr. Mariappan - 8883961900 Mr. Shanmugam - 9865413664 Mr. Elumalai - 9500727272 04272443887 victormachinessalem@gmail.com	Destoners- 250 kg/hr to 1000 kg/hr Graders- 3' to 6' L and 1' to 2.5' B Hullers- 50 kg/hr to 200 kg/hr
3. AGROMECH ENGINEERS, No. 374, Patel Road, Coimbatore, Tamil Nadu - 641 009.	Mr. Sundarrajan - 9791766406 agromechcbe@yahoo.com	Destoners- 250 kg/hr to 2000 kg/hr Graders- 3' to 12' L and 1' to 3' B Hullers-150 kg/hr, Pulverisers- 20 kg/hr to 100 kg/hr, Elevators as per requirement
4. PERFURA TECHNOLOGIES (INDIA) PRIVATE LTD, No. 7, Maruthamalai Gounder Lay Out, Ganapathy, Coimbatore, Tamil Nadu - 641 006.	Mr. Udhaygopal - 098948 00009 Ms. T.S.Sowmya 0422 4534009 sales@perfuratech.com www.perfuratech.com	Destoners-250 kg/hr to 2000 kg/hr Graders-3' to 6' L and 1' to 2.5' B Hullers-100 kg/hr, Pulveriser-20 kg/hr to 100 kg/hr, Elevator as per requirement
5. KMS INDUSTRIES, No. 514, Palani Andavar nagar, Ranga layout II, Nallampalayam, Coimbatore - 641 006.	Mr. Kannan 9894218517, 9597872888 kovaimillstore@gmail.com kmsindustries888@gmail.com	Destoner-250 kg/hr to 2000 kg/hr, Grader-3' to 6' L and 1' to 2.5' B, Pulveriser-20 kg/hr to 100 kg/hr

c. Images of small millet processing equipment

AVM ENGINEERING INDUSTRIES



Destoner cum Grader
with Aspirator



Single chamber
Huller



Double chamber
Huller



Four chamber Huller

VICTOR AGRO SALES



Destoner with Aspirator



Grader



Single chamber Huller

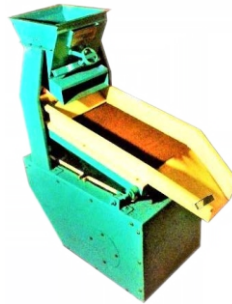


Double chamber Huller

AGROMECH ENGINEERS



Grader with Aspirator



Destoner



Huller

PERFURA TECHNOLOGIES (INDIA) PVT. LTD.



Destoner with Grader & Aspirator



Dehusker



Huller

Some tips and points to be kept in mind

1. *These are general guidelines and it would be better to visit existing processing units and discuss with experts in the field before taking the plunge.*
2. *Analyze the market potential in the proposed area of operation and your capabilities before choosing the scale of operation.*
3. *The new entrant/operator should take relevant onsite/practical training before starting the operations.*
4. *Choose equipment only after checking its performance for the small millet crops cultivated in your place.*

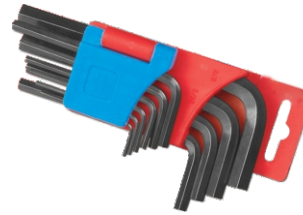
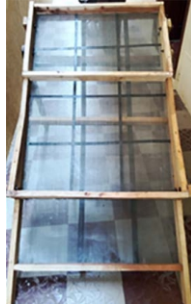
4. Spares, accessories and tools

It is better to get the following spares, accessories and tools while purchasing the processing equipment

1. Spanner set for all the bolts used in the equipment
2. Allen keys for the shunk nut used in the equipment
3. Wire brush for cleaning the sieves in the grader
4. Air blower for cleaning inaccessible parts of all equipment and to remove grain/rice stuck in sieve holes in grader
5. Hand sieves for identifying sieves with right hole size to be used in grader for its effective use for different small millet crops and for pre and post hulling operations
6. Extra pulleys of different sizes for adjusting rpm to hull the different small millet crops
7. Spare belts
8. Portable grader for removing dust and large impurities in the grains like sticks, clothes and mud balls, etc before going for grading operations
9. Extra set of sieves for grader based on small millet crops to be processed
10. Magnifying glass for checking uniformity of grains and average size of the grains



