FARM MACHINERY TESTING CENTRE

DEPARTMENT OF FARM MACHINERY AND POWER ENGINEERING
COLLEGE OF TECHNOLOGY & ENGINEERING
Maharana Pratap University of Agriculture and Technology
Udaipur (Raj.)-313001

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Dr. S. M. Mathur
PI (FMTC)

No. CTAE/FMP/FMTC/2017/741
Date :10 .01.2017

To,

M/s Shreeji Agro Industries,
Panchasar Road, Near Shreeji PVC Pipe,
Wankaner (Gujarat)
Pin: 363 621

Subject: Test Report of Tractor operated Reversible MB Plough
(Model: 2FH520 and 3FH480).

Sir,

This is in reference to your application dated 28.06.2016 and testing fees deposited vide Challan number 119 dated 28.06.2016 for testing of Tractor operated Reversible MB Plough (Model: 2FH520 and 3FH480). The test of the machines has been conducted. The test report (No.: CTAE/FMP/FMTC/2016/76 & CTAE/FMP/FMTC/2016/77) of the machines are enclosed with this letter.

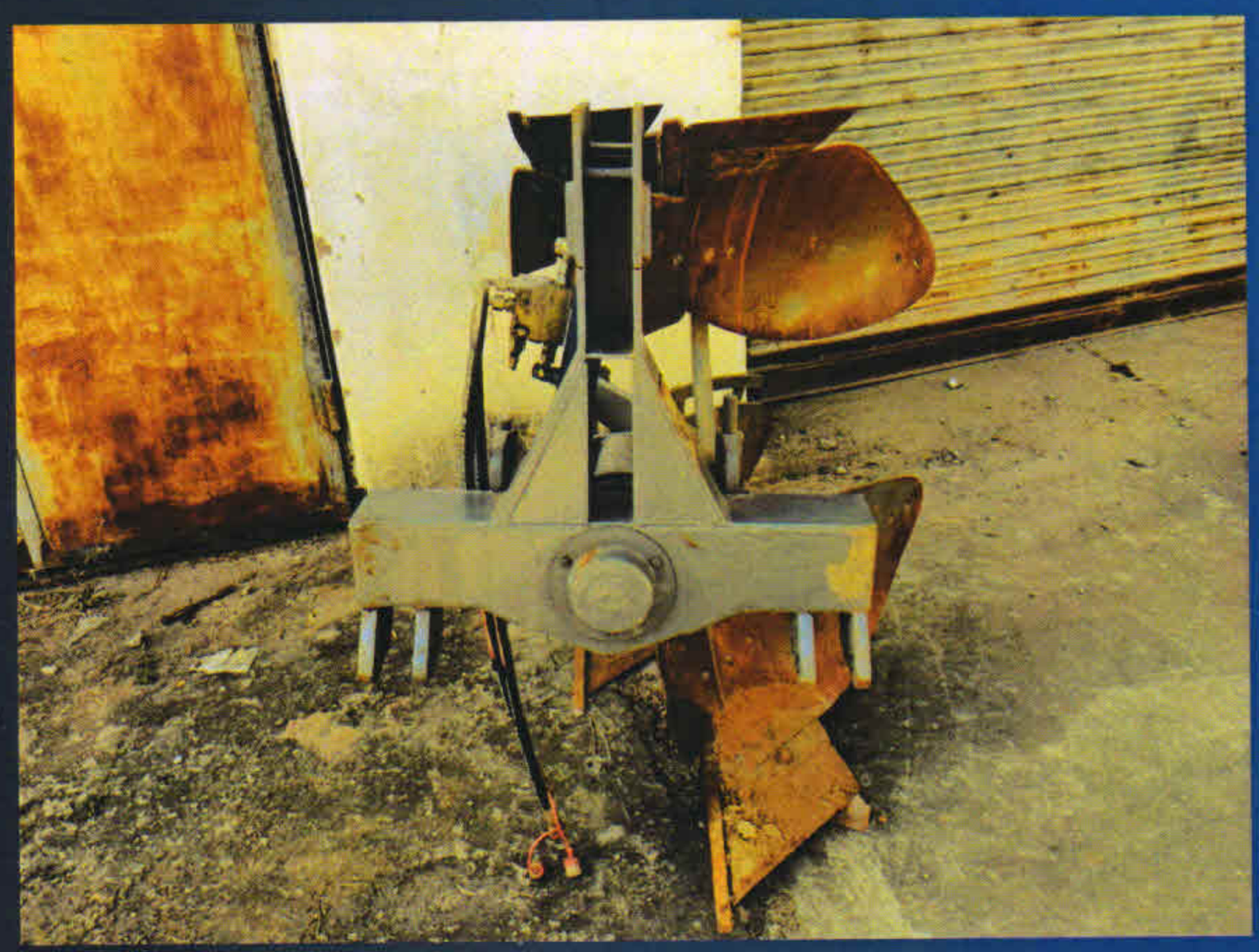
Thanking you

Dr. S. M. Mathur
Principle Investigator,
Farm Machinery Testing Centre

Encl:

