

Lab



**SELF PROPELLED COMBINE HARVESTER  
“INDO FARM AGRICOM 1070SW (TRACK TYPE)”**



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://nrfimtti/dacnet.nic.in>

Telefax No. : 01662-276984  
E-Mail : [fmti-nr@nic.in](mailto:fmti-nr@nic.in)

**15.5 Bearings:**

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

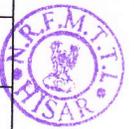
**15.6 Wear of track:**

The wear of track condition of track found normal and no sign of crack or damage observed after 104.0 hours of field and lab test.

**15.7 Wear of the Peg tooth:**

The wear of the peg tooth 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 50 hours of test (g)	Percent wear (%)
<b>a) Peg tooth of threshing cylinder:</b>			
1.	208.5	207.8	0.34
2.	208.1	207.0	0.53
3.	212.6	211.7	0.42
4.	206.1	205.0	0.53
5.	216.9	216.2	0.32
6.	215.2	214.5	0.33
7.	213.3	212.3	0.47
8.	216.0	215.4	0.28
<b>b) Peg tooth of concave:</b>			
1.	206.7	205.9	0.39
2.	213.4	212.2	0.56
3.	210.6	209.5	0.52
4.	198.0	196.8	0.61



**16 SUMMARY OF OBSERVATIONS, COMMENTS AND RECOMMENDATIONS**

**16.1 Engine Performance Test:**

Engine Brake power, kW (Ps)	Crankshaft torque, Nm(kgf-m)	Engine speed (rpm)	Hourly fuel consumption kg/h (l/h)	Specific fuel consumption kg/kWh (kg/hph)	Specific energy, kWh/l (hph/l)
<b>i) Maximum power - 2 hours test:</b>					
39.96 (54.35)	140.2 (14.3)	2850	11.173 (13.675)	0.280 (0.206)	2.922 (3.975)

<b>ii) Power at rated engine speed (2800 rpm)</b>					
40.24 (54.72)	143.7 (14.7)	2800	11.688 (14.306)	0.290 (0.214)	2.813 (3.825)
40.12 (54.57)	143.3 (14.6)	2800	11.247 (13.766)	0.280 (0.206)	2.914 (3.964)*
<b>iii) Maximum torque:</b>					
32.11 (43.67)	169.0 (17.2)	1800	8.406 (10.289)	0.262 (0.192)	3.121 (4.244)
34.70 (47.19)	172.3 (17.6)	2014	6.622 (8.105)	0.191 (0.140)	4.281 (5.822)*
<b>iv) Five hour rating test: *</b>					
<b>a) Engine loaded to 90% of maximum power:</b>					
37.26 (50.67)	128.9 (13.1)	2891	10.242 (12.536)	0.275 (0.202)	2.979 (4.052)
<b>b) maximum power:</b>					
40.03 (54.43)	143.3 (14.6)	2793	11.195 (13.702)	0.280 (0.206)	2.921 (3.973)

\* Under high ambient condition.

**Remarks:**

- i) The maximum power output of the engine was observed as 39.96 kW (54.35 Ps) at 2850 rpm of engine at full throttle.
- ii) The specific fuel consumption corresponding to maximum power at full throttle setting measured as 0.280 Kg/kwh (0.206 kg/hph).
- iii) The back-up torque of the engine was measured as 19.01 % under natural ambient condition at full throttle.
- iv) The maximum smoke density was recorded as 2.17 (Bosch No.).
- v) The maximum temperature of engine oil, coolant (water) and exhaust gas were observed as 88.0, 93.0 and 587°C respectively.
- vi) The lubricating oil & coolant consumption during five hours rating test were measured as 0.53 g/kWh (0.39 g/hph) and 0.56% of total coolant capacity respectively.

**16.2 Turning ability:**

The radius of turning circle at LHS and RHS was observed satisfactory.

**16.3 Visibility:**

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

**16.4 Braking Performance:**

No specific brake mechanism is provided. The combine stops by bringing the starting control levers LHS and RHS, to the neutral position.

**16.5 Mechanical Vibration:**

The amplitude of mechanical vibration of components are given in chapter 12 of this report. The observation reading marked (\*) for various assemblies on higher side and suitable arrangement should be provided to dampen the vibration for operator's comfort.