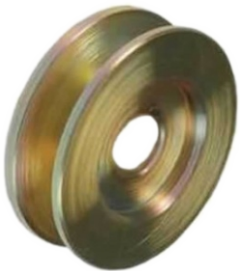
Portable grader



Allen key set



Air blower



Extra pulley



Spare belt



Hand sieve



Wire brush

5. Testing the equipment at the manufacturers' workshop/site

Once the set of equipment is chosen, order is placed and the machines are ready for dispatch, they need to be tested at the manufacturers' workshop/site. The purpose of checking at this point of time is to see if all the parts of the equipment are functioning well and any modifications and accessories needed are taken care of before dispatch. This section explains testing procedures for grader, destoner and huller, which are the main equipment needed in SMPU.

a. Grader with aspirator



4' X 2' Grader with aspirator

Checking the components

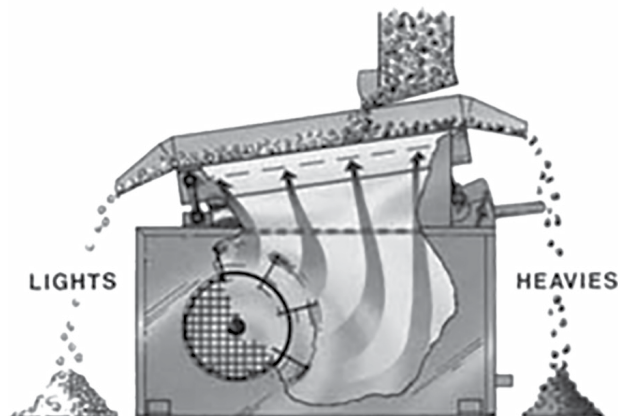
S. No.	Component	Problem(s)	Probable reason(s)	Solution(s)
A. Before running the equipment				
1.	Feed hopper	Does not shut properly- leakage of materials	Feed control valve/mechanism not working properly	Get it repaired
2.	Foundation holes in frame	Not drilled	May have forgotten	Get it drilled
3.	Safety guard for drive belts/ pulleys	Not installed	May have forgotten	Get it installed
4.	Emergency switch	Not installed	May have forgotten	Get it installed
5.	Sieve sets	Sieve frame is not properly fixed in the grader frame	Minor correction of either sieve set or grader mainframe needed	Get it done at the fabricators place
B. While running the equipment				
1.	Moving parts	Undue noise & vibration	Not properly fitted	Get it fitted properly
2.	Screen guards	Undue noise & vibration; the gap between the guard and the main body is high	Not mounted/fitted properly	Get it mounted/fitted properly
3.	Motor rotation	Anti-clockwise rotation	Wrong motor phase connection	Change the phase connection

Procedures for checking the performance

Take 20 kg of ungraded sample (preferably sample of grains if predominant variety of the prevalent small millet crop in the location, where it is going to be installed) for checking removal of dust and light foreign material and large and small size foreign material from the grains. Take 15 - 20 kg of graded grains for checking separation of grains according to size and 10 kg of hulled fractions for checking separation of rice and grit based on size.

S. No.	Description of function	Problem(s)	Probable reason(s)	Solution(s)	Remark(s)
A. Pre cleaning with aspirator & grader					
1.	Aspirator - Expected to remove dust and lighter materials from grains	Grains come out with dust and light materials	Dampener not adjusted	Adjust dampener	If problem is still not solved, fan rpm to be reduced
2.	Grader - Expected to remove i. sand and smaller grains and ii. Large twigs, mud balls, straw, etc. from normal sized grains	Grains come mixed with MOTG	Sieve size is not proper	Use proper sized sieves	Suggestion: Bottom sieve- 0.8 to 1.1 mm; middle 1.4 to 1.7 mm & top 2.6 to 3.0 mm
B. Pre- hulling					
3.	Grader - Separation of grains into three grades- Large grains (10%), normal sized grains (70 to 80%) and small grains (10 to 20%)	Improper separation	Sieve size is not proper	Use proper sized sieves	Choose sieves suitable for the predominant small millet crop to be processed
C. Post- hulling					
4.	Aspirator - Expected to remove millet husk, husk rich flour and other dust from rice	Not separating properly	Dampener not adjusted	Adjust dampener Use	If problem is still not solved, fan rpm to be reduced
5.	Grader - Separation of un-hulled grains, shattered rice kernels from hulled whole grain rice	Not separating properly	Sieve size is not proper	Proper sized sieves	Sieve size of bottom sieve should be more than the destoner bed mesh size; Choose sieves suitable for the predominant small millet crop to be processed; Get additional sieve sets

