BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

Proposed Draft ***Indian Standard***

CARROT /RADISH WASHER — TEST PROCEDURE AND RECOMMENDATIONS ON SELECTED PERFORMANCE CHARACTERISTICS

FAD 20 — Agriculture and Food Processing Equipment Sectional Committee	Last date of comments: 24 January, 2023

FOREWORD

The test code and procedure described below are formulated with view for improvement of the design and better adaptation of Carrot/Radish washer.

Root vegetables like carrot, radish grow on heavy soils which are more rough and coarse. As the above vegetables grow under the soil they are well prone to mud and dust. These crops are harvested either manually or mechanically. They can easily be contaminated with microbial actions, physical damage, cracking cuts, bruising etc. They cannot be stored along with soil for a long time. It is necessary to wash off the mud and dirt particles which would reduce the physical appeal in the market and also aid in further processing. Traditional method of washing root vegetables are by trampling under feet in running water like streams and also in washing yards. This not only damages the product but also results in contamination because it is constantly rubbed with the feet. The operation requires more labour and the labourers are constantly exposed to chill water during the washing operation. Washers may be continuous or batch type. Soaking in still or moving water is effective only if dirt or other surface undesirable is present in small quantities and is loosely attached to the product. So there is a need for and efficient washer to remove the mud and other foreign matter present on the surface of root crops. Adequately cleaning is a critical operation in the production and distribution of root crop vegetables.

1 SCOPE

This standard covers the following:

1.1 Methods for testing of Carrot/Radish washer.

1.2 Assessment of the evaluative requirements applicable for Qualifying Minimum Performance Criteria of the Carrot/Radish washer.

1.3 Criteria for determining variants and new model of Carrot/Radish washer for the purpose of testing and certification.

2 REFERENCES

The following Indian Standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated:

IS No	*Title*
RNAM	RNAM Test Codes & Procedures for Agricultural Machinery
IS 3327 : 1982	Specification for pedal-operated paddy (*first revision*)
IS 6284: 1985	Test code for power Thresher for cereals (*second revision*)
IS 8122 (Part 1): 1994	Test code for power combine harvester Part 1-terminology (*first revision*)
IS 9020 : 2002	Power threshers-safety requirements (*first revision*)
IS 11234 : 1985	Test code for power thresher for groundnut
IS 15805 (Part 1) : 2008	Straw Reaper - Combine - Test Code : Part 1 Terminology
IS 15805 (Part 2) : 2008	Straw Reaper - Combine Test Code : Part 2 Performance Tests

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Confidential Test — The test conducted for providing confidential information on the performance of Carrot/Radish washer whether ready for commercial production or not, or to provide any special data that may be required by the manufacturer / applicant.

3.2 Commercial Test — The tests conducted for establishing performance characteristics of Carrot/Radish washer that are ready for commercial production or already in production.

3.2.1 *Initial commercial Test* — The tests conducted on indigenous or imported prototype Carrot/Radish washer ready for commercial production.

3.2.2 *Batch Test* (*Conformity of Production*) — The tests conducted on Carrot/Radish washer which have already undergone initial commercial test and are being manufactured / sold commercially in the country.

3.2.3 *Repeat Test* — The tests conducted on Carrot/Radish washer, to validate the performance in

case of not meeting the evaluative requirements of this standard or to ascertain the re-occurrence of breakdown / defects observed in earlier tests, for the same parameter and on the same sample under the test after rectifying the defects or after replacing the defected part/sub-assembly by new part of the same specifications.

3.2.4 *Evaluative requirements* — Requirement under this category are the ones which are mandatory for acceptance of the Carrot/Radish washer for the purpose of commercial production/ subsidies. The testing agency will assess the performance of the Carrot/Radish washer under test and release the report.

3.3 Non Evaluative requirements — Requirements under this category are the ones which are not mandatory for acceptance of the Carrot/Radish Carrot/ Radish washer for the purpose of commercial production / subsidies / NABARD financing. However, the authorized testing agency may observe the performance for these requirements and record in the test report.

3.4 Carrot/ Radish Washer — Following terminology related to this machine shall apply.

3.4.1 *Washed Carrot/ Radish* — Carrot/Radish free of extraneous matter viz., sand, dirt etc. after washing.

3.4.2 *Cleaned* Carrot/Radish — Carrot/Radish free of small fibrous roots after washing.

3.4.3 *Broken* — Damaged / broken Carrot/Radish collected from the outlet after washing.

3.4.4 *Washing efficiency* — Washed Carrot/Radish (after removal of dirt, sand etc.) received at the outlet with respect to the total Carrot/Radish (uncleaned) fed at the inlet expressed as percentage by mass.