**16.6 Noise measurement:**

- i) The ambient noise emitted by the machine was measured as 88.6 dB(A). Which is slightly on higher side as compared to specified limit of 88 dB (A).
- ii) The noise at driver's ear level was measured as 97.8 dB(A) which is within limit when compared to warning levels of 98 dB(A)

**16.7 Field Test:****16.7.1 Summary of field tests:**

The results of the field test for paddy harvesting are summarized below:

S. No.	Observation	Range of observations	Average of observations
1.	Speed of operation, kmph	2.04 to 4.16	3.07
2.	Area covered (ha/h)	0.208 to 0.487	0.364
3.	Fuel consumption: - (l/h) - (l/ha)	7.100 to 14.384 19.241 to 42.644	9.804 27.157
4.	Crop throughput (tonne/h)	4.985 to 11.109	8.283
5.	Grain breakage in main grain outlet(%)	0.254 to 1.047	0.549
6.	Header losses(%)	0.091 to 1.245	0.344
7.	Total non-collectable losses(%)	0.338 to 1.656	0.908
8.	Total collectable losses(%)	0.252 to 1.259	0.772
9.	Total processing losses(%)	0.792 to 3.538	1.884
10.	Threshing efficiency(%)	98.68 to 99.74	99.21
11.	Cleaning efficiency(%)	91.95 to 98.10	96.81

**16.7.1.1 Paddy Harvesting:**

- i) The grain breakage ranged from 0.254 to 1.047% (Avg. 0.59%) which is within the specified limit of 2.5 % in Indian Standard.

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- ii) The total non-collectable losses ranged from 0.338 to 1.656% (Avg. 0.549%) which is within the specified limit of 2.5 % in Indian Standard.
- iii) The total processing losses ranged from 0.792 to 3.538 % (Avg. 1.884%). Average value of total processing losses is within the specified limit of 2.5% in IS 8122 (part 1) : 1994.
- iv) The threshing efficiency ranged from 98.68 to 99.74% (Avg. 99.21%). Threshing efficiency conforms with the limit specified in BIS.
- v) The cleaning efficiency ranged from 91.95 to 99.10% (Avg. 96.81%). Average value of cleaning efficiency conforms with limit 96% in BIS. Losses are within the specified limit in Indian Standard. Threshing and cleaning efficiencies are higher than the minimum value specified in Indian Standard.

#### 16.7.2 Harvesting of any other crops:

The performance of combine to harvest paddy crop was evaluated as the same were recommended by the applicant.

#### 16.7.3 Ease of Operation and Safety Provision:

- i) The controls provided around the operator are within easy reach, but not labelled with symbols as per Indian standard. Therefore it is recommended that the symbols as per the requirement of IS-6283-1998 may be provided.
- ii) The design of stone trap need to be modified for cleaning without removing the stone trap.
- iii) Spark arresting device is not provided in the engine exhaust system which is considered essential.
- iv) Slip clutch / safety device in knife drive, crop auger drive and threshing drum drive are considered essential from safety point of view which needs to be provided.
- v) The mechanical arrangement for adjusting the reel speed is not provided, needs to be added such that the same could be controlled from operators position.
- vi) The grain tank should be provided with suitable device to know the grain fill.

#### 16.7.4 Assessment of Wear:

- i) The wear of engine components i.e cylinder liners, piston, piston rings, valves, valve guides, springs, big-end bearings and main bearings were observed within the permissible limit.
- ii) The transmission gears and components were found in normal working condition.
- iii) The timing gears, clutch lining, release bearing were found in normal working condition.

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- iv) The condition of the components of hydraulic system and steering system was observed to be normal.
- v) The condition of the bearing, chains, sprockets and belts was observed to be normal.
- vi) The components of starter motor and alternator were found in normal working condition.
- vii) The range of wear of peg tooth of threshing cylinder & concave were observed 0.28 to 0.53 % and 0.39 to 0.61% respectively after 50 hours of harvesting.

**16.8 Hardness and Chemical composition:**

- 1. The Hardness of knife blade in reminder zone is not within the prescribed limit of IS :6025-1999.
- 2. Manganese content in knife blade and chemical composition of knife back is not conforming to the limits specified in IS:6025-1999 and IS:10378-1982 respectively. Knife blade and knife back conforming to Indian Standard in hardness and chemical composition should be used at regular production level.