1. One copy of test report (No.: CTAE/FMP/FMTC/2016/76 & CTAE/FMP/FMTC/2016/77)

Test Report No.	Name of the Machine/Implement	Month	Year
CTAE/FMP/FMTC/2016/76	TWO BOTTOM HYDRAULICALLY REVERSIBLE MOULD BOARD PLOUGH (MODEL NO: 2FH 520 12)	December	2016



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(The Institute is approved Testing Centre by Department of Agriculture & Cooperation, Ministry of Agriculture, GOI vide letter no. 8-1/2004-My (I&P) dated September 14, 2010 and subsequent letters)

Test Report No.	Name of the Machine/Implement, Model No.	Month	Year
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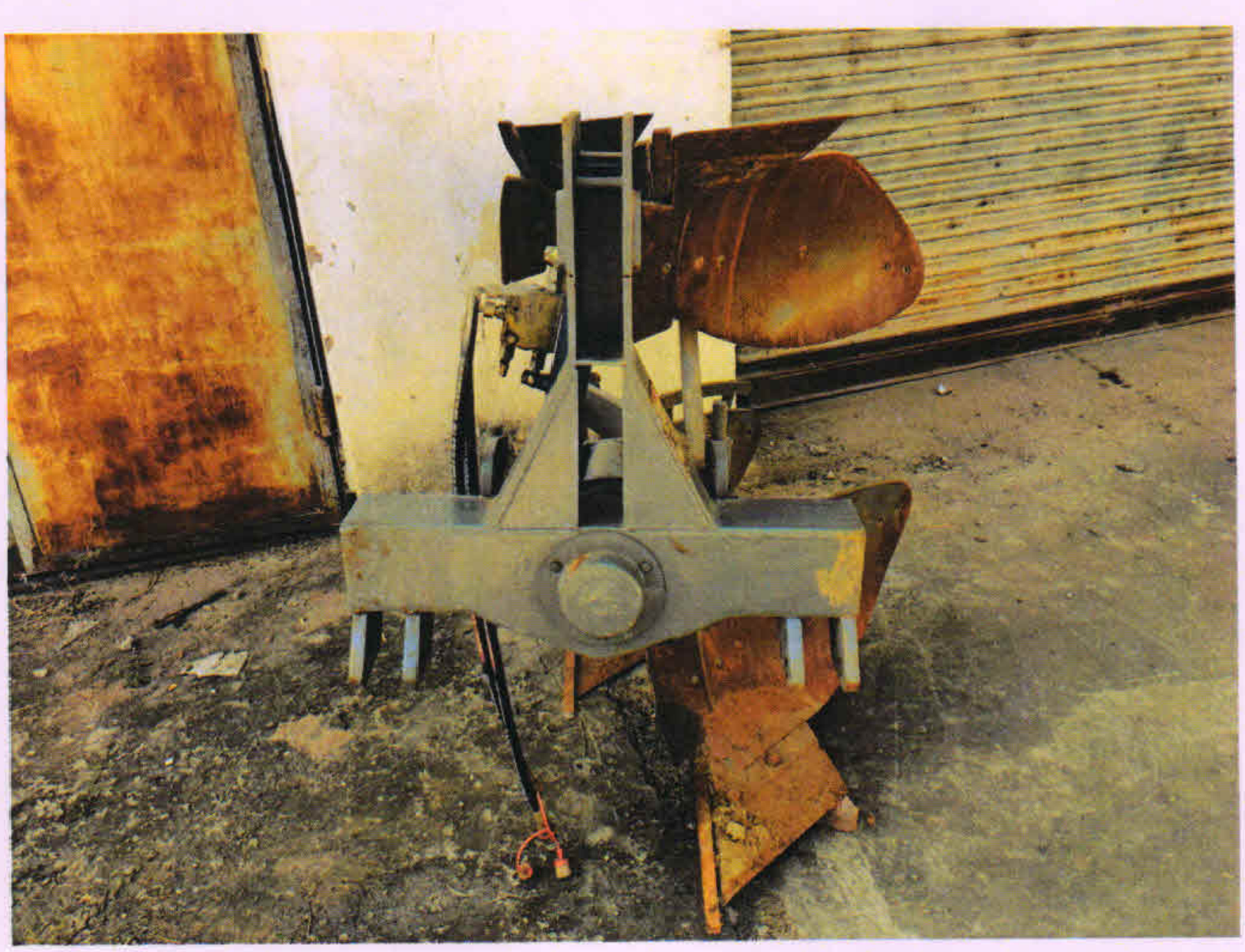

