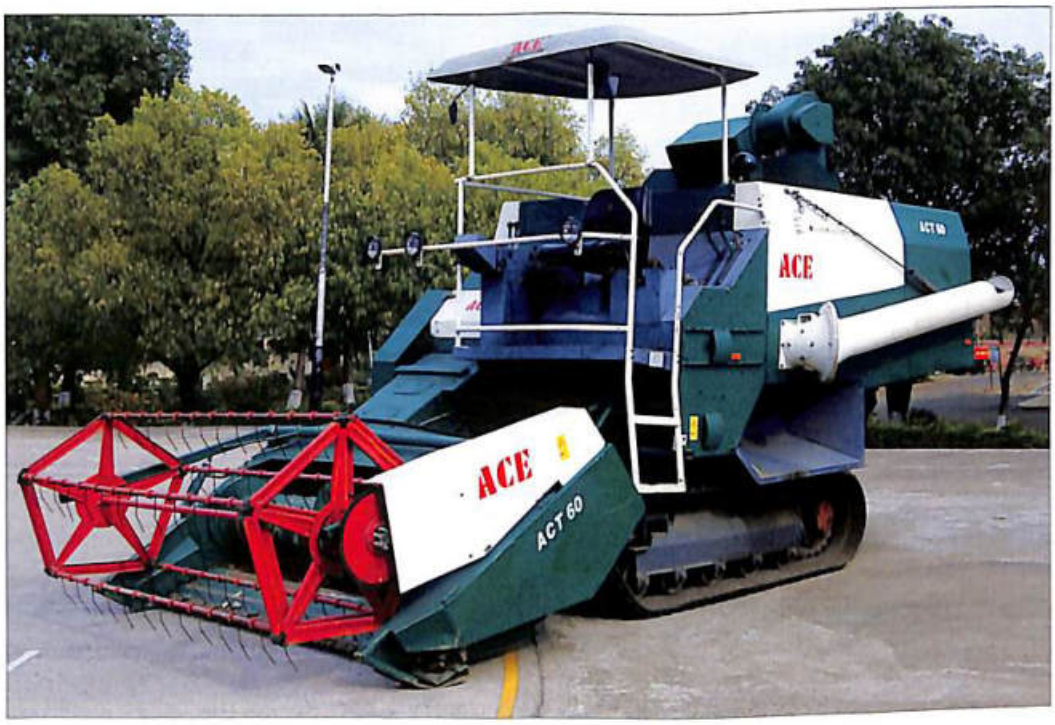
व्यावसायिक परीक्षण रिपोर्ट
COMMERCIAL TEST REPORT **(Initial)**

संख्या / No. : Comb-58/1380/2013
माह / Month : March, 2013



ACE, ACT 60 SELF PROPELLED, COMBINE HARVESTER (TRACK TYPE)

सत्यमेव जयते

भारत सरकार

GOVERNMENT OF INDIA

कृषि मंत्रालय (कृषि एवं सहकारिता विभाग, मशीनीकरण एवं प्रोद्योगिकी प्रभाग)

Ministry of Agriculture (Deptt. of Agri. & Co-op, Mechanization & Technology Division

केन्द्रीय कृषि मशीनरी प्रशिक्षण एवं परीक्षण संस्थान

CENTRAL FARM MACHINERY TRAINING & TESTING INSTITUTE

(An ISO : 9001-2008 Certified Institute)

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3. SPECIFICATIONS

3.1 Combine Harvester

Make	:	ACE
Model	:	ACT 60
Serial Number/Chassis No.	:	80001
Type	:	Self propelled track type
Year of manufacture	:	2012

3.2 Prime mover (Engine)

Make	:	Tata
Model	:	497 SP 27
Type	:	Four stroke, Naturally Aspirated, liquid cooled, direct injection, diesel engine.
Serial number	:	C YY 6 15800

Engine speed (Manufacturer's recommended production setting), (rpm) :

- Maximum speed at no load,	:	3100 ± 100
- Low idle speed	:	800 ± 100
- Speed at maximum torque	:	1500
- Rated speed	:	2800
- Rated speed for field operation	:	2800
Location	:	Behind the Grain tank
Mounting	:	On M.S. frame with anti vibration mountings

3.2.1 Cylinder & Cylinder Head:

Number	:	Four
Disposition	:	Vertical, inline
Bore/stroke, (mm)	:	97/100
Capacity as specified by the applicant, (cc) (apa)	:	2956
Compression ratio	:	19.0 (± 1) : 1
Type of cylinder head	:	Monoblock
Type of cylinder liners	:	Dry
Type of combustion chamber	:	Direct injection, Re-entrant, toroidal
Arrangement of valves	:	Overhead
Valve clearance (cold):		
- Inlet valve, (mm)	:	0.2
- Exhaust valve, (mm)	:	0.3