**16.9 Maintenance/Service problems:**

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

**16.10 Identification plate of Combine Harvester:**

The identification plate is provided on the combine harvester as specified in IS:10273-1999.

**16.11 Literature supplied with the Machine:**

No operator or workshop manual was provided with test sample. Therefore following literature should be provided with machine in Hindi and other regional languages for the guidance of the users in accordance with IS:8132-1983.

- 1. Operator manual.
- 2. Service manual.
- 3. Part catalogue.
- 4. Repair manual.



## 17. SELECTED PERFORMANCE AND OTHER CHARACTERISTICS AS PER IS: 15806-2008.

Sr. No.	Characteristics	Requirement	Declared	Observed	Remark
1.	<b>Prime mover performance</b>				
i)	Max. Power (absolute) Average max. power observed during 2 hrs. max. power test in natural ambient condition kW(Ps)	It should not be less than 5% of the declared value.	42.7 (58)	39.96 (54.35)	Does not conform
ii)	Max. power observed during test after adjusting the no load engine speed as per recommendation of the manufacturer for field work, kW (Ps)	Max. power observed must not be less than 5% of declared value.	42.7 (58)	39.96 (54.35)	Does not conform
iii)	Power at rated engine speed, kW (Ps)	The observed value must not be less than 5% of the declared value by the applicant.	42.7	40.24 (54.72)	Does not conform
iv)	Specific fuel consumption g/kWh.	The average observed value during 2 hr. max. power test must be within $\pm 5\%$ of the declared value by applicant/manufacturer.	250	0.280 (0.206)	Does not conform
v)	Max. smoke density (bosch no.) at 80% load between the speed at max. power & 55% of speed at max. or 1000 rpm whichever ever is higher, should be observed as per CMVR rule	For tractor :- 5.2 bosch no. or 75 hartridge For engine :- Free deceleration or natural aspirated or turbo charges - 65 hartridge	3.25	2.17	Conforms
vi)	Max. crank shaft torque, (N-m) observed during the test after no load engine speed is	It must not be less than 8% of declare value by manufacturer.	171	169.0	Conforms

		adjusted as per manufacture's recommendation for field work				
	vii)	Back up torque, %	7% min.	10.0	19.01	Conforms
	viii)	Max. operating temp. To be declared by manufacturer	i) engine oil	Lubricant 135°	Lubricant 88.0	Conforms
			ii) Coolant	Coolant 115°	Coolant 93.0°	Conforms
	ix)	Lubrication oil consumption, g/kWh	1% of SFC at 5hr. max. power test during high ambient condition	1 % max of specific fuel consumption	0.53	Conforms
2.	<b>Brake performance</b>					
	i)	Max. stopping distance at a force equal to or less than 600 N on break pedal, m	10 m or $S \leq 0.15V + V^2/130$ V= speed corresponding to 80% of design max. speed, kmph		Not applicable for track type	-
	ii)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec <sup>2</sup> .	$\leq 600N$ .		-do-	-
	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		-do-	-
3.	<b>Mechanical vibration</b>					
	i)	Operator's platform	120 $\mu$ m max.	120 $\mu$ m	290	<b>Does not conform</b>
	ii)	Steering wheel	150 $\mu$ m max.	-	Not applicable for track type	-
	iii)	Seat with driver seated	120 $\mu$ m max.	120 $\mu$ m	260	<b>Does not conform</b>
4.	<b>Air cleaner oil pull over</b>					
	i)	Max. oil pull over in % age when tested in accordance with IS: 8122 pt. (II)-2000	0.25% max.		Not applicable as dry air filter is used	
5.	<b>Noise measurement</b>					
	i)	Max. ambient noise emitted by combine dB (A)	88 dB (A) as per CMVR	88	88.6	<b>Does not conform</b>