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Type of test	:	Commercial
Name of machine	:	Two Bottom Hydraulically Reversible Mould Board Plough
Test code referred	:	IS: 6288 –1971(Reaffirmed in 2004) (Test Code for Mould board Ploughs) IS: 10691-1983 (Reaffirmed in 2006) (Specification for Share for Tractor Operated Mould board Ploughs) IS: 4468 (Pt-I)-1997 (Reaffirmed in 2001) (Agricultural Wheeled Tractors-Rear Mounted Three-point Linkage)
Test requested by	:	M/s Shreeji Agro Industries, Panchar Road, Near Shreeji PVC Pipe, Wankaner 363 621
Testing authority	:	Farm Machinery Testing Centre, Deptt. of Farm Machinery and Power Engineering, CTAE, MPUAT,Udaipur-313001
Period of test	:	August 2016 – September 2016

2. The data given in the Test Report pertain to the particular machine submitted for test by the Applicant.
3. The data collected during the test do not in any way attribute to the durability of the machine.
4. The results reported in this report are observed values and no corrections have been applied for atmospheric and site conditions.

Selected Conversions

S. No.	Units	Conversion Factor
1	**Force**	
	1 kgf	9.80665 N
		2.20462 lbf
2	**Power**	
	1 hp	1.01387 metric hp (Ps)
		745.7 W
	1 Ps	735W
	1 kW	1.35962 Ps
3	**Pressure**	
	1 psi	6.895 kPa
	1 kgf/cm^2	98.067 kPa = 735.56 mm of Hg
	1 bar	100 kPa = 10 N/cm^2
	1 mm of Hg	1.3332 m-bar

CONTENTS

1. SCOPE OF TEST

1.1 LABOTATORY TEST

- Checking of specifications
- Hardness of soil engaging components of plough

1.2 FIELD TEST

- Quality of work
- Rate of work
- Labour requirement
- Power requirement
- Ease of operation and adjustment
- Defects, breakdowns and repairs

2. METHOD OF SELECTION

The test sample was directly submitted by the applicant for test at this Institute.

3. SPECIFICATIONS

3.1	**General**	:	
	Name of implement	:	Two bottom hydraulic reversible mould board plough
	Name and Address of Manufacturer	:	M/s Shreeji Agro Industries, Panchar Road, Near Shreeji PVC Pipe, Wankaner 363 621
	Type of implement	:	Tractor mounted (Two way)
	Make	:	Shreeji
	Model	:	2FH 520 12
	Serial number	:	17
	Number of plough bottoms	:	Two
	Year of manufacture	:	2016
	Recommended power	:	Tractor (45 hp and above)
	Tractor used	:	John Deere 5053S (45 hp)
3.2	**Constructional details**		
3.2.1	**Frame**	:	Frame is made by welding one straight flat of size 914×99.73×25.70 mm and another bend MS flat of size 988×99.80×25.30 on MS flat of size 364×101.58×21.45 mm at

front and both flats are bolted together at rear end with rear standard in between them. Both flats are bolted and welded between two MS flats of size 223×101.14×11.50 mm with three nut and bolts which are firmly welded at front end. A slender member made of MS flat of size 99.19×16.64 mm is welded at a distance of 223 mm from front end.