3.4.5 *Cleaning efficiency* — Cleaned Carrot/Radish collected at the outlet with respect to the total vegetable mixture collected at the Carrot/Radish outlet expressed as percentage by mass.

3.4.6 *Percent Damage* — The broken/damaged Carrot/Radish collected from the outlet with respect to total input of vegetables expressed as percentage by mass.

3.4.7 *Feed Rate* — The quantity of Carrot/Radish fed at the machine inlet per unit time.

3.4.8 *Output* — The total mass of the Carrot/Radish collected at the machine main outlet per unit time.

3.4.9 *Extraneous Matter* — Organic / Inorganic material comprising of dirt, gravel, small stones/pebbles, lumps of earth, clay, mud etc.

3.4.10 *Percentage of unwashed* Carrot/Radish — The unwashed Carrot/Radish collected from outlet with respect to total Carrot/Radish input expressed in percentage by mass.

3.4.11 *Percentage of uncleaned Carrot/ Radish* — The unclean Carrot/ Radish (with fibrous roots) collected from outlet with respect to the vegetables fed at the inlet expressed as percentage by mass.

3.4.12 *Carrot/ Radish washer* — An equipment operated by a power source viz., manual operated, electric motor, engine used for washing and cleaning Carrot/Radish .

3.4.13 *Power source* — The power required to operate the washer such as the manual operated,

electric motor and engine.

3.4.14 *Sample* — The quantity of Carrot/Radish taken from the outlet at a particular time period.

4 GENERAL GUIDELINES

4.1 Selection — For commercial test, the Carrot/ Radish washer shall be selected at random from the production line or as directed by the testing authority. The Carrot/ Radish washer shall be complete with all its usual accessories and in condition generally offered for sale. The Carrot/ Radish washer shall be new and should not be given any special treatment or preparation for test. The manufacturer may submit prototype for confidential test report. The nature of test shall be stated by the manufacturer.

4.2 Specification sheet — The manufacturer/applicant shall supply the specification of the Carrot/ Radish washer consisting of the items listed in the specimen report given in Annex A, as well as any other information required by the testing authority to carry out the tests.

The manufacturer / applicant should also supply technical literature such as operational, maintenance and service manuals, and parts catalogue.

4.3 Running-in — The manufacturer / applicant shall run-in the machine before test under his responsibility and in accordance with his usual instructions. The running-in shall be carried out in collaboration with the testing authority or the procedure agreed to with the manufacturer/applicant. After running-in, servicing and preliminary settings should be done according to the printed literature supplied by the manufacturer/applicant.

4.3.1 The place and duration of running-in shall be reported.

4.4 Servicing and Preliminary Setting after Running-

4.4.1 After completion of running-in, servicing and preliminary settings should be done according to the printed literature supplied by the manufacturer/ applicant. The following may be carried out, wherever applicable:

a) Tightening the nuts and bolts;
b) Checking and adjusting the tension of belts and chains;
c) Checking and adjustment of safety devices, if any, and
d) Any other checking or adjustment recommended by the manufacturer after the running-in period, and included in the printed literature of the Carrot/ Radish washer.

4.5 Repairs and Adjustments during Tests — All the repairs and adjustments made during the tests shall be reported together with the comments of any practical defects/shortcomings.

5 MEASURING TOLERANCES

The measuring apparatus shall be such that the following items shall have the tolerances within the limits shown against each:

a) Rotational speeds, rev/min ±0.5 percent
b) Time ±0.2 s
c) Distance, m or mm ±0.5 percent

d) Force, N and torque, N-m ±1.0 percent
e) Mass, kg ±0.5 percent
f) Power consumption kWh ±1 percent

6 TESTS

Various tests to be conducted on Carrot/ Radish washer are given in Table 1. The implementing authority shall decide about the tests and their frequency to be carried out during initial commercial and batch testing (*see* 3.2 and 3.2.2).

Table 1 Tests to be Conducted on Carrot/ Radish Washer

Sl. No.	Tests	Ref. to	Remarks
i)	Checking of specification	*See* 7	
ii)	Field test /Performance	*See* 8	
iii)	Components/assembly inspection	*See* 9	
vi)	Special characteristics	-	If any

7 CHECKING OF SPECIFICATIONS

7.1 The information given by the manufacturer/ applicant in the specification sheet (see 4.2) shall be verified by the testing authority and reported. Details of the components and assemblies which do not conform to the relevant Indian Standards shall also be reported. The adequacy or otherwise of the literature shall be indicated.