3.2.2 Fuel System:

Type of fuel feed system	:	Force feed

3.2.2.1 Fuel tank:

Capacity, (l)	:	103.500
Location	:	On LHS of combine
Provision for draining of sediments / water	:	Drain plug provided
Material of fuel tank	:	M. S. Sheet

	17.10 Labelling of combine harvester (Provision of Labeling plate):					
	1)	Make	Should conform to the requirements of IS: 10273- 1987 along-with declared value of HP	--	ACE	Yes
	2)	Model		--	ACT 60	Yes
	3)	Year of manufacture		--	03-2012	Yes
	4)	Engine number		--	CYY 615800	Yes
	5)	Chassis number		--	80001	Yes
	6)	Declaration of power, kW)		--	42.7	Yes

17.11 Category of breakdowns / defects:

Sl. No.	Characteristic	Category (Evaluative / Non Evaluative)	Requirements as per IS: 15806-2008,Annexure A1,A2 & A3	As observed	Whether meets the requirements (Yes/No.)
1.	Critical	Evaluative	No critical breakdown	**None**	Yes
2.	Major	Evaluative	Not more than Three and neither of them should be repetitive in nature.	**Two**	Yes
3.	Minor	Evaluative	Not more than five and frequency of each should not be more than two.	**None**	Yes
4.	Total breakdowns	Evaluative	In no case, the total number of breakdowns should exceed five, that is, (3 major + 2 minor) or 5 minor breakdowns.	**Two**	Yes

18. SUMMARY OF OBSERVATIONS. COMMENTS AND RECOMMENDATIONS

18.1 Engine performance Test :

Sr.No.	Engine Brake Power, (KW)	Crankshaft Torque, (Nm)	Engine Speed (rpm)	Hourly Fuel Consumption kg/h, (l/h)	Specific Fuel Consumption (kg/kwh)	Specific Energy (kwh/l)
I)	Maximum Power- 2 hours test:					
	42.8	144	2840	12.31	0.240	3.49
II)	Power at rated engine speed test (2800 RPM)					
	42.6	145.3	2800	12.14	0.242	3.45
	40.2	136.9	2800	11.81	0.246	3.43*
III)	Maximum torque :					
	24.8	158.1	1500	6.47	0.218	3.99
	31.8	148.1	2050	8.69	0.228	3.71*
IV) a)	Five hour rating test Engine loaded to 90% of maximum power :					
	37.2	122	2913	11.04	0.248	3.37*
b)	Maximum power :					
	40.7	136	2856	11.97	0.245	3.41*

***Under high ambient condition**

Remarks:

i. The maximum power output of the engine was observed as **43.0** kW at 2854 rpm of engine at full throttle.
ii. The specific fuel consumption corresponding to maximum power at full throttle setting measured as **0.243**kg /kwh
iii. The back-up torque of the engine was measured as **9.79 %** under natural ambient condition at full throttle.
iv. The maximum smoke density was recorded as 0.24 m−1 (Bosh No.).
v. The maximum temperature of engine oil, coolant (water) and exhaust gas were observed as 113, 96 and 507 respectively.
vi. The lubricating oil & coolant consumption during five hours rating test were measured as 0.49 g/kwh & 0.69 % of total coolant capacity respectively.

18.2 Turning Ability:

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

18.3 Visibility:

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

18.4 Braking Performance:

No specific brake mechanism is provided. The combine stop by bringing the control levers of LHS and RHS driving roller/track to the neutral position.

18.5 Mechanical Vibration:

The amplitude of mechanical vibration of components are given in the chapter 8 of this report. The observation reading marked (*) for various assemblies on higher side and suitable arrangement should be provided to dampen the vibration for the operator's comfort.

18.8 Noise Measurement:

I) The ambient noise emitted by the machine was measured as 88 db (A).
II) The noise at drivers ear level was measured as 97 db(A) which is within limit when compared to warning levels of 98 db (A).

18.7 Field Test:

Summary of field test:

The result of the field test for the paddy harvesting is summarized below.