Size of bolt, mm	:	112.89×18.19 ϕ
Dimensions (mm)	:	
Length, mm	:	938
Width, mm	:	364
Number, diameter& spacing of holes on mainframe for fixing each standard, mm	:	03, 19.20 ϕ & 78.30

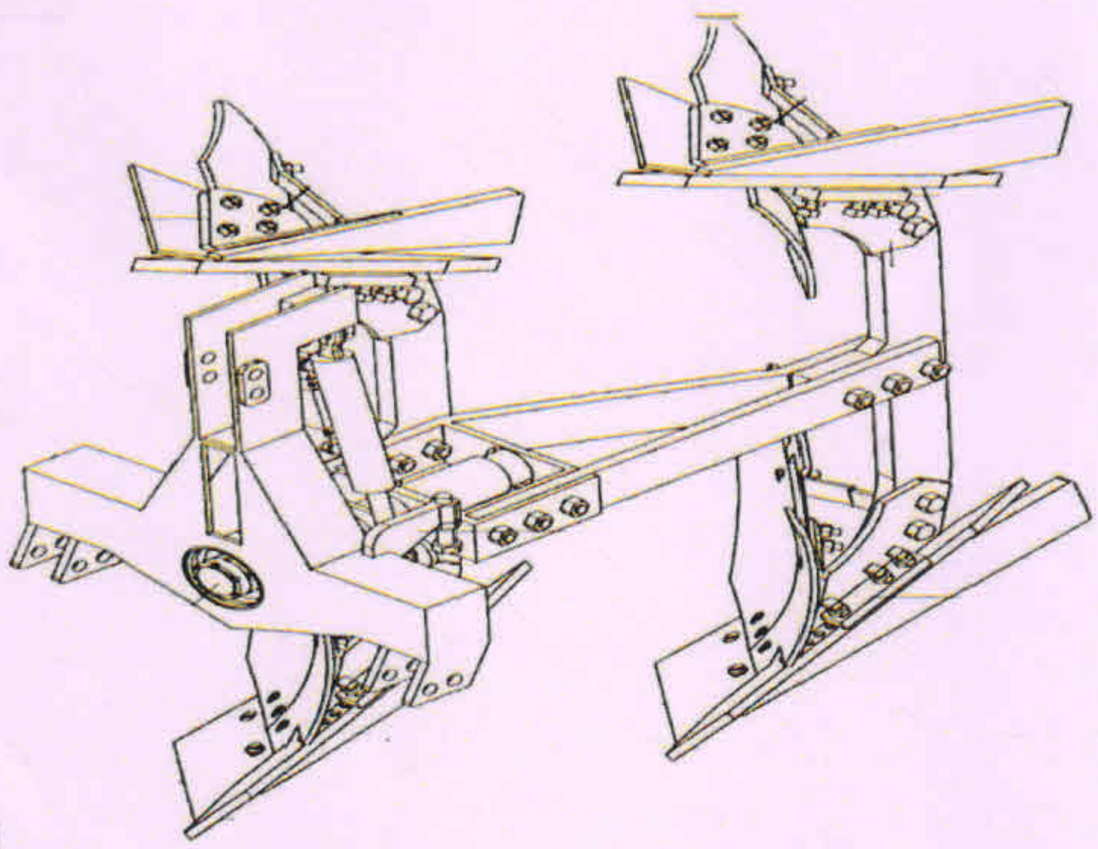

Fig. 1. Schematic view of 2-bottom hydraulic reversible mould board plough

3.2.2 Standard :

Number	:	Two
Material	:	Mild Steel
Projected length, mm	:	1095
Curved length, mm	:	1312
width, mm	:	125 (max)
Thickness, mm	:	32.70
Method of fixing	:	Each standard is bolted to the main frame at the center with three nut and bolts, whereas outer ends are bolted to the frog to which plough bottom is fixed.
Size of bolt, mm	:	112.89×18.19 ϕ

3.2.3 Plough Bottom :

Constructional details	:	Plough bottom consisted of mould board, share, share-bar and landside bolted and welded to the frog.
Number	:	Four (Two on each side)
Size of plough, mm	:	2×302
Vertical suction, mm	:	17.42-18.54
Horizontal suction, mm	:	2.0-3.2

3.2.3.1 Mould board :

Type	:	General purpose
Material	:	M.S. Plate
Length, mm	:	756 (Projected), 764 (Curved)
Width, mm	:	395 (Projected), 416 (Curved)
Thickness, mm	:	11.10
No & size of hole on mould board, mm	:	7, 15.80ϕ
Method of fixing mould board	:	Mould board is bolted to frog with the help of four nut and bolts.
Type and size of bolts, mm	:	Countersunk bolts, 39.92×12.24ϕ

Support for mould board :

Constructional details	:	MS flat of size 294×40.25×10.02 mm bolted at one end on landside and on mould board at another end for stability of the mould board.
Number	:	Four (One for each mould board)
Material	:	Mild steel

3.2.3.2 Share :

Type	:	Type-6 as per IS-10691-1983, reaffirmed in 2001
Size, mm	:	453×162
Thickness, mm	:	
At middle	:	12.08-12.52
At cutting edge	:	1.49-2.05
Number & size of holes on share, mm	:	2, 14.26ϕ
Method of fixing share	:	Share is bolted to the frog with two countersunk bolts each of size 43.67×12.43ϕ.