b. Destoner



Destoner principle of operation

Checking the components

S. No.	Component	Problem(s)	Probable reason(s)	Solution(s)
A. Before running the equipment				
1.	Feed hopper	Does not shut properly- leakage of materials	Feed control valve/ mechanism not working properly	Get it repaired
2.	Holes in the frame for foundation bolts	Not drilled	May have forgotten	Get it drilled
3.	Safety guard, if aspirator is there	Not installed	May have forgotten	Get it installed
4.	Emergency switch	Not installed	May have forgotten	Get it installed

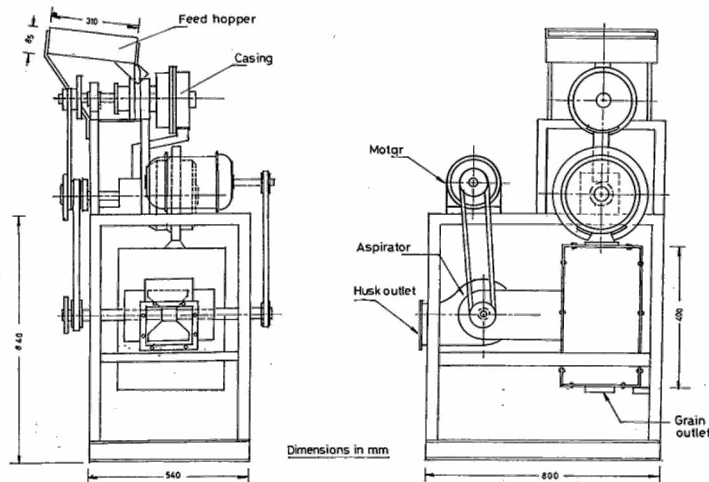
S. No.	Component	Problem(s)	Probable reason(s)	Solution(s)
5.	Destoner bed mesh	Not as specified	Oversight	Get specified bed mesh installed
6.	Fan box door	Not freely moving	Oversight	Movement to be made smooth
B. While running the equipment				
1.	Moving parts	Undue noise & vibration	Not properly fitted	Get it fitted properly
2.	Motor rotation	Anti-clockwise rotation	Motor phase connection wrong	Change the phase connection
3.	Air pressure in destoner bed	Not sufficient	1. Air leakage from sides or unintended openings 2. Fan speed not enough	1. Get leakages plugged 2. Fan should be properly fixed to the shaft
4.	Belt tension, in the case of destoner with grader & aspirator	Undue slip of the belt	1. Wrong size belts 2. Distance between pulleys not as required	1. Check belt tension in pulley drivers and rectify/ replace with suitable belt. 2. Fine adjustment between pulleys to be done.

Procedures for checking the performance

Take 20 kg of raw material sample and fill the feed hopper for checking destoning efficiency. Take 15 –20 kg of graded grains for checking separation of grains according to weight/ density. Take 10kg of hulled and graded fractions for checking separation of fractions based on weight. Take 10 kg of hulled and grader fractions for checking separation of rice and grit into hulled rice and unhulled grains.