Sl. No.	Observation	Range of observation	Average of observation
1	2	3	4
1.	Speed of operations, kmph	2.016 to 2.635	-
2.	Area covered (ha/h)	0.186 to 0.508	-
3.	Fuel consumption: -(l/h -(l/ha))	 7.00 to 10.00 16.785 to 30.331	-
4.	Crop throughput (tonne/ha)	4.145 to 6.594	-

1	2	3	4
5.	Grain breakage in main grain outlet (%)	0.043 to 0.943	0.540
6.	Header losses (%)	0.140 to 0.731	0.452
7.	Total non-collectable losses (%)	0.371 to 1.340	0.786
8.	Total collectable losses (%0	0.000 to 1.186	0.468
9.	Total processing losses (%)	0.742 to 2.166	1.103
10.	Threshing efficiency (%)	98.68 to 99.84	99.39
11.	Cleaning efficiency (%)	97.84 to 99.43	98.56

18.7.1 Paddy Harvesting

i) The grain breakage range from 0.043 to 0.943 % which is considered to be normal.

ii) The total non-collectable losses ranged from 0.371 to 1.34 % which is considered to be normal.

iii) The total processing losses ranged from 0.742 to 2.166 % which is considered to be on normal against max. Limit of 2.5 % as per IS.

iv) The threshing efficiency ranged from 98.68 to 99.84 % which is considered to be normal.

v) The cleaning efficiency ranged from 97.84 to 99.43 % which is considered to be normal.

18.7.2 Harvesting of any other crops:

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

18.7.3 Operation in Wet Soil : The operation of combine harvester was found satisfactory in dry as well as wet fields.

18.7.4 Ease of operation and safety provision:

i) The control provided around the operator is within easy reach.

ii) The stone trap needs to be provided before the concave

iii) Spark arresting device is not provided in the engine exhaust system which is considered essential.

iv) Slip clutch/ safety devices in knife drive, crop auger and threshing drum drive are considered essential from safety point of view which needs to be provided.

v) The provision for adjusting the reel speed is not provided, which needs to be provided

vi) The grain tank is should be provided with suitable device to know the grain fill.

vii) Mechanical lock for reel in raised position needs to be provided to ensure safety while working on cutter bar.

18.7.4 Assessment of Wear:

i) The wear of engine components i.e. cylinder liners, piston, piston rings, valves, valve guides, springs, big-end bearing were observed within the permissible limit.

ii) The transmission gears and components wear found in normal working condition.

iii) The timing gears, clutch lining, release bearing were found in normal working condition.

iv) The condition of the component 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 component of starter motor and alternator were found in normal working condition.

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

18.7.5 Hardness and chemical composition:

I) The hardness of knife blade in reminder zone is not within the permissible limit of IS: 6025-1999.

18.8 Maintenance / service problems:

No noticeable maintenance / service problem was observed during the course of test at this institute however the following provisions needs to be provided in the machine

i) Provision of threshing drum speed variation to cater for varying crop conditions

18.9 Safety provisions

i) The slip clutch should be provided in all the drives to prevent the damage to the drive belts and fire hazard in case of choking of combine harvester during the crop harvesting.

ii) The tail lights hazard indicator lights and reflectors should be provided on combine harvesters to prevent any accident during crossing of village roads in night during the harvesting operation.

iii) Grain unloading light should be provided for safe and ease parking of grain collecting vehicle.

iv) The provision for mechanical lock of cutting platform in raised position should be provided for safety during maintenance work.

18.9 Identification plate of combine:

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

18.10 Literature supplied with the machine:

The following literature supplied in English were supplied with the machine for reference during testing and these where found adequate, however, it needs to be modified in Hindi and other regional language for the guidance of the users in accordance with IS :8132-1983.

1. Operator manual ACT 60 Harvester Combine.
2. Operator's Service book Tata 497 SP Industrial Engine
3. Spare Part's Catalogue ACT 60
4. Spare Part's Catalogue of Tata 497 SP Industrial Engine

19.0 Citizen charter

Duration of Test	Test duration under citizen charter	Whether the report released within time frame given in the citizen charter	Remark
October 2012 to March 2013 5 Months	10 Months	Yes	--

TESTING AUTHORITY:

R.K.NEMA
AGRICULTURAL ENGINEER

H.L.YADAV
SENIOR AGRICULTURAL ENGINEER

C.R.LOHI

DIRECTOR

Test Report compiled by: **Pratyush Satya,** Senior Technical Assistant

20. APPLICANT'S COMMENTS

Para No	Our Reference	Applicant's comments
20.1	**17.3**	**Will work out to reduce amplitude of mechanical vibration**
20.2	**17.8**	**Will meet all feasible requirements in due course of time**
20.3	**17.9**	**Will audit manufacturing process as per applied IS Standard**

Comb-58/1380/2013	ACE , ACT 60 SELF PROPELLED COMBINE HARVESTER (TRACK TYPE) - Comm. (ICT)