3.2.3.2.1	**Share bar**	:	
	Material	:	Mild steel
	Size, mm	:	927×33.56×22.10
	Length of tapered section, mm	:	105
	Size of cutting edge, mm	:	
	Width		21.75
	Thickness		3.55-3.65
	No. & size of grooves on bar point, mm	:	18, 17.09ϕ
	Method of fixing	:	Share bar is inserted into bracket and locked in the groove provided on the share bar by lock bolt of size 57.65×15.52ϕ
3.2.3.3	**Land Side**	:	
	Number	:	Four (One for each plough bottom)
	Material	:	Mild steel
	Dimensions, mm	:	
	Projected Length		
	Front	:	520
	Rear	:	668
	Width		
	Front	:	132
	Rear	:	135
	Thickness		
	Front	:	27.50
	Rear	:	27.43
	Method of fixing of landside to frog	:	It is firmly welded to frog
3.2.3.4	**Shin of share**	:	
	Numbers	:	Four (One for each plough bottom)
	Material	:	Mild steel
	Length, mm	:	
	Projected		320
	Curved		343
	Width, mm	:	130
	Thickness, mm	:	12.70
	Method of fixing	:	It is bolted to frog with the help of two nut and bolts.
	Size of bolt, mm	:	39.05×12.21ϕ

3.2.3.5	**Frog**	:	
	Number	:	Four (One for each plough bottom)
	Material	:	Mild Steel
	Method of fixing	:	It is fixed on the standard with the help of three nut and bolts of size 73.78×18.48ϕ.
	No. and size of holes on frog, mm	:	
	for standard	:	3, 19.24ϕ
	for mould-board	:	4, 14.30ϕ
	for share	:	2, 14.10ϕ
	for shin	:	2, 14.16 ϕ
3.2.4	**Reverse mechanism**	:	
	Type	:	Hydraulic operated
	Construction details	:	The reverse mechanism is operated through double acting hydraulic cylinder by hydraulic system of the tractor. The hydraulic cylinder is connected between upper and lower hitches, can enable the hitch pyramid to rotate through 180 degree around the main shaft. When the implement is hitched to the three-point linkage of tractor, hitch pyramid becomes fixed and the complete frame along with plough bottoms is free to rotate 180 degree along the axis of hollow shaft.
3.2.4.1	**Hydraulic Cylinder**	:	
	Type	:	Double acting
	Size of Cylinder, mm	:	275×62.63ϕ (OD)
	Stroke length, mm	:	158.58
	Diameter of the connecting rod, mm	:	27.84ϕ
	Size of high pressure pipeline	:	1108×19.05ϕ (OD)
	Pressure rating of high pressure line	:	330 bar
3.2.4.2	**Center of pull adjustment**	:	Not Provided
3.2.4.3	**Main Shaft**	:	The main shaft is fitted inside hollow pipe which is firmly welded to main frame.
	Size, mm	:	
	Length		595
	Diameter		89.96
3.2.5	**Hitch Pyramid**	:	
	Constructional details	:	The upper hitching system is made by welding two MS flats of size 124×12.08 mm. Lower hitching system is made up of hollow rectangular MS pipe of size 128×147 mm. Both upper and lower hitching systems are welded on hollow pipe of size 173.24ϕ (OD) which is fitted on main shaft with the help of two taper roller bearings (No. 33019) mounted on main frame.