7.2 While checking the dimensions of the Carrot/ Radish washer, the conditions laid down in 4.2 shall be followed.

8 PERFORMANCE TESTS

8.1. TEST AT NO-LOAD

8.1.1 *Power Consumption*

8.1.1.2 Install the washer on a levelled place. Use electric motor of appropriate power, fitted with an energy meter for running the washer. The manufacturer shall declare the speed of operation of the Carrot/ Radish washer in their recommendations.

8.1.1.3 Run the washer at no-load for at least 30 minutes at the specified revolution of the washing drum and record the readings of the energy meter. Calculate the power consumption at no-load for one hour.

8.1.1.4 Record the data according to item (1) of Annex H.

8.1.2 Visual Observations — During and after completing power consumption test, the data given in item (2) of Annex H shall be recorded based on visual observation.

8.2 TEST AT LOAD

8.2.1 Short-Run Tests

8.2.2 Install the Carrot/Radish washer on levelled ground.

8.2.3 Take sufficient quantity of the Carrot/ Radishs to be washed as per manufacture literature.

8.2.4 Attachment of Prime Mover and Washer — Attach the washer with a suitable prime mover, preferably an electric motor. An energy meter or some form of transmission dynamometer shall be fitted. The power delivered to the washer may be supplied by connecting the prime mover with the help of flat or V-belt and pulleys with the main shaft of the washer.

8.2.5 Operation and Collection of Data — Operate the washer at the specified speed of the washing unit for one hour at the declared maximum input capacity.

8.2.5.1 During the one-hour run period as in 8.2.5, collect the following samples and data:

a) Three sets of samples at an interval of about 20 minutes (including the time for sample collection) at the Washer outlet.

NOTE — The time for collection of samples should be recorded accurately.

8.2.5.2 At the end of the test, collect and weight the Carrot/Radish from the main outlet. If engine is used as prime mover, record the fuel consumed during the run period.

8.2.5.3 Repeat the test given in 8.2.5.1 and 8.2.5.2 for minimum three times at various feed rates as per manufacture literature.

8.2.5.4 Record the data in Data Sheet as given in Annex J.

8.2.5.5 Visual observations — During and after the run tests, inspect the washer visually and record the observations in Data Sheet as given in Annex J.

8.2.6 Analysis of the Samples — Analyse the samples obtained at the outlet - To be analysed for unwashed, broken and uncleaned Carrot/Radish .

8.2.6.1 Record the data in Data Sheet as given in Annex K.

8.2.7 *Calculations*

a) Total Carrot/Radish input per unit time (kg)=B+C+D+E

Where,

B = quantity of washed and cleaned Carrot/Radish collected from outlet (kg).

C = quantity of broken Carrot/Radish from the outlet per unit time (kg).

D = quantity of unwashed Carrot/Radish from outlet per unit time (kg).

E = quantity of uncleaned Carrot/Radish from outlet per unit time in the case of root vegetables (kg).

b) Percentage of broken

Carrot/Radish (%) = $C/A \times 100$

Where,

C = quantity of broken Carrot/Radish from outlet per unit time (kg).

A = total Carrot/Radish input per unit time (kg).

c) Percentage of

Unwashed Carrot/Radish (%) = D/A × 100

where,

D = quantity of unwashed Carrot/Radish from outlet per unit time (kg).

A = total vegetable input per unit time(kg).

d) Percentage of

Uncleaned Carrot/Radish (%) = E/A × 100

where,

E = quantity of uncleaned Carrot/Radish obtained at outlet per unit time (kg).

A = total Carrot/Radish input per unit time (kg).

8.2.8 *Determination of Efficiencies*

a) Washing efficiency (%) = W/I × 100

Where,

W = quantity of washed Carrot/Radish collected from outlet (kg).

I = total quantity of Carrot/Radish fed at the inlet (kg).

b) Cleaning efficiency = C/F ×100

Where,

C = quantity of cleaned Carrot/Radish (free of fibrous roots) obtained from the sample taken at outlet (kg).

F = total quantity of the sample taken at outlet (kg).

8.2.8.1 Record the data in Data Sheet as given in Annex M.

8.2.9 *Determination of Power Consumption*

8.2.9.1 In case of energy meter fitted prime mover, the difference between two consecutive readings shall give power consumption for 60 minutes, interval.

8.2.9.2 In case of dynamometer fitted prime mover, the average reading taken shall give the average torque required by the following formula:

Power, kW = Torque, kgfm × Speed, rev/min

8.2.9.3 Record the data in Data Sheet as given in Annex M.

8.2.10 Determination of Capacity –Mass of the washed Carrot/Radish collected at the machine outlet per unit time.

8.2.10.1 Record the data in Data Sheet as given in Annex M.

8.3 Long-Run Test — Operate the washer for at least 20 hours at load, which should be covered by continuous run of at least 5 hours. Record the major breakdowns, defects developed and repairs made in Data Sheet as given in Annex N.