S. No.	Description of function	Problem(s)	Probable reason(s)	Solution(s)	Remark(s)
A. Pre-hulling cleaning and segregation					
1.	Destoning first phase - Expected to segregate heavier materials- stones, mud balls, sand and others in the back and grains in the front	Stones and heavier materials not adequately segregating	Adjustment of destoner settings- bed angle and fan box opening- not done properly	Make necessary adjustments to get desired results	Choose destoner settings, suitable for the predominant small millet crop to be processed
2.	Destoning second phase - Expected to segregate unfilled and lighter grains in the front and other normal grains in the back	Unfilled and light grains not adequately segregating	Adjustment of destoner settings- bed angle and fanbox opening- not done properly	Make necessary adjustments to get desired results	Get the proper mesh size suitable for small millet crop to be processed
B. Post-hulling cleaning and segregation					
3.	Destoning (post hulling & grading-first phase) - Expected to segregate unhulled grains in the front and hulled rice in the back	Unhulled grains not segregated adequately	Adjustment of destoner settings- bed angle and fan box opening- not done properly	Make necessary adjustments to get desired results	See that destoner mesh size is smaller than the sieve size of bottom sieve of the grader, which is used before destoning in the post-hulling phase
4.	Destoning (post hulling & grading-second phase) - Expected to segregate lighter hulled fractions in the front from the heavier hulled fractions(rice) in the back	Hulled fractions are not segregated properly	Adjustment of destoner settings- bed angle and fan box opening- not done properly	Make necessary adjustments to get desired results	

c. Impact huller with aspirator



Centrifugal Huller - (Double Chamber)

S. No.	Component	Problem(s)	Probable reason(s)	Solution(s)
A. Before running the equipment				
1.	Feed hopper	Does not shut properly- leakage of materials	Feed control valve / mechanism not working properly	Get it repaired
2.	Holes in frame for foundation bolts	Not drilled	May have forgotten	Get it drilled
3.	Safety guard	Not installed	May have forgotten	Get it installed
4.	Emergency switch	Not installed	May have forgotten	Get it installed

S. No.	Component	Problem(s)	Probable reason(s)	Solution(s)
5.	Pulley bolt position	In the machine side	Oversight	To be changed to the outer side
6.	Pulley alignment	Not aligned properly	Oversight	To be aligned
7.	Dampener	Not freely moving	Oversight	Movement to be made smooth
B. While running the equipment				
1.	Moving parts	Undue noise & vibration	Not properly fitted	Get it fitted properly
2.	Screen guards	Undue noise & vibration; the gap between the guard and the main body is more	Not mounted /fitted properly	Get it mounted/fitted properly
3.	Motor/impeller/aspirator fan rotation	Anti-clockwise rotation	Wrong phase connection	Change the phase connection and/or make change in wiring
4.	Belt tension	Undue slip between pulleys	1. Wrong size belts 2. Distance between pulleys not as required	1.Check belt tension in pulley drives and rectify/ replace with suitable belt 2.Fine adjustment between pulleys to be done

Procedures for checking the performance

Take at least 10 to 20 kg of cleaned and graded grains of each intended variety and have test run of the huller. As the size and other features of varieties vary a lot, it is better to bring grains from the area of installation.

S. No.	Description of function	Problem(s)	Probable reason(s)	Solution(s)	Remark(s)
A. Hulling					
1.	Hulling	<p>More broken rice & grits with hulled rice</p> <p>High share of un-hulled grains in output along with rice</p> <p>Huller pillow block / bearing gets very hot</p>	<p>High impeller rotation per minute</p> <p>Low impeller rpm</p> <p>1.Wrong alignment of impeller and pulleys in the shaft</p> <p>2.Bearings held too tight in casing and/or not matching for the rpm of shaft</p> <p>3.Impeller defect</p>	<p>Get rpm of huller reduced by changing either drive or driven pulley or both</p> <p>Get rpm of huller increased by changing either drive or driven pulley or both</p> <p>1. Get it aligned properly</p> <p>2.Change with suitable bearing</p> <p>3. Change Impeller</p>	
B. Husk removal with aspirator					
2.	Aspirator	Rice, grits & other usable material come out with husk	Dampener not adjusted	Adjust dampener	If problem is still not solved, fan rpm to be reduced and/or length of dampener to be increased

Huller performance

Huller performance can be measured by calculating hulling efficiency, rice recovery percentage grain shattering percentage and through put/capacity.

1. **Hulling efficiency:** How many unhulled grains come through in 100 grains of the output after one pass through the huller.

2. **Rice recovery percentage:** Weight of the rice fraction in the output as a percentage of input material.