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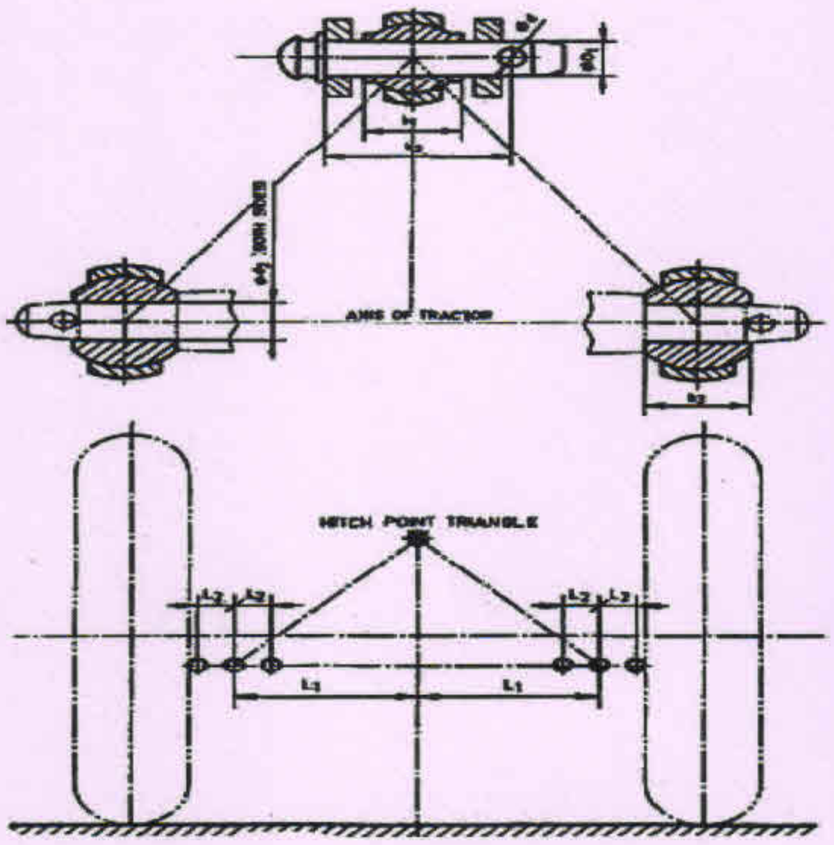

Fig. 2. Different dimensions of hitch pyramid

Specification of Hitch pyramid as per IS: 4468-1977

S. No.	Specifications	Dimensions (mm)		Remarks
		As per IS	As measured	
1.	**Upper hitch points, mm**			
	Diameter of hitch pin	25.27-25.40	25.38	Conforms
	Diameter of hitch pin hole	25.70-25.91	25.79	Conforms
	Linch pin hole distance	93 (Min.)	138.23	Conforms
	Width between inner surface of yoke	52.0 (Min.)	64.70	Conforms
	Width between outer surface of yoke	86 (Max.)	84.50	Conforms
2.	**Lower hitch point, mm**			
	Diameter of hitch pin	27.79-28.0	27.82	Conforms
	Diameter of hitch pin hole	28.70-29.03	29.00	Conforms
	Linch pin hole distance	49 (Min.)	123.65	Conforms
3.	**Diameter of linch pin hole, mm**			
	Upper hitch pin	12.0 (Min.)	12.32	Conforms
	Lower hitch pin	12.0 (Min.)	12.28	Conforms
4.	**Mast height, mm**	460 (Min.) 510 (Min.)	622	Conforms
5.	**Lower hitch point span, mm**	681.5-684.5 823.5-826.5	681.5	Conforms

3.3 Overall dimensions, mm

Length : 1882

Width : 915

Height : 1330

3.4 Mass, kg : 520

4. CONFORMITY TO INDIAN STANDARDS

Specifications of Share for Tractor-Operated Mould Board Plough as per IS:10691-1983 (Reaffirmed Feb 2006):

Clause No.	Requirements as per IS	Observation	Conformity to IS
1	2	3	4
3	**Types**		
3.1	On the basis of the dimensions, the share shall be of following 7 types: a) Type 1, b) Type 2, c) Type 3, d) Type 4, e) Type 5, f) Type 6 and g) Type 7	As per the dimensions measured the share falls in Type 6 category	Conforms
7	**OTHER REQUIREMENTS**		
7.1	The cutting edge of the share shall be beveled to a distance not more than 10 mm.	6-7 mm	Conforms
	The thickness of cutting edge shall be between 0.5 to 2 mm and should be uniform, as for as possible.	Thickness of cutting varied between 1.49 to 2.05 mm	Conforms
7.2	The counter sunk bolt of 10 mm size shall be used for fixing the share with frog. As for as possible, the bolt of M10 size should be used.	Counter sunk bolt of 12.24 mm is used for fixing share	Conforms
7.3	The shares shall be supplied with bolts in holes	Supplied	Conforms
8	**WORKMANSHIP AND FINISH:**		
8.1	The shares shall be free from flaws, scratches, cracks and other defects. All fins, burrs, flashes and sharp edges other than the cutting edge shall be removed.	No such defects were noticed	Conforms
8.2	In case of steel shares, the welding of gunnels shall be satisfactory in all respect. The welding shall not be porous.	No such defects were noticed	Conforms
8.3	A coating of protective paint or grease on soil-facing surface of the share shall be provided. The bottom surface not in direct contact with soil shall have an anti-rust paint coating	provided	Conforms
9	**MARKING AND PACKING**		
9.1	The share shall be with the following particulars:		
	a)Manufacturer's name and recognized trade-mark, if any;	Not provided	---
	b) Size ;	Not Provided	---
	c) Type; and	Not Provided	---
	d) Batch/ code number.	Not Provided	---

