व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT

संख्या / No. : COMB-73/1426
माह/ Month : August, 2012

TRACTOR POWERED COMBINE HARVESTER 'FARMLINE TDC-3900'

सत्यमेव जयते

भारत सरकार
कृषि मंत्रालय
(कृषि एवं सहकारिता विभाग)

GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE
(DEPARTMENT OF AGRICULTURE & COOPERATION)

उत्तरी क्षेत्र कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान
ट्रैक्टर नगर, सिरसा रोड, हिसार –125001 (हरियाणा)

NORTHERN REGION FARM MACHINERY TRAINING AND TESTING INSTITUTE
TRACTOR NAGAR, SIRSA ROAD, HISAR-125001 (HARYANA)

Telephone : 01662- 276172 , 276824
Website : http:// nrfmtti.dacnet.nic.in

Telefax No. : 01662-276984
E-Mail : fmti-nr@nic.in

15.5 Bearings:

All the bearings of different assemblies of the combine were inspected and found in normal working conditions

15.6 Wear of Rasp Bar:

The percentage wear on mass basis of rasp bar of the threshing drum was measured and recorded as under:

Sl. No.	Mass of rasp bar before test (g)	Mass of rasp bar after 52.36 hours of test (g)	Percentage wear (%)
1.	5097	5059	0.75
2.	4979	4929	1.00
3	5106	5072	0.67
4	5094	5048	0.90

15.8 Wear of the Peg Teeth:

The wear of the peg teeth of the threshing cylinder and concave was measured. The percentage wear on mass basis was computed and the results are given below:

Sl. No.	Original mass before test (g)		Mass after 27.28 hours of test (g)		Percent wear	
	Threshing cylinder	Concave	Threshing cylinder	Concave	Threshing cylinder	Concave
1.	211.3	210.7	210.7	209.8	0.28	0.43
2.	205.4	208.5	204.7	208.1	0.34	0.19
3	214.9	208.1	214.4	207.5	0.23	0.29
4	214.9	216.7	214.5	216.0	0.19	0.32
5	197.2	209.7	196.2	209.0	0.51	0.33
6	202.4	210.4	202.0	209.9	0.20	0.24
7	215.1	-	214.0	-	0.51	-
8	211.7	-	211.1	-	0.28	-

16. SUMMARY OF OBSERVATIONS, COMMENTS AND RECOMMENDATIONS

16.1 Compatibility of tractor on the combine

16.1.1 Adequacy of power :

During the period of test, no over loading of the prime mover was observed. The power available from the prime mover to drive the combining unit was found to be adequate.

16.1.2 Modifications on standard tractor :

The following modification in the tractor were made in order to make it suitable for combine use.

i) Spark arresting device should be necessary.

ii) Safety cover for silencer should be necessary.

16.2 **Header lifting test :**

During 1000 cycles, no leakage of hydraulic oil was observed and working of hydraulic system is normal.

16.3 **Turning ability:**

Radius of turning circle of LHS & RHS was found satisfactory.

16.4 **Visibility:**

The visibility around the cutter bar from operator's seat in normal sitting position is satisfactory.

16.5 **Braking Performance:**

i) The mean deceleration and stopping distance corresponding mean 2.5m/sec^2 declaration was 15.84m and 116N under cold condition.

ii) The performance of parking brake was found satisfactory.

16.6 **Mechanical Vibration:**

The amplitude of mechanical vibration of components marked as (*) in chapter 11 of this report are on higher side. This calls for providing suitable remedial measures to dampen the vibration to improve the operational comfort and service life of various components & sub assemblies.

16.7 **Noise measurement:**

i) The ambient noise emitted by the machine was measured as 89.8dB(A) which is normal when compared with warning and danger limits of 85 and 90 dB(A) respectively.

ii) The noise at driver's ear level was measured as 97.3 dB(A) which is normal when compared with warning and danger levels of 98 dB(A) for an exposure of 8 hours per day specified by ILO.