NOTE — For the purpose of certification the Carrot/Radish washer shall be run at no-load for 8 hours only.

9 COMPONENT / ASSEMBLY INSPECTION

The washing drum, Drive mechanism, Spray wand assembly, feeding unit shall be dismantled after conducting all the tests.

The following measurement/ observations shall be made and reported

9.1 Washing drum — To be Inspected visually and their condition shall be reported.

9.2 Drive mechanism — The drive Mechanism shall be opened and inspected for the entry of dust, mud, water and oil. The condition of chains and sprockets shall also be examined.

9.3 Spray wand assembly — To be Inspected visually and their condition shall be reported.

9.4 Carrot/Radish **feeding unit** — To be Inspected visually and their condition shall be reported.

10 ACCEPTANCE CRITERIA FOR PERFORMANCE CHARACTERISTICS

10.1 The product may be accepted for performance after confirming compliance to all evaluative requirements. Performance characteristics of Carrot/Radish washer along with the tolerances with respect to the declared values and in certain cases minimum/maximum values are given in Table 2.

NOTE — In case of a parameter not meeting evaluative requirements of this standard, the 'Repeat Test' as defined above may be conducted. In case the parameter not meeting the evaluative requirement during the Repeat Test as defined above may be conducted.

11 ACCEPTANCE CRITERIA IN CASE OF BREAKDOWN/DEFECTS

11.1 The equipment may be accepted subject to the following conditions:

a) There is no 'critical breakdown' during its validation after all tests including repeat tests;
b) There are not more than one 'major breakdown'; and
c) There are not more than three 'minor defects' during the test and the frequency of each is not more than two.

In no case, the total number of breakdowns should exceed four, that is (1 Major + 3 Minor) or 4 minor breakdowns.

NOTE — In case of single critical breakdown/more than one major breakdown/ more than four minor defects and their frequency being not more than two, the 'Repeat Test' as defined above may be conducted.

11.2 In case of multiple consequential failures resulting from a single Defect / breakdown, the primary single defect/breakdown shall only be counted.

11.3 Categorizations of defects in terms of 'Critical', 'Major' and 'Minor' for various sub-assemblies/parts are provided in the Annex C, D and E.

12 SUMMARY REPORT

12.1 For the guidance of the users, compile a Summary Report in Data Sheet as given in Annex P.

Table 2 Parameters Applicable for Qualifying Minimum Performance Criteria

(*Clause* 11)

Sl No.	Characteristic		Category (Evaluative/ Non-evaluative)	Requirement	Tolerance	Remark
	(1)		(2)	(3)	(4)	(5)
1.	**Field requirements**					
	a)	*Cleaning efficiency*	Evaluative	88 %	tolerance of ± 5 percent	
	b)	*Washing efficiency*	Evaluative	90 %	tolerance of ± 5 percent	
	c)	*Percent damage / bruise*	Evaluative	8 %	tolerance of ± 2 percent	
2.	**Safety Requirements:**					
	a)	Provision of guards on moving parts	Evaluative	*Yes*	--	---
	b)	Location and direction of Feeding Chute	-do-	*Yes*	--	
3.	**Literature (submission to test agency):**					
	a)	Operator manual	Evaluative	*Provided*	--	---
	b)	Parts catalogue	Evaluative	*Provided*	--	---
	c)	Workshop/service manual	Evaluative	*Provided*	--	---
4.	**Labelling of machine (provision of labelling plate) should be permanent**					
	a)	Name of manufacturer	Evaluative	*Metallic plate shall be riveted permanently on the*		
	b)	Make add country of origin	Evaluative			
	c)	Model	Evaluative			
	d)	Year of manufacture	Evaluative			

	g)	Size of machine	Evaluative	*machine at place where it can be easily identified.*		
	h)	Maximum Electric motor power, kW	Evaluative			
	j)	Power consumption, kWh	Evaluative			

ANNEX A

SPECIFICATION SHEET

(To be declared by the Manufacturer)

A-1 GENERAL

a) Make :
b) Model :
c) Type :
d) Year of manufacture :
e) Country of origin :

A-2 POWER UNIT

a) Type of prime mover :
b) Recommended power, kW (hp) :
c) Type of drive :

A-3 CROPS TO BE WASHED

a) Main crop :
b) Other crops :

A-4 MAIN DRIVE

a) Type
   1) Directly coupled :
   2) Belt drive :
   3) Chain drive :
   4) Gear drive :
b) Size of belt/chain/gear :
c) Size of pulley/sprocket :
d) Diameter of main shaft :
e) Recommended speed of main drive, rev/min. :