5. LABORATORY TEST

5.1 Hardness:

5.1.1 Hardness of share:

Hardness as observed (Avg.)	Hardness as per IS: 6459-1972	Conformity to IS
HB		
355	350 to 450	Conforms

Remark: - The average hardness of the share was recorded as 355 HB against the requirement of 350 to 450 HB.

5.1.2 Hardness of Bar-Point:

Hardness as observed (Avg.)	Hardness as per IS: 6459-1972	Conformity to IS
HB		
360	350 to 450	Conforms

Remark: - The average hardness of the share bar was recorded as 360 HB against the requirement of 350 to 450 HB.

5.2 Chemical Analysis:

5.2.1 Chemical Analysis of share*:

Constituents	Chemical composition (%) as per IS: 10691-1983	Chemical composition as observed (%)	Conformity to IS
Carbon (C)	0.70-0.80	0.73	Conforms
Manganese (Mn)	0.50-0.80	0.76	Conforms
Phosphorous (P)	0.050 (max)	0.027	Conforms
Sulpher (S)	0.050 (max)	0.020	Conforms

5.2.1 Chemical Analysis of share bar*:

Constituents	Chemical composition (%) as per IS: 10691 1983	Chemical composition as observed (%)	Conformity to IS
Carbon (C)	0.70-0.80	0.75	Conforms
Manganese (Mn)	0.50-0.80	0.77	Conforms
Phosphorous (P)	0.050 (max)	0.029	Conforms
Sulpher (S)	0.050 (max)	0.021	Conforms

***Supplied by the manufacture** (Chemical Test certificate No. GN/16-17/05/586, 587 dated 23/06/2016 issued by G.N. Altech, Samrat Industrial Area, Rajkot, Gujarat)

5.3 Wear of soil engaging critical components:

5.3.1 Share (Blade):

S. No.	Weight of share, kg		Per cent Wear	Wear Rate (%)
	Initial	After 40 hr		
1	4.154	3.323	20	0.5
2	4.119	3.377	18	0.45
3	4.073	3.777	22	0.55
4	4.130	3.180	23	0.57

5.3.2 Share (Bar):

S. No.	Weight of share bar, kg		Per cent Wear	Wear Rate (%)
	Initial	After 40 hr		
1	5.948	5.155	13.33	0.33
2	6.200	5.327	14.07	0.35
3	5.968	5.324	10.79	0.27
4	5.957	5.331	10.50	0.26

6. FIELD PERFORMANCE TEST

The field test of MB plough was conducted at CTAE farm, Udaipur with John Deere tractor as a prime mover for operating the plough. The working of the Hydraulic reversible M.B. plough was observed satisfactory.

During the field test, data were collected and analyzed for quality of work, rate of work and draft of implement. The details of test result are given in following Table1.

Table 1: SUMMARY OF FIELD PERFORMANCE TEST

S. No.	Parameter	Range
1	Type of soil	Sandy loam
2	Soil bulk density (g/cc)	1.69-1.71
3	Soil moisture (%)	10.12-11.02
4	Cone index of the soil(kPa)	
	Before ploughing operation	462-505
	After ploughing operation	112-132

5	Furrow length, m	176-177
6	Engine speed, rpm	
	No load	1530-1550
	On load	1290-1340
7	Speed of operation, km/h	2.67-2.82
8	Wheel slip, (%)	8.82-13.33
9	Depth of cut, cm	18-21
10	Width of cut, cm	64-68
11	Effective field capacity, ha/h	0.158-0.161
12	Field efficiency, %	83.95-89.77
13	Draft of implement, kgf	500-605
14	Time required to cover one hectare area, h	6.20-6.32
15	Fuel consumption, l/h	5.2-5.5

6.1.1 Rate of Work

- ❖ The rate of work was observed as 0.158-0.161 ha/h when speed of operation varied between 2.67-2.82 kmph.
- ❖ The time required for ploughing one hectare area was recorded as 6.20-6.32 h.
- ❖ The field efficiency of the implement was worked out as 83.95-89.77 %.