	ii)	Max. noise at operator's ear level dB (A)	98 dB (A) as per CMVR,	98	97.8	Conforms
6.	<b>Discard limit</b>					
	i)	Cylinder bore diameter	Must not exceed the values declared by the manufacture	97.3	97.04	Conforms
	ii)	Piston diameter	-do-	Not specified	96.88	<b>Does not conform</b>
	iii)	Ring end gap	-do-	2.0	0.65	Conforms
	iv)	Ring groove clearance	-do-	0.22	0.15	Conforms
	v)	Diametrical and axial clearance of big end bearing	-do-	0.20 Diametrical clearance	0.06	Conforms
				0.60 Axial clearance	0.30	Conforms
	vi)	Diametrical and axial clearance of main bearings	-do-	0.40 Diametrical clearance	0.10	Conforms
				0.60 Axial clearance	0.15	Conforms
	vii)	Thickness of brake lining	-do-	-	Not applicable as no separate breaking is provided	-
	viii)	Thickness of clutch plate	-do-	-	Not applicable as hydraulic motor are used to engage the drive	-
7.	<b>Field performance</b>					
	i)	Suitability for crops	Wheat & paddy essential	Paddy	Paddy	<b>Does not conform</b>
	ii)	Grain breakage in grain tank	≤ 2.5 %	≤ 2.5	0.549	Conforms
	iii)	Non collectable losses	≤ 2.5% for wheat, paddy & gram ≤ 4.0% for soybean	≤ 2.5	0.908	Conforms
	iv)	Threshing efficiency	≥ 98% wheat & paddy	≥ 98%	99.21	Conforms

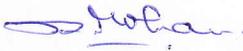
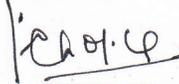
	v)	Cleaning efficiency	≥ 96 % wheat & paddy	≥ 96%	96.81	Conforms	
8.	<b>Safety requirement</b>						
	i)	Guards against all moving per	Essential	-	Provided	Conforms	
	ii)	Lighting arrangement a) Head light b) Parking light c) Indication d) Reverse gear e) Brake f) Number plate	Essential as per CMVR		Not applicabel	-	
	iii)	Grain tank cover	Essential		Not provided	<b>Does not conform</b>	
	iv)	Spark arrester in engine's exhaust	Essential		Not provided	<b>Does not conform</b>	
	v)	Stone trap before concave	Essential		Provided	Conforms	
	vi)	Rear view mirror	Essential				
	vii)	Slip clutch at following drives - a) Cutting platform b) under shout conveyor drive c) Grain & tailing elevator	Essential		Not provided	<b>Does not conform</b>	
	viii)	Anti slip surfaces at operator platform & ladder & proper gripping for the control levers	Essential		Provided	Conforms	
	ix)	Working clearance around the controls	Essential 70 mm, min.		Provided	Conforms	
	x)	Labelling of control gauge	Essential		Not provided	<b>Does not conform</b>	
	9	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)		Not applicable	-
		ii)	Knife blade As per IS :6025 -1982	It must have Chemical composition as C= 0.70-0.95 % Mn =0.30-0.50 %	N.A	Carbon 0.76% Manganese 0.61%	Conforms  <b>Does not conform</b>



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	iii) Knife back Must meet the requirement of IS:10378-1982	The knife back shall be manufactured from Carbon Steel having minimum carbon content of 0.35 %	N.A	Carbon 0.18 %	Does not conforms
10.	<b>Labelling of combine harvester</b>				
	It should conforms to IS: 10273-1987	Essential, It should mention make & model, Engine No., Chassis No., Year of manufacture, Power & SFC of engine		Provided	Conforms
11.	<b>Break down (critical major &amp; minor)</b>				
	-	Essential as per IS: 15806-2008 Annexure A1, A2, A3		NIL	Conforms

**TESTING AUTHORITY:**

(R. M. TIWARI) AGRICULTURAL ENGINEER	
(P. K. CHOPRA) SENIOR AGRICULTURAL ENGINEER	
(HIMAT SINGH) -DIRECTOR-	

**APPLICANT'S COMMENTS**

Sl. No.	Our Reference	Applicant comments
1.	Para 17, Sl. No.1 (i), (ii), (iii) & (iv)	We had taken this with our engine supplier, the same will be corrected in regular production machines.
2.	Para 17, Sl. No. 3 (i), (ii) & (iii)	Our R&D is working to reduce mechanical vibrations to the desired level.
3.	Para 17, Sl. No. 5 (i)	Our R&D is working to reduce noise to the desired level.
4.	Para 17, Sl. No. 8 (iii), (iv), (vii) & (x)	Grain tank cover spark arrester slip clutches and labelling of controls and gauges will provided in regular production machines.
5.	Para 17, Sl. No. 9 (ii) & (iii)	Our R&D is working to reduce Manganese in knife blade and to increase carbon in knife back to the desired level

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