Expected rice recovery performance for different small millet crops

S.No.	Small millet	Rice recovery %
1.	Little millet	70 - 75
2.	Barnyard millet	60 - 65
3.	Kodo millet	60 - 64
4.	Foxtail millet	70 - 75

3. **Grainshattering percentage:** The weight of the shattered grains in the output as a percentage of the input material

4. **Through put / Capacity:** What is the maximum quantity of input grains it can process in an hour?

- N.B:**
- a) Percentage of broken rice to be calculated after grading the hulled rice fractions in grader.
 - b) Moisture content of the grains affects the broken rice percentage and it should be below 12%.
 - c) For the processing equipment that is expected to process multiple small millets, if possible test at least three of them – either foxtail or little millet, kodo millet, and either proso millet or barnyard millet

Common aspects to be checked for all the machines

1. Earthing points
2. Loose wires

6. Installation

a. Selection of location

1. The unit should be as far as possible constructed above ground level, preferably at an elevated place.
2. For ease of transportation, it should be approachable by road and any vehicle should be able to load and unload easily from the unit.
3. The unit should not be constructed near the river bed or at places where natural calamities recur frequently.

b. Indicative floor plan

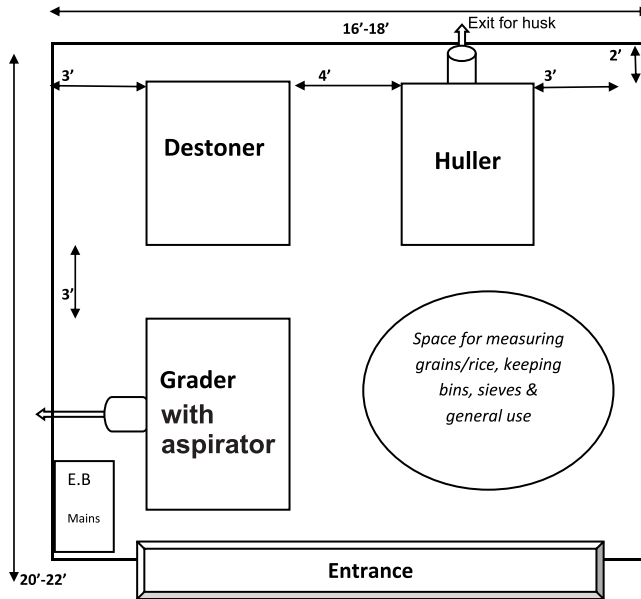
Indicative ideal floor plan for village/community scale unit & small scale enterprise level unit is given, which may help the new entrant to plan placing of machinery at his/ her site.

Important points to be considered during installation

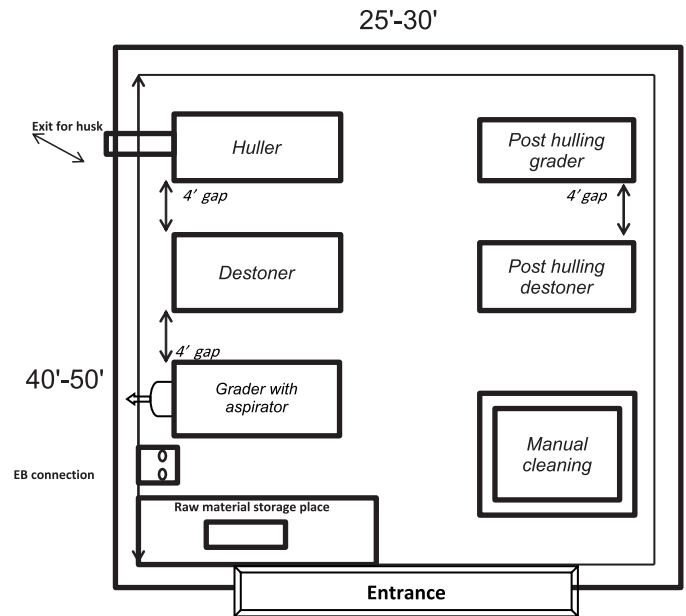
1. A minimum of 3 to 4 feet clear space should be maintained between any two equipment; this would allow for smooth movement of material.
2. The output from aspirator vents of both the grader/destoner and the huller should be collected and disposed outside the room.
 - Individual windows/ports can be made for this purpose.
 - A flexible canvas like material stitched into a tube-like shape can be used to collect and convey the dust & husk out of the room.
3. As far as possible, an air draft should be set up – a place for air to enter and a place for air to go out.
4. A clear and unambiguous board should be displayed in all local languages saying NO WATER allowed inside the room.