Combine Run Hours During Test

Annexure-I

A	Laboratory Tests:	Hours
1.	Running-in	3.5
2.	Engine Performance test	14.88
3.	Radius of turning space & turning circle	0.50
4.	Location of center of Gravity	0.50
5.	Visibility test	0.00
6.	Brake performance Test	0.75
7.	Noise measurement	1.25
8.	Mechanical vibration Test	1.25
9	Header Lifting Test	3.00
B	**Field Test:**	
1	Paddy Harvesting	56.9
2	Miscellaneous test and other run hours including ideal run, transportation, trails and preparation for test	12.33
	TOTAL	**94.86**

Annexure-II

OBSERVATION SHEET FOR FIELD TESTING (PAADY HARVESTING)

Test No.	Date of test	Variety of crop	Field soil condition Dry/Wet	Height of plants (cm)	Length of ear head (cm)	No. of grains per ear head	Plant Population		Straw grain ratio	Moisture (%)		Atmospheric conditions at the time of test	
							No of plant/m^2	No of tillers/m^2		Grain	Straw	R.H (%)	Press-ure, (Kpa)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	01.11.12	Pusa Basmati	Dry	90 to 120	28 to 31	225 to 235	18 to 22	234 to 245	1.732	20.0	60.0	27	97.4
2	02.11.12	Pusa Basmati	Wet & Muddy	96 to 110	30 to 36	229 to 235	18 to 22	233 to 240	1.752	20.0	60.0	27	97.7
3	19.11.12	Pusa Basmati	Dry	95 to 102	28 to 30	228 to 233	18 to 20	205 to 212	1.969	15.2	55.0	29	97.6
4	20.11.12	Pusa Basmati	Dry	92 to 100	28 to 30	288 to 302	18 to 22	235 to 263	2.226	13.4	55.7	25	97.6
5	21.11.12	Pusa Basmati	Wet & Muddy	75 to 85	28 to 32	228 to 232	18 to 20	285 to 305	1.490	15.5	45	29	97.6
6	22.11.12	Pusa Basmati	Wet & Muddy	80 to 95	28 to 32	260 to 269	20 to 23	287 to 300	1.403	18.2	50.5	29	97.6
7.	24.11.12	1121 Basmati	Dry	80 to 100	18 to 30	80 to 97	17 to 19	200 to 220.	2.279	20.8	N.R	27	97.6
8	25.11.12	1121 Basmati	Dry	85 to 95	20 to 28	81 to 97	18 to 22	223 to 260	2.513	15.2	N.R	25	97.6
9	26.11.12	1121 Basmati	Dry	80 to 90	18 to 28	85 to 95	19 to 23	195 to 230	2.034	23.7	60.6	29	97.6
10	28.11.12	Pusa Basmati	Dry	95 to 105	26 to 30	225 to 255	18 to 22	234 to 245	1.531	13.5	52.7	29	96.7

Annexure-III

FELD TEST DATA ANALYSIS (PADDY HARVESTING)

Test No.	Date of test	Duration of test (hr.)	Speed of operation (kmph)	Width of cut (m)	Rate of work		Through put		Fuel consumption		Pre-harvest loss (kg/ha)	Crop straw/Grain ratio (SKH/GKH)	Crop through put (t/h)	Grain breakage in main outlet (%) (a)
					Area covered (ha/hr.)	Grain output (Kg/h.)	Clean Grain (kg/h) GKH	Straw (kg/h) SKH	(l/h)	(l/ha)				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	01.11.12	3.00	2.161	1.913	0.286	1963.702	1979.240	3428.430	7.600	26.573	53.66	1.732	5.407	0.586
2	02.11.12	4.50	2.016	1.933	0.186	1486.450	1506.230	2639.215	9.000	48.517	30.66	1.752	4.145	0.943
3	19.11.12	6.00	2.123	1.956	0.508	1632.250	1647.760	3245.630	8.520	16.785	36.60	1.969	4.893	0.479
4	20.11.12	6.41	2.175	1.917	0.331	1438.618	1453.025	3234.970	8.410	25.407	51.80	2.226	4.687	0.366
5	21.11.12	7.99	2.527	1.950	0.322	1867.349	1881.303	2803.918	9.065	28.152	35.00	1.490	4.685	0.043
6	22.11.12	6.34	2.225	1.970	0.329	2260.766	2274.28	3189.926	10.000	30.331	36.80	1.403	5.464	0.903
7	24.11.12	5.50	2.523	1.956	0.271	1638.90	1644.78	3659.51	7.000	25.830	50.33	2.279	5.307	0.547
8	25.11.12	7.66	2.546	1.970	0.427	1504.130	1516.750	3811.067	8.101	18.994	21.73	2.513	5.327	0.675
9	26.11.12	3.50	2.448	1.933	0.435	1804.220	1816.800	3695.895	7.714	17.733	14.16	2.034	5.512	0.401
10	28.11.12	6.00	2.635	1.907	0.273	2590.980	2605.610	3988.870	8.500	31.14	31.30	1.531	6.594	0.459
Avg														0.540