A-5 WASHING DRUM

a) Type :
b) Material :
c) Constructional feature :
d) Diameter :
e) Width :
f) Recommended speed :
g) Number and type of bearings :
h) Number and size of tumbler bars :
j) Type of abrasive surface :
k) Slope of drum :

A-6 SPRAY WAND ASSEMBLY

a) Length :
b) Diameter :
c) Number of holes/nozzles :
d) Diameter of holes/nozzles :
e) Spacing of holes/nozzles :
f) Details of spray assembly:
g) Details of pump assembly if any
h) Operating pressure of the pump

A-7 CHASSIS AND DRIVE MECHANISM

a) Length of idle roller :
b) Length of running roller :
c) Drive :
d) Type of bearing :

A-8 CARROT/RADISH **FEEDING**

a) Type :
b) Height and location of feeding system :
c) Recommended maximum feed rate :
d) Size of feeding chute :

A-9 TRANSPORT

a) Type :
b) Number of wheels :
c) Size of wheels :
d) Wheel bearing :
e) Type of towing arrangement :

A-10 OVERALL DIMENSIONS

a) Length :
b) Width :
c) Height :
d) Ground clearance :
e) Total mass :

A-11 CONTROLS

A-12 SAFETY FEATURES, IF ANY

NOTE — If any other items are provided, their details should be filled in.

Place: **Signature: _____**

Date: **Designation: _____**

ANNEX B

DATA SHEET FOR MATERIAL OF CONSTRUCTION

B-1 DATE OF TEST

B-2 MATERIAL OF CONSTRUCTION

Sl No.	Component	Material	Size
i)	Frame		
ii)	Feeding system		
iii)	Washing drum		
iv)	Tumbler bar		
v)	Abrasive Material		
vi)	Main shaft		
vii)	Spray assembly		
viii)	Idler roller		
ix)	Running roller		
x)	Outlet		
xi)	Transport wheel		
xii)	Pulleys		
xiii)	Others		

NOTE — Delete the component which is not applicable to a particular washer and add if any other component is provided.

ANNEX C

(*Clause* 11.1(a))

CATEGORIES OF BREAKDOWNS/DEFECTS (VEGATBLE WASHER)

(Critical Breakdown)

Code	Aggregate	Critical Defects	Sub-assembly/Part	Applicable Norms
(1)	**(2)**	**(3)**	**(4)**	**(5)**
C1	Electric motor	Winding failure	Coil	As under *col* 3 and 4

ANNEX D

(*Clause* 11.1 (b))

CATEGORIES OF BREAKDOWNS/DEFECTS (VETABLE WASHER)

(Major Breakdown)

Code	Aggregate	Critical Defects	Sub-assembly/Part	Applicable Norms
(1)	**(2)**	**(3)**	**(4)**	**(5)**
Mj 1	Transmission	Breakage/Crack	Axle	As under *col* 3 and 4
Mj 2	Washing drum	Crack	Drum	do

ANNEX E

(*Clause* 11.1 (c))

CATEGORIES OF BREAKDOWNS/DEFECTS (CARROT/ RADISH WASHER)

(Minor Breakdown)

Code	Aggregate	Critical Defects	Sub-assembly/Part	Applicable Norms
(1)	**(2)**	**(3)**	**(4)**	**(5)**
Mn 1	Washing drum-Main shaft	Clogging	Holes	As under *col* 3 & 4
Mn 2	Tumbler bar	Breakage / Crack	Tumbler bar	do
Mn 3	Abrasive surface	Damage	Abrasive material	do
Mn 4	Spray assembly	Clogging	Nozzles	do
Mn 5	Spray wands	Clogging	Nozzle	do

ANNEX F

DATA SHEET FOR VISUAL OBSERVATIONS AND PROVISION FOR ADJUSTMENTS

F-1 OBSERVATIONS

a) Adequacy of marking of inlet and outlets
b) Adequacy of marking of direction of rotation of washing drum
c) Adequacy of protection of bearings against the ingress of dust
d) Adequacy of safety arrangements, especially at moving points and at inlet
e) Provision for lubrication of moving parts
f) Provision for belt tightening
g) Provision for transportation
h) Provision for easy changing of components requiring frequent replacement
j) Provision for anti-corrosive coatings
k) Balancing of washer unit
m) Welding of seams
n) Tightness of bolts and nuts and other fasteners
a) Other observations

F-2 PROVISION FOR ADJUSTMENTS

a) Feed rate
b) Speed of washing drum
c) Slope of washing drum

F-3 QUALITY OF WORK

Quality of work is determined by water consumption, washing efficiency, power consumption and soundness of construction.