16.8 Safety clutch or provision must be provided to undershot conveyor, threshing drum and tailing auger/elevator.

16.9 Field Test:

16.9.1 Summary of field tests:

The results of the field test are summarized below:

S. No	Parameters	Range of parameters		Average of parameters	
		Wheat Harvesting	Paddy Harvesting	Wheat Harvesting	Paddy Harvesting
1.	Speed of operation (kmph)	2.44 to 3.77	1.61 to 2.43	2.74	2.23
2.	Area covered (ha/h)	0.557 to 0.974	0.350 to 0.580	0.665	0.489
3.	Fuel consumption: - (l/h) - (l/ha)	 3.88 to 4.96 4.51 to 8.74	 4.0 to 5.0 8.26 to 11.44	 4.48 6.91	 4.47 9.31
4.	Crop throughput (tonne/h)	2.39 to 6.74	4.0 to 9.87	4.80	7.08
5.	Grain breakage in main grain outlet(%)	1.252 to 2.067	0.103 to 1.237	1.727	0.480
6.	Header losses(%)	1.430 to 6.930	0.205 to 0.321	3.804	0.278
7.	Total non-collectable losses(%)	1.455 to 6.950	0.222 to 0.389	3.846	0.315
8.	Total collectable losses(%)	0.093 to 0.231	Nil to 0.515	0.171	0.288
9.	Total processing losses(%)	1.525 to 2.376	0.159 to 1.314	1.940	0.805
10.	Threshing efficiency(%)	99.70 to 99.90	99.48 to 100	99.82	99.71
11.	Cleaning efficiency(%)	94.04 to 98.26	95.50 to 97.83	97.46	96.39

16.8.2 Wheat Harvesting:

i) The grain breakage in all the varieties tested was measured as 1.252 to 2.067 % which is normal.

ii) The total non collectable losses ranged from 1.525 to 2.376 percent which is considered to be on the higher side. The major constituent of non-collectable losses is header loss.

iii) The total processing losses ranged from 1.644 to 2.251 which is normal. The major constituent of processing losses is grain breakage.

iv) The threshing efficiency ranged from 99.70 to 99.90 % which is considered normal.

v) The cleaning efficiency ranged from 94.04 to 98.26% which is considered to be higher side.

Necessary improvements to bring down the grain breakage, Header losses and improve cleaning efficiency are required to be incorporated.

16.8.3 Paddy Harvesting:

i) The grain breakage ranged from 0.103 to 1.237% which is considered to be normal side.

ii) The total non-collectable losses ranged from 0.222 to 0.389% which is normal side.

iii) The total processing losses ranged from 0.159 to 1.314% which is considered to be slightly on normal side against max. limit of 2.50% specified by BIS.

iv) The threshing efficiency ranged from 99.48 to 100% which is consider to be higher side.

v) The cleaning efficiency ranged from 95.50 to 97.83% which is considered to be on lower side.

Necessary improvements are required to be incorporated.

16.8.4 Harvesting of any other crops:

The performance of combine to harvest wheat and paddy was evaluated.

16.8.5 Ease of Operation and Safety Provision:

i) The controls provided around the operator are within easy reach but not properly labelled with proper symbols and direction of operation of controls are not provided for the guidance of operator. Therefore it is recommended that the symbols as per the requirement of IS-6283-1998 may be provided.

ii) Safety device/slip clutches in threshing drum drive, reel drive, cutter bar drive & feeder conveyor drive are also considered essential from safety point of view.

iii) The grain tank needs to be provided with suitable device to know the grain fill and covered fully in order to avoid any accident while working on the the machine.

iv) There is no provision for adjusting the threshing drum speed except the changing of pulley size which make it difficult to adjust the speed for harvesting different verities of crop. Speed variation through suitable hydraulic variator pulley is recommended.

v) The design of stone trap need to be modified for easy cleaning.

vi) Safety cover should be provided on all header sprocket and chain at regular production level.

The safety frames to protect the grain and tailing auger, blower body from damage while crossing the field bunds are considered essential and may be provided from safety point of view.

16.8.6 Assessment of Wear:

i) The condition of the components of brake system and steering system was observed to be normal.

ii) The condition of the bearing, chains, sprockets and belts was observed to be normal.

iii) The components of starter motor and alternator were found in normal working condition.

iv) The rate of wear of rasp bar and peg teeth of threshing cylinder & concave were observed to be normal.

16.9 Hardness and Chemical composition:

i) The hardness of knife blade in the remainder zone & hardness zone was measured as 52 & 47 HRC respectively. The hardness of knife blade does not complying with IS:6025-1991. Therefore, proper blade should be used at regular production level.

ii) Carbon content of knife back is lower and Manganese content in knife blade is higher than the IS requirement. This should be looked into at production level.