Annexure-IV

FIELD TEST DATA ANALYSIS (PADDY HARVESTING)

Test No.	Total collectable losses Unthreshed from main outlet (%) (A)	Loss due to combine, percent by mass							Total losses A+B	Threshing efficiency (%)	Cleaning efficiency (%)
		Non collectable losses (%)(c)									
		Straw outlet (Rake)				Sieve(Shoe)					
		Threshed (1)	Unthreshed (2)	Broken (3)	Total (a) (1+2+3)	Threshed	Unthreshed (2)	Broken	Total (b) (1+2+3)	Header loss (c)	Total (B) (a+b+c)		
	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1	0.275	0.156	0.000	0.000	0.156	0.083	0.000	0.000	0.084	0.546	0.785	1.061	99.73	99.43
2	0.826	0.403	0.018	0.005	0.427	0.156	0.005	0.021	0.182	0.731	1.340	2.166	99.14	98.27
3	0.000	0.198	0.017	0.000	0.215	0.068	0.058	0.000	0.127	0.601	0.942	0.942	99.59	99.19
4	0.043	0.151	0.079	0.000	0.230	0.099	0.032	0.000	0.131	0.631	0.992	1.035	99.84	97.84
5	0.046	0.067	0.048	0.000	0.115	0.078	0.008	0.000	0.086	0.539	0.740	0.786	99.63	98.53
6	0.261	0.073	0.000	0.000	0.073	0.022	0.000	0.000	0.022	0.499	0.594	0.855	99.58	99.10
7	1.186	0.045	0.004	0.000	0.049	0.026	0.000	0.008	0.034	0.288	0.371	1.557	98.82	98.23
8	0.678	0.251	0.084	0.000	0.335	0.141	0.010	0.024	0.175	0.321	0.831	1.509	99.22	98.43
9	1.179	0.308	0.128	0.005	0.441	0.097	0.016	0.008	0.121	0.140	0.702	1.881	98.68	98.23
10	0.182	0.178	0.076	0.000	0.254	0.067	0.000	0.013	0.080	0.226	0.560	0.742	99.74	98.32
Avg.	0.468									0.452	0.786	1.103	99.39	98.56

Comb-58/1380/2013 | ACE , ACT 60
SELF PROPELLED COMBINE HARVESTER (TRACK TYPE) - Comm. (ICT)

Annexure-V

DETAILS OF GREASING & OILING POINTS

1)	Grease Nipples : to be greased after each working day	
S. No.	Location	No. of Grease Nipples
i)	Cutter bar drive	2
ii)	Reel drive shaft	3
iii)	Feeding unit drive shaft	2
iv)	Threshing drum bearing	2
v)	Tensioner pulley	4
vi)	Main drive pulley	1
vii)	Blower Bearing	2
viii)	Cutter bar drive shaft	3
	Total:	19
2)	Oiling Points	
i)	Reel	12
ii)	Undershot conveyor	2
iii)	Cutter bar blade joint & ball joint	2
	Total:	15

Annexure-VI

SYMBOLS AND ABBRIVIATION

SYMBOLS:

I. SYMBOLS ASSIGNED TO BASIC SI UNIT

S.N.	PHYSICAL QUANTITY	NAME OF SI UNIT	SYMBOL
1	Length	Meter	m
		Millimeter	mm
2	Mass	Kilogram	kg
		Gram	g
		Tonne	t
3	Time	Second	s

II	SYMBOLS ASSIGNED TO SOME DERIVED UNIT		
S.N.	PHYSICAL QUANTITY	NAME OF SI UNIT	SYMBOL
1.	Area	Square centimeter	cm^2
		Square meter	m^2
		Hectare	ha
2	Speed / velocity	Meter per second	m/s
		Kilometer per hour	kmph
3	Pressure	Newton per square millimeter	N/mm^2
4	Time	Minute	min
		Hour	h
5	Volume	Cubic centimeter	cm^3
		Milliliter	ml
		Litre	1

ABBREVIATIONS:

As per applicant	:	apa	Clause	:	Cl
Degree	:	deg	Figure	:	Fig
Indian standard	:	IS	Kilowatt	:	kW
Number	:	No.	Not available	:	N.A.
Not Recorded	:	N. R.	Percent	:	%
Reference	:	Ref.	Revolutions per minute	:	rpm