F-4 LABOUR REQUIREMENT

……. labourers cum operators are required for the continuous operation the machine.

F-5 EASE OF OPERATION, ADJUSTMENTS AND SAFETY

The equipment should be easy to operate and no problem to be observed in handling the machine during the operation. Guards and safety covers should be provided on all rotating parts.

F-6 DEFECTS, BREAKDOWN AND REPAIRS

The equipment to be operated to be operated for 3 long run tests continuously to assess the performance of the machine. No breakdown to be occurred during the long run tests. There should be no defects and repairs during the test.

F-7 HARDNESS TEST

Hardness of different of different parts of vegetable washer

Sl No	Part of the machine	Material of Construction	Hardness to be maintained
i)	Feed hopper	Mild steel	130-140 HV (MICRO VICKERS HARDNESS)
ii)	Hollow machine shaft	Mild steel	80-85 HRB
iii)	Cylinder screen	Stainless steel	140-150 HV (MICRO VICKERS HARDNESS)
iv)	Washing cylinder support rod	Mild steel	90.0-95.0 HRB
v)	Machine frame	Mild steel	260-280 HV (MICRO VICKERS HARDNESS)
vi)	Machine side plate	Mild steel	75-90 HRB

F-8 CHEMICAL COMPOSITION

The chemical composition of different parts of washing machine.

Sl No	Part of the machine	Material of Construction	Chemical Composition	% weight of Fe
i)	Feed hopper	Mild steel	Carbon (C) Silicon (Si) Manganese (Mn) Phosphorous (P) Sulphur (S)	0.050- 0.060 0.050 – 0.060 0.170 – 0.180 0.010 – 0.020 0.002 – 0.004
ii)	Hollow machine shaft	Mild steel	Carbon (C) Silicon (Si) Manganese (Mn) Phosphorous (P) Sulphur (S)	0.120- 0.200 0.150 – 0.200 0.650 – 0.750 0.010 – 0.030 0.005 – 0.020
iii)	Cylinder screen	Mild steel	Carbon (C) Silicon (Si) Manganese (Mn) Phosphorous (P) Sulphur (S)	0.140-0.160 0.80-0.120 0.460-0.520 0.010-0.020 0.005-0.015

iv)	Washing cylinder support rod	Mild steel	Carbon (C) Silicon (Si) Manganese (Mn) Phosphorous (P) Sulphur (S)	0.200- 0.270 0.190 – 0.230 0.550 – 0.650 0.040 – 0.060 0.040 – 0.055
v)	Machine frame	Mild steel	Carbon (C) Silicon (Si) Manganese (Mn) Phosphorous (P) Sulphur (S)	0.200- 0.270 0.190 – 0.230 0.550 – 0.650 0.040 – 0.060 0.040 – 0.055
vi)	Machine Side plates	Mild steel	Carbon (C) Silicon (Si) Manganese (Mn) Phosphorous (P) Sulphur (S)	0.140-0.160 0.120-0.140 0.520-0.600 0.010-0.040 0.005-0.020

F-9 SUMMARY OF OBSERVATIONS, COMMENTS AND RECOMMENDATIONS

a) Average feed rate capacity was observed as……
b) The water consumption of the machine is observed as…….
c) Washing efficiency of the machine is observed as…. (more than 95%)
d) The power consumption was observed as……. (kWh)
e) Adequacy of Literature – The manufacturer need to provided Operator's manual and Service manual to users in English/local language

F-10 Performance test

Summary of Performance Test at No-Load Condition:

Sl No	Parameters	Observations
i)	Total time of operation, h	
ii)	Power consumption, kWh	
iii)	Speed of motor, rpm	
iv)	Speed of machine shaft, rpm	
v)	Average sound/noise level of machine during operation, dB (Maximum and Minimum)	

Summary of Performance Test at Load Condition:

Sl No	Parameters	Observations
i)	No. of batches fed	
ii)	Time per each batch, h	
iii)	Power consumption, kWh	

iv)	Water consumption, m^3 /h	
v)	Speed of motor, rpm	
vi)	Speed of machine shaft, rpm	
vii)	Average sound/noise level during operation, dB (Maximum/Minimum)	
viii)	Feed rate capacity, kg/h	
ix)	Washing efficiency, %	
x)	Cleaning efficiency, %	
xi	Broken, %	

ANNEX G

DATA SHEET FOR SAFETY PROVISIONS

G-1 GENERAL

a) Protective cover for the prime mover shall be provided
b) Presence of any sharp corners and protruding fasteners.