16.10 Maintenance/Service problems:

No noticeable maintenance/service problem was observed during the the course of test at this Institute

16.11 Labelling of Combine Harvester:

The labelling plate is provided on the combine harvester. But it needs to be provided as per IS:10273-1999.

16.12 Literature with the machine:

16.12.1 Literature has been provided by the manufacturer but it needs to be modified as per IS:8132-1999 .

16.12.2 It is suggested to bring out technical literature for operation, maintenance & repairs of combine harvester in printed form in Hindi and other regional languages as per relevant Indian Standard.

17. Selected performance and other characteristics of combine harvester as per IS: 15806-2008.

S. No.	Performance parameters		Characteristics	Requirement	Declared	Observed	Remark
1.	Prime mover perfor-mance						
		i)	Max. Power (absolute)	Average max. power observed during 2 hrs. max. power test in natural ambient condition should not be less than -5% of the declared value.	Not applicable	Not applicable	--
		ii)	Max. power during field test after adjusting the no load engine speed as per declaration of the applicant, kW	Max. power observed must not be less in -5% of declared value.	Not applicable	Not applicable	--
		iii)	Power at rated engine speed, kW	The observed value must not be less -5% of the declared value by the applicant.	Not applicable	Not applicable	--
		iv)	Specific fuel consumption g/kWh.	The average observed value during 2 hr. max. power test must be within ±5% of the declared	Not applicable	Not applicable	--

				value by applicant/ manufacturer.			
		v)	Max. smoke density, bosch no.	Max. smoke density at 80% load between the speed at max. power & 55% of speed at max. or 1000 rpm which ever is higher, should be observed as per CMVR rule requirement which are as below - For tractor :- 5.2 bosch no. or 75 hartridge For engine :- Free declaration or natural aspirated or turbo charges -65 hartridge	Not applicable	Not applicable	--
		vi)	Max. crank shaft torque, N - m	Max. crank shaft torque observed during the test after no. load engine speed is adjusted as per manufacture's recommendation for field work must not be less than 8% of declare value by manufacturer.	Not applicable	Not applicable	--
		vii)	Back torque, %	7% min.	Not applicable	Not applicable	--
		viii)	Max. operating temp. i) engine oil ii) Coolant	To be declared by manufacturer. Not Specified 105^{0}C	Not applicable	Not applicable	--
		ix)	Lubrication oil consumption	1% of SFC at 5hr. max. power test during high ambient condition	Not applicable	Not applicable	--

2.	**Brake performance**						
		i)	Max. stopping distance at a force equal to or less than 600 N on break pedal, m	10 m or S≤ 0.15V + $V^2/130$ V= speed corresponding to 80% of design max. speed, kmph	--	6.49 m In cold condition 7.03 m in hot condition	Conforms
		ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec^2.	≤ 600N.	--	103 In cold condition 116 In hot condition	Conforms
		iii)	Whether parking brake is effective at a force of 600 N at foot pedal or 400 N at Hand and lever	Yes or No	--	Yes	Conforms
3.	**Mechanical vibration**						
		i)	Operator's plateform	120 µm max.	--	631	**Does not conform**
		ii)	Steering wheel	150 µm max.	--	718	**Does not conform**
		iii)	Seat with driver seated	120 µm max.	--	654	**Does not conform**
4.	**Air cleaner oil pull over**						
		i)	Max. oil pull over in % age when tested in accordance with IS: 8122 pt. (II)-2000	0.25% max.	-	Not applicable	--
5.	**Noise measurement**						
		i)	Max. ambient noise emitted by combine db (A)	As per CMVR 88 db (A)	-	89.8	**Does not conform**
		ii)	Max. noise at operator's ear level db (A)	As per CMVR, 98 db (A)	-	97.3	Conforms
6.	**Discard limit**			To be specified by manufacturer, mm	-		
		i)	Cylinder bore diameter	-do-	-	Not applicable	--
		ii)	Piston diameter	-do-	-	Not applicable	--
		iii)	Ring end gap	-do-	-	Not applicable	--
		iv)	Ring groove clearance	-do-	-	Not applicable	--
		v)	Diametral and axial clearance of big end bearing	-do-	-	Not applicable	--