Indicative floor plan

a. For village/community scale SMPU



b. For small scale enterprise level SMPU



N.B: Figures given are not to scale

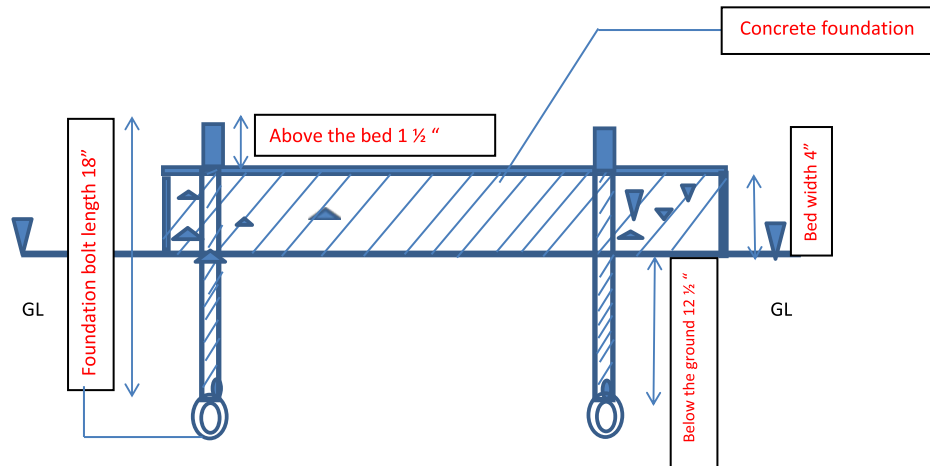
Additional points to be considered for Entrepreneur/Small and Medium-sized Enterprises(SME) level SMPU.

Ease of material flow is an important factor to be taken into account when deciding the plant layout for entrepreneur /SME level SMPU. Given the process flow diagram detailed in page 3 and using other principles of plant design, the following recommendations are being made for the floorplans / equipment layout in an enterprise level SMPU.

1. The storage space for received grains should be close to or one side of the doorway.
2. The aspirator cum grader, which is to be used for dust removal, needs to be located nearest to the storage space for received grains.
3. On the other side of the aspirator cum grader would be the destoner. Both aspirator cum grader and destoner are used for cleaning and segregating the grains to make them ready for hulling.
 - The sequence of placement of grader and destoner will change if aspirator is attached to destoner
4. The storage space for huller-ready grains should be clearly separated and demarcated from the space where received material is stored; preferably on the other end of the room. Each of the sacks with huller ready grain grades should be clearly and visibly marked.
5. Then the huller and post-hulling equipment need to be placed.
6. The post hulling intermediate products should not be stored; once a material has been dehusked, it should be processed to its terminal state (rice, grits, etc.) and packed away at the end of the shift.
7. The hulled ready for dispatch material should not be stored in the same room in which equipment have been installed.
8. A proper space needs to be identified to store the grader sieves – either hung on walls, or arranged on a rack made for that purpose.
9. Storage space should be away from windows and close to where the ceiling level ventilator is located.

c. Guidelines for laying the foundation for equipment

1. Mark the intended place of equipment in the floor bed as per floor plan.
2. Take the foundation details from the fabricator and prepare a foundation bed with bolts as specified at least a week before installation of the equipment. This is in order to get the foundation bed properly cured and ready for installation of equipment.
3. The level of foundation bed should be higher than the floor level of the building as indicated in the picture.