G-2 Guards shall be provided to prevent accidental contact of persons or parts of clothing being caught in the transmission system. Guards should not to hinder in any adjustments, servicing and operation.

G-3 FEEDING SYSTEM

a) Type
b) Details of the system

G-4 ANY OTHER PROVISION

ANNEX H

DATA SHEET FOR TEST AT NO-LOAD

H-1 POWER CONSUMPTION

a) Source of power :
b) Type of drive :
c) Total time of run :
d) Average power consumption for one hour :

H-2 OBSERVATIONS

a) Presence of any marked oscillation during operation :

b) Presence of undue knocking or rattling sound :
c) Frequent slippage of belts / rollers :
d) Smooth running of shafts in their respective bearings :
e) Any marked unusual wear or slackness 'in any component :
f) Any marked rise in bearing temperature :
g) Other observations :

Remarks

ANNEX J

DATA SHEET FOR TEST AT LOAD

J-1 SOURCE OF POWER :

J-2 POWER RATING, KW :

J-3 TYPE OF DRIVE :

J-4 TYPE OF CROP :

J-5 TEST DATA*

Sl No	Date	Feed rate, (kg/h)	Starting time	Finishing Time	Stoppage if any	Duration (h)

Speed of Operation (rpm)	Total Quality of crop feed (kg)	Power Consumption Energy metre reading (kWh)		Torque (Nm)	Power Consumed During Test (kWh)
		initial	final		

No. of samples	**Total quality collected at the outlet, kg**

***The data should be collected for every test conducted on different feed rates.

Test should be conducted at specified speed and speeds of I5 percent less and more than specified

J-6 OBSERVATIONS

a) Presence of any marked oscillation during operation
b) Presence of undue knocking or rattling sound
c) Frequent slippage of belts/rollers
d) Smooth running of shafts in their respective bearings
e) Smooth flowing of Carrot/ Radish through the washing drum
f) Any marked rise in bearing temperature
g) Any marked wear and breakdown
h) Other observations if any

ANNEX K

DATA SHEET FOR ANALYSIS OF SAMPLES

Sl No.	**Washing drum speed** (rpm)	**Total mass of sample** (kg)	**Sample analysed**	**Mass of** Carrot/Radish			
				Unwashed (kg)	**Broken** (kg)	**Washed & cleaned** (kg)	**Uncleaned** (kg)

ANNEX M

DATA SHEET FOR EFFICIENCIES, POWER REQUIREMENT AND CAPACITY

Sl No.	Item	Results
i)	Speed of washing drum, rpm	
ii)	Feed rate, kg/h	
iii)	Power required, kW	
iv)	Total quantity of Carrot/Radish received at the outlet,	
v)	Unwashed Carrot/Radish , %	
vi)	Uncleaned Carrot/Radish , %	
vii)	Broken Carrot/Radish , %	
viii)	Washing efficiency, %	
ix)	Cleaning efficiency, %	
x)	Capacity, kg/h	

ANNEX N

DATA SHEET FOR LONG-RUN TEST

N -1 TOTAL RUNNING TIME, H :

N-2 CONTINUOUS RUNNING TIME, H :

N-3 BREAKDOWNS IN THE UNIT :

N-4 ANY MAJOR REPAIRS CONDUCTED :

N-5 ANY OTHER OBSERVATIONS :

ANNEX P

SUMMARY REPORT

P-1 NAME OF MANUFACTURER

P-2 MODEL NUMBER

P-3 NAME OF TESTING STATION

P-4 BRIEF DESCRIPTION OF THE CARROT/RADISH **WASHER**

P-5 TYPE AND VARIETY OF CROP

P-6 ADJUSTMENTS

a) speed, rpm

P-7 POWER REQUIREMENT, KW

a) at no-load

b) at load

P-8 PERCENTAGE OF BROKEN CARROT/RADISH**, %**

P-9 PERCENTAGE OF UNWASHED CARROT/RADISH**, %**

P-10 CAPACITY, kg/h

P-11 WASHING EFFICIENCY, %

P-12 CLEANING EFFICIENCY, %

P-13 ANY MARKED OBSERVATION AFFECTING PERFORMANCE

P-14 ANY MARKED BREAKDOWNS

P-15 OTHER OBSERVATIONS

ANNEX Q

DRAWINGS TO BE PROVIDED

Q-1 ISOMETRIC VIEW OF THE DRAWING

Q-2 EXPLODED VIEW OF THE DRAWING

Q-3 FRONT VIEW OF THE DRAWING

Q-4 TOP VIEW OF THE DRAWING

Q-5 SIDE VIEW OF THE DRAWING

EXAMPLES OF THE DRAWING

1.	Isometric view of the drawing	
2.	Exploded view of the drawing	
3.	Front view of the drawing	
4.	Top view of the drawing	
5.	Side view of the drawing	