6.1.2 Quality of Work

- ❖ The depth of operation and working width of implement were measured as 18-21 cm and 64-68 cm respectively.

6.2 Lobour requirement

- ❖ One skilled operator is needed to operate the tractor and the implement simultaneously.

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Fig. 3. Field testing of 2-bottom reversible mould board plough

Fig. 4. Draft measurement of 2-bottom hydraulic reversible mould board plough

6.3 Ease of operation and adjustments

- The reversing of plough bottoms during field operation was satisfactory.
- The furrow opening by the plough was satisfactory.
- The primary tillage operation performed by plough was satisfactory.

7. DEFECTS BREAKDOWNS AND REPAIRS

No breakdown was occurred in the implement during the course of test.

TESTING AUTHORITY

Field Test Conducted By:	**Er. A. K. Singh (SRF)**
Test Report Prepared By:	**Er. Jayant Ghatge (SRF)**
Test Report Checked By:	**Er. S. S. Vyas** **(Research Engineer)**
Principle Investigator (FMTC)	**Dr. S. M. Mathur** **(Professor & PI)**

ANNEXURE-I

BRIEF SPECIFICATION OF THE TRACTOR USED DURING FIELD OPERATION

1	Make, model and type	John Deere5203 S, Four Wheel, general purpose Agriculture tractor
2	Number of cylinder	Three
3	Maximum PTO power, kW (Ps)	33.7(45.82)As per Test Report No.T-512/994 Dec. 2004
4	Rated engine speed, rpm	2400
5	No load engine speed during field test, rpm	----
6	Drawbar power, kW (Ps)	27.8(37.79)
7	**Drawbar pull, kN:**	
	- Without ballast	15.60
	- With ballast	20.05
8	Type of wheel equipment	Pneumatic
9	**Number & size of tyre:**	
	-Front	Two, 7.50-16, 6 PR
	-Rear	Two, 14.9-28, 12 PR
10	**Standard track width, mm**	
	-Front	1325
	-Rear	1410
11	Wheel base, mm	2050
12	Ballast condition	Used as ballasted
13	**Total operational mass, kg:**	
	-Front	980
	-Rear	1535
	- Total	2515

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ANNEXURE-II

FIELD PERFORMANCE RESULTS

Place of test: CTAE farm, Udaipur

S. No.	Parameters	Test trials		
		I	**II**	**III**
1	Duration of test (h)	3.96	3.76	4.17
2	Furrow length	176	177	176
3	Type of soil	Sandy loam		
4	Bulk density (g/cc)	1.71	1.69	1.70
5	Soil moisture (%)	10.12	11.02	10.58
6	Previous treatment	Nil		
7	Engine speed (rpm)			
	-No load	1530	1550	1535
	-On load	1290	1320	1340
8	Cone index of the soil (kPa)			
	Before ploughing operation	462	490	505
	After ploughing operation	112	132	132
9	Forward speed (km/h)	2.76	2.67	2.82
10	Wheel slip (%)	8.82	10.87	13.33
11	Av. Depth of Cut (cm)	18	19	21
12	Av. Width of cut (cm)	64	67	68
13	Area covered (ha/h)	0.158	0.159	0.161
14	Time required for one ha (h)	6.32	6.20	6.21
15	Theoretical field capacity (ha/h)	0.176	0.179	0.191
16	Field efficiency (%)	89.77	88.82	83.95
17	Implement draft (kgf)	560	500	605
18	Fuel consumption (l/h)	5.2	5.4	5.5

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ANNEXURE: III

SYMBOLS AND ABBREVIATIONS

SYMBOLS

I. Symbols assigned to basic units

S.No.	Physical Quantity	Name of S.I. Unit	Symbol
1	Length	Meter	m
		Millimeter	mm
2	Mass	Kilogram	kg
3	Time	Second	S

II Symbols assigned to some derived units

S.No.	Physical Quantity	Name of S.I. Unit	Symbol
1	Area	Square centimeter	cm^2
		Square meter	m^2
		Hectare	ha
2	Mass	Gram	g
		Kilogram	kg
		Tonne	t
3	Speed/Velocity	Meter per second	m/s
		Kilometer/hour	km/h
4	pressure	Newton per square millimeter	N/mm^2
5	Time	Minute	min
		Hour	h
6	Volume	Cubic centimeter	cm^3
		Milliliter	ml
		Liter	l

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