Foundation bed for processing equipment



Foundation bolt

N.B: Figures given are not to scale

d. Steps in installation

Once the floor plan is finalised, the purchased equipment needs to be installed. Steps on how to go about installing the equipment are shared below:

1. Once the foundation is ready, place each equipment in the intended place and connect it to the EB main box properly; Avoid loose wiring, as otherwise the wires may hamper easy movement during operation of the equipment.
2. Do the electrical wiring neatly and with concealed piping from the mains to each equipment.
3. Have an EB main box with Voltmeter & Ammeter and three bulbs for each phase of current.
4. Give proper earthing to each equipment.
5. A proper space needs to be marked for the tool box or tool board and another for spares and components' box / rack within the room.
6. After installation do the following:
 - a. Check all the wire connections and see that the machines are in firm foundation with proper earthing.
 - b. Start each machine individually (idle run) and see if any loose parts/guards are vibrating or the machine is making undue noise and rectify it if so.
 - c. Check idle run of each equipment for undue heating.
 - d. See the direction of the rotation of impeller in huller and fan box in aspirator and make corrections in wiring if needed.
 - e. Check belt tension in pulley drives and rectify it if there is undue slip.

7. Testing the SMPU equipment after installation

Purposes:

1. Ensuring the smooth functioning of the equipment
2. Basic training for the operator/ owner; it will cover how to operate and get good quality output, all adjustments in the equipment, do's and don'ts, regular maintenance, troubleshooting, etc.; So the presence of such persons is to be ensured.

General procedure:

If detailed testing of the equipment at the manufacturers' site has already been done, then the following can be undertaken for testing the SMPU equipment at the site after installation; otherwise follow the instructions given in the section on 'Testing the equipment at the manufacturers' workshop/site'

1. Take sample grains (small millet varieties to be processed), at least 20 kgs of each variety, and have a trial run of the aspirator cum grader, destoner and huller.
2. Demonstrate to the operator how to get higher output and to ensure the quality of the output by operating each equipment, in terms of steps in operating and adjustments to the control parameters to be made based on necessity.
 - a. With the help of the aspirator, remove lighter materials like dust, mud, husks, straw and hollow grains.
 - b. With the help of the grader, remove bigger & heavier materials like twigs & big stones.
 - c. Then use the grader to separate the cleaned grains into different sizes.
 - d. Put the different size grains separately in the destoner. Now adjust destoner settings with the help of fan box opening such that stones and heavier materials are removed from the back side, and grains are collected in the front side.
 - e. Then adjust the fan box setting and put the grains without stones to get heavier grains from back and lighter ones at the front outlet of destoner.
 - f. Take the cleaned and graded grains from the destoner and do test run of the huller.
 - g. Tell the operator how to change the flow rate based on the huller output; increase the flow rate if the broken is more and vice versa.
 - h. Check huller aspirator exhaust pipe assembly to see if grains/broken rice kernels are coming out along with husk. Adjust aspirator dampener accordingly.
 - i. Tell the operator about the need for the final manual cleaning and how to go about it.
 - j. Tell the operator about the different kind of primary outputs and how to use the same.
 - k. While checking the equipment, teach him how to observe the equipment output and make adjustments in the fan box opening and angle of destoner bed, sieve size selection in graders, dampener control in aspirators and feed hopper adjustment in huller for getting good quality output.
 - l. More details on operating the equipment can be seen in Audio-visual Training Manual on Community Scale Small Millet Processing, which can be accessed at <http://www.dhan.org/smallmillets2/sm-resources-processing.html>
3. While running the equipment, see if undue heating of the bearings and moving parts is there and rectify it.
4. Tell the operator about regular and periodic maintenance works to be done.

8. Support from DHAN Foundation

DHAN Foundation will help the purchaser in the following ways:

- Arrange for exposure visit to equipment offered by manufacturers and to successfully operating SMPU
- Give hands-on training to operators/proprietors/mechanics on operating SMPU



Training on small millet processing,
Koraput, Odisha



Rubber roller type huller being
developed by McGill



Pneumatic grain cleaner prototype

Vernacular names of small millet crop

<i>English</i>	<i>Tamil</i>	<i>Kannada</i>	<i>Telugu</i>	<i>Oriya</i>	<i>Hindi</i>	<i>Marathi</i>
<i>Foxtail millet</i>	<i>Thinai</i>	<i>Navane</i>	<i>Korra</i>	<i>Kanghu</i>	<i>Kakum</i>	<i>Kang</i>
<i>Kodo millet</i>	<i>Varagu</i>	<i>Haarka</i>	<i>Arikelu</i>	<i>Kodua</i>	<i>Kodon</i>	<i>Kodra</i>
<i>Barnyard</i>	<i>Kuthiraivali</i>	<i>Oodhalu</i>	<i>Udhalu</i>	<i>Khira</i>	<i>Sanwa</i>	<i>Morbardi</i>
<i>Little Millet</i>	<i>Saamai</i>	<i>Same</i>	<i>Samalu</i>	<i>Suan</i>	<i>Kutki</i>	<i>Sava</i>
<i>Proso millet</i>	<i>Panivaragu</i>	<i>Baragu</i>	<i>Variga</i>	<i>Bachari</i>	<i>Chena</i>	<i>Vari</i>