ANNEX R

R-1 SPECIFICATIONS

GENERAL	
Name of manufacturer	
Email	
Telephone	
Name of Machine/Equipment	
Type	
Make	
Model & S. No.	
Year of manufacture	
Machine dimension (L×W×H), mm	
Washing capacity, kg/h	
Weight of the Machine, kg	
Colour of the machine	

POWER UNIT	
Provision & Type	
Type of prime mover	
Motor power, hp	
Motor phase	
Type of drive	

R-2 MAIN PARTS OF WASHING MACHINE

Feed Hopper	
Hopper length, mm	
Hopper width, mm	
Hopper height, mm	
Hopper capacity , kg	
Feed opening size (L×W), mm	
Thickness of sheet material, mm	
Construction details	

Washing Chamber	
Hollow machine shaft diameter, mm ID/OD, mm	
Washing cylinder size (D×L), mm	
Inspection window size (L×W), mm	
Inspection window closing door size (L×W×T), mm	
No. of inspection windows	
Cylinder sheet thickness, mm	
Effective length of screen, mm	
Screen aperture shape	
Screen aperture size (L×W), mm	
Screen pitch, mm	
Screen sheet thickness, mm	
Water supplying pipe diameter, mm ID/OD	
Water supplying pipe length, mm	
Water delivering hole diameter, mm	
No. of water delivering holes	
Height of water supplying pipe from ground level, mm	
Construction details	

Discharge Outlet	
Outlet opening size (L×W), mm	
Outlet opening closing plate size (L×W×T), mm	
Outlet opening lever size (D×L), mm	
Thickness of sheet material, mm	
Height of outlet from ground level, mm	
Construction details	

R-3 MACHINE FRAME DETAILS

R-4 DIMENSIONS OF MACHINE

Other Items	
Transmission guard size (L×W×H), mm	
Inspection window size (L×W), mm	
Inspection window closing door size (L×W), mm	
Thickness of sheet material, mm	
No. of bearings	
Bearing type	

No. of sprockets	
Sprocket diameter, mm (Gear box/ Hollow machine shaft)	

ANNEX S

CONFORMITY TO INDIAN STANDARDS (IS 11032 : 1984)

Clause	Requirements	Observations	Remarks
1	MATERIAL		
1.1	The material used for various components of the cleaner shall be mild steel or cast iron.		
2	CONSTRUCTIONAL REQUIREMENTS		
2.1	Frame: The frame shall be made of suitable size mild steel angle section and shall be covered with mild steel sheet.		
2.2	Hopper: It shall be provided with a feed regulating device. The minimum thickness of the sheet used for hopper shall be 1.6 mm.		
2.3	Rotary Screens: One or two rotary screens depending on the type of the cleaners shall be used. In case of single screen, the screen shall rotate in clockwise direction and in case of double screen; the screens shall rotate in opposite direction.		
2.4	Blower: If fitted it shall be provided with a control to regulate air flow rate.		
2.5	Transmission Drive: A suitable system for transmitting the power shall be provided. It may consist of V-belt and pulley or sprocket and chain		
2.5.1	Transmission guards shall be provided to prevent accidental contact of persons or parts of clothing being caught in the transmission system, unless the system is so constructed or placed as to be safe without guards.		
2.5.2	The guards shall be so designed as not to hinder in easy adjustment, servicing and operation of the cleaner.		
2.5.3	It is preferable that all guards shall be either permanently attached or firmly secured to prevent their removal without the aid of tools. The servicing and adjustments shall be possible without complete removal of the guards.		
2.6	Shafts: The shafts shall be supported on ball bearings at both the ends.		
3.0	OTHER REQUIREMENTS		
3.1	Provision for belt tightening shall be made.		
3.2	Arrangement for lubrication of bearings shall be made.		
3.3	Provision for easy transportation and towing with tractor shall be provided.		
3.4	The equipment shall be provided with the operator's manual		
4.0	WORKMANSHIP AND FINISH		

4.1	Welding used for joining different components shall not be porous.		
4.2	Any sharp corners and protruding fasteners shall be avoided.		
4.3	Components shall be free from cracks, pits, burrs and other visual defects which may be detrimental for their use.		
4.4	The components shall be painted with the rust preventive paints.		
5.0	MARKING AND PACKING: Marking: Each equipment may be marked with the following particulars:		
5.1	Manufacturer's name and recognized trade-mark		
5.2	Model, batch code or serial number.		
5.3	Power rating, kW		
5.4	Rated input capacity.		