		vi)	Diametral end axial clearance of main bearings	-do-	-	Not applicable	--
		vii)	Thickness of brake lining	-do-	-	Not applicable	--
		viii)	Thickness of clutch plate	-do-	-	Not applicable	--
7.	**Field perfor-mance**				-		
		i)	Suitability for crops	Wheat & paddy essential	-	Wheat, paddy	Conforms
		ii)	Grain breakage in grain tank	≤ 2.5%	-	Wheat- 1.252 – 2.067 Avg. 1.727 Paddy- 0.103 -1.237 Avg. 0.480	Conforms Conforms
		iii)	Non collectable losses	≤ 2.5 % for wheat, paddy & gram ≤ 0.4 % for soybeans	-	Wheat- 1.455 – 6.950 Avg. 3.846 Paddy- 0.222 -0.389 Avg. 0.315	**Does not conform** Conforms
		iv)	Threshing efficiency	≥ 98% wheat & paddy	-	Wheat- 99.70-99.90 Avg. 99.82 Paddy- 99.48-100.0 Avg.99.71	Conforms Conforms
		v)	Cleaning efficiency	≥ 96 % wheat & paddy	-	Wheat- 94.04-98.26 Avg. 97.46 Paddy- 95.50 -97.83 Avg. 96.39	Conforms Conforms
8.	**Safety require-ment**						
		i)	Guards against all moving per	Essential	-	Provided	Conforms
		ii)	Lighting arrangement a) Head light b) Parking light c) Indication d) Reverse gear e) Brake f) Number plate g) Work light	Essential	-	Provided as per CMVR	Conforms
		iii)	Grain tank cover	Essential	-	Provided	Conforms
		iv)	Spark arrester in engine's exhaust	Essential	-	Not applicable	--

		v)	Stone trap before concave	Essential	-	Provided	Conforms
		vi)	Rear view mirror	Essential	-	Provided	Conforms
		vii)	Slip clutch at following drives – a) Cutting plateform b) under shout conveyor drive c) Grain & tailing elevator	Essential	-	Not provided	**Does not conform**
		viii)	Anti slip surfaces at operation platform & ladder & proper gripping for the control levers	Essential	-	Provided	Conforms
		ix)	Working clearance around the controls	Essential 70 mm, min.	-	Provided	Conforms
		x)	Labeling of control gauge	Essential	-	Provided	Conforms
9.	**Material of construction**						
		i)	Guard should conforms to IS:6024-1983	The guard (except ledger plate) shall be manufactured from malleable iron casting (IS: 2108-1977), steel casting (IS: 1030-1974) or steel forging (IS: 2004-1978)	Made from forged steel and ledger plate is integrated part of guard	C=0.41% Si=0.28% Mn=0.63% P=0.039% S=0.041%	Unascertainable as the relevant IS code does not specify the content limit.
		ii)	Knife blade Must meet the requirement of IS: 6025-1999	It should have chemical composition as C=0.70 to 0.95% Mn=0.30 to 0.50%	-	C=0.82% Mn=0.61%	Conforms **Does not conform**
		iii)	Knife back Must meet the requirement of IS: 10378-1982 material requirement	The knife back shall be manufactured from Carbon Steel having minimum carbon content of 0.35 %	-	C=0.13%	**Does not conform**

10.	**Labeling of combine harvester**	Essential as per IS: 10273	-	Not provided	**Does not conform**
11.	**Break down (critical major & minar)**	Essential as per IS: 15806-2008 Annexure A_1, A_2, A_3	-	No break down occurred	conforms

TESTING AUTHORITY

(R.M. TIWARI) ASSISTANT ENGINEER (W/S)	
(P. K. CHOPRA) SENIOR AGRICULTURAL ENGINEER	
A. N. MESHRAM **-DIRECTOR-**	

Tests conducted/Reports compiled by :

1. Sh. S.A. Hinge, Senior Technical Assistant

Applicant's comments

I. All of the applicant comments are recorded and added in the final test report.
II. We will purchase knife back and knife blade which are complying their hardness and chemical composition as per IS: 6025 and IS: 10378 respectively.
III. Labelling of all controls with symbols as per IS: 6283-1998.
IV. We will provide following in a future production:
   a) Possible design of Stone trap.
   b) Safety covers at reel drive, threshing drum drive, conveyor drive, cutter bar drive, grain conveying drive.
   c) Safety devices or clutches at upper grain auger, bottom tailing auger, tailing elevator, upper tailing auger, Bottom tailing auger.
V. We will provides modification in a prime mover for their Spark arresting device and safety covers for silencer in a future regular production.
VI. Mechanical vibration will be minimizes in future production.