Also see other publications of DHAN Foundation on small millets

Processing of small millets

1. Protocol for Assessment of the Existing Small Millet Processing Units
 2. Assessment of Existing Small Millet Processing Equipment in India
 3. Audio-visual Training Manual on Community Scale Small Millet Processing
- All three can be accessed at [**http://www.dhan.org/smallmillets2/sm-resources-processing.html**](http://www.dhan.org/smallmillets2/sm-resources-processing.html)

Small millet food products

1. Technical Bulletin on Value Added Products from Small Millets
 2. Protocol for Training of Trainers (ToT) on Small Millet Recipe Demonstration
- Both can be accessed at [**http://www.dhan.org/smallmillets2/sm-resources-food.html**](http://www.dhan.org/smallmillets2/sm-resources-food.html)

Promoting consumption of small millets

1. Film on cooking show covering 28 small millet recipes
[**http://www.dhan.org/smallmillets2/sm-recipe-videos.html**](http://www.dhan.org/smallmillets2/sm-recipe-videos.html)
2. **Nam Unave Nam Marabu**- A small millet recipe book on small millets
[**http://www.dhan.org/smallmillets2/file/nam%20unavu%20nam%20marabu.pdf**](http://www.dhan.org/smallmillets2/file/nam%20unavu%20nam%20marabu.pdf)
3. Awareness posters on small millets
[**http://www.dhan.org/smallmillets2/sm-poster.html**](http://www.dhan.org/smallmillets2/sm-poster.html)
4. Small Millet Music Treat- A music album in Tamil
5. Puthayal (Treasure) - An effort to revive lost food habits - Ten episodes of radio programme

Policy

1. Small Millets, Big Potential: Diverse, Nutritious and Climate Smart – A Policy Brief
 2. Small Millets, In Mainstream Diets: *Promoting Decentralised Processing Infrastructure*- A Policy Paper by Mr. M. Karthikeyan
- Both the papers can be accessed at [**http://www.dhan.org/smallmillets2/sm-resources-policy.html**](http://www.dhan.org/smallmillets2/sm-resources-policy.html)

DHAN Foundation

DHAN Foundation is a Pan-Indian development NGO working with 1.6 million poor families across 14 states in India. The two main goals of DHAN Foundation are i) Poverty reduction and ii) Promoting grassroots democracy. Currently, it is implementing seven major thematic development programs on Microfinance, Tankfed Agriculture, Rainfed Farming, Development Education, Panchayat Raj, Coastal Livelihoods and ICT for Poor.

Scaling up Small Millet Post-harvest and Nutritious Food Products Project

DHAN Foundation has been promoting production and consumption of small millets in various parts of the country since 2011. It has identified and promoted location-specific varieties and other production technologies; developed improved huller and appealing small millet food products developed small millet recipe films and book; undertaken large-scale promotional events and marketing of small millet value added products. It has initiated small millet foundation to scale up the technologies, practices and working models developed across India for bringing back small millets in the mainstream diets.

DHAN Foundation is currently implementing '**Scaling up Small Millet Post-harvest and Nutritious Food Products Project**', which aims at scaling up the reach of small millet processing equipment and value added food products to reduce the drudgery of women and improve the food security in India. This project is implemented in collaboration with Tamil Nadu Agriculture University and McGill University, Canada. This project is supported by International Development Research Centre (IDRC) and Global Affairs Canada (GAC). Our initiatives on small millets can be viewed at www.dhan.org/smallmillets/ & www.dhan.org/smallmillets2/

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Scaling up Small Millet Post-harvest and Nutritious Food Products Project