



**INTERNATIONAL TRACTORS LIMITED,
SONALIKA INTERNATIONAL DI-730 II FE TRACTOR**



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)

ट्रैक्टर नगर, बुदनी (म.प्र.) ४६६ ४४५ TRACTOR NAGAR, BUDNI (M.P.) 466445

Phone : 07564-234729 Fax : 07564-234743 E-mail : fmti-mp@nic.in Website: <http://cfmmtti.dacnet.nic.in>



T- 878/1392/2013

INTERNATIONAL TRACTORS LIMITED,
SONALIKA INTERNATIONAL DI-730 II FE TRACTOR
Commercial (Initial)

Manufacturer : M/s. International Tractors Limited.
Vill. Chack Gujran, P.O. Piplanwalan,
Jalandhar Road,
HOSHIARPUR (Punjab) – 146 022

Test requested by (applicant) : The Manufacturer
Selected for test by : The Applicant
Place of running-in : At manufacturer's works

Duration of said running-in (h):
- Engine : 35
- Transmission : 35

Method of Selection : The tractor was submitted directly by the applicant for test. Hence, method of selection is not known.

1. SPECIFICATIONS

1.1 **Tractor:**
Make : International Tractors Limited
Model : Sonalika International DI-730 II FE
Variant, if any : No variant models declared by the manufacture
Type : Four wheeled, Rear wheel driven, standard Agricultural Tractor.
Year of manufacture : 2012
Chassis number : AZNSD 282488/3S
Country of Origin : India

1.2 **Engine:**
Make : International Tractors Ltd.
Model : 2105 DL
Type : Four stroke, naturally aspirated, water cooled, direct injection, diesel engine.
Serial number : 2105 DL 23 C 283338 F 6
Engine speed (Manufacturer's recommended production setting)(rpm):
- Maximum speed at no load : 2200 to 2400
- Low idle speed : 600 to 700
- Speed at maximum torque : 1200 to 1400
Rated speed, (rpm):
- For PTO use : 2100
- For drawbar use : 2100

1.3 **Cylinder & Cylinder Head:**
Number : Two
Disposition : Vertical, in-line
Bore/stroke, (mm) : 105 / 118
Capacity as specified by the applicant, (cc) : 2044



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Compression ratio, (apa) : 18.5 (± 0.2) :1
Type of cylinder head : Individual, inline
Type of cylinder liners : Wet, replaceable
Type of combustion chamber : Direct combustion, Re-entrant
Arrangement of valves : Overhead, Inline
Valve clearance (cold/hot):
- Inlet valve, (mm) : 0.30
- Exhaust valve, (mm) : 0.40

1.4 **Fuel System:**
Type of fuel feed system : Gravity & force feed

1.4.1 **Fuel tank:**
Capacity, (l) : 55.00
Location : Above the clutch housing
Provision for draining of sediments/ water : Provided
Material of fuel tank : Metallic

1.4.2 **Water separator :** Not Provided

1.4.3 **Fuel feed pump:**
Make : Bosch, India
Type : Plunger
Model/Group combination No. : FP/KSG 22AD 55/2, 9 440 030 032
Provision of sediment bowl : Provided (Metallic)
Method of drive : Through cam shaft of fuel injection pump.

1.4.4 **Fuel filters:**
Make : Bosch, India
Model/Group combination No. : 9450030120
Number : Two
Type of elements:
- Primary : Cloth
- Secondary : Paper
Capacity of final stage filter, (l) : 0.500

1.4.5 **Fuel Injection pump:**
Make : Bosch, India
Model/Group combination No. : F002 AOZ 688, PES2A90D320RS3500
Type : Inline, Plunger
Serial number : 20146734
Method of drive : Through timing gears

1.4.6 **Fuel injectors:**
Make : Bosch, India
Model/Group combination No. : F 002 C70 552 201
Type : Multiholes (Five holes)
Manufacturer's production pressure setting, (MPa) : 25.0 + 0.8
Injection timing : 13 ± 1 degree before TDC
Firing order : 1 – 2



17. SUMMARY OF OBSERVATIONS, COMMENTS & RECOMMENDATIONS

17.1 Evaluative (mandatory) / Non-evaluation (Non-mandatory) parameter applicable for qualifying Minimum Performance criteria as per Clause-4 (Table-1) of IS: 12207-2008 for acceptance of the tractor for the purpose of subsidies/NABARD financing are summarized as under:

S. No.	Characteristic	Category (Evaluative / Non Evaluative)	Requirements as per IS: 12207-2008	Values declared by the applicant (D)/ Requirement (R)	As observed	Whether meets the requirements (Yes/No.)
1	2	3	4	5	6	7
17.1.1 PTO Performance :						
a)	Maximum power under 2 h test, (kW) (Natural ambient condition)	Evaluative	Declared value to be achieved with a tolerance of: -5 / +10% for PTO power >35hp. - 7.5/+10% for PTO power ≤ 35 hp	17.5 (D)	17.9	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	17.5 (D)	17.9	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	+ 5%	285 (D)	264	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	113 (D)	104.4	Yes
e)	Back-up torque, percent	Non Evaluative	7 percent, min.	7 percent, min. (R)	28.6	Yes
f) Maximum operating temperature, (°C)						
1) Engine oil						
		Non Evaluative	The declared value should not exceed the max. value specified by the oil company and the observed value under high ambient condition should not exceed the declaration.	132 (D)	103	Yes
2) Coolant (water)						
		Evaluative	The declared value should not exceed the boiling temperature of coolant under the pressurized or otherwise and the observed value under high ambient condition should not exceed the declaration.	118 (D)	100	Yes
g)	Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.64 (R)	0.45	Yes
h)	Smoke level	Evaluative	Maximum light absorption coefficient of 3.25 per metre or equivalent BOSCH No. 5.2 or 75 Hatridge value (As per CMVR)	3.25 per metre (R)	0.21 per metre	Yes



1	2	3	4	5	6	7
17.1.2 Drawbar performance :						
a)	Max. drawbar pull with ballast corresponding to 15 percent wheel slip, (kN)	Non Evaluative	Minimum 65% of static mass with ballast	14.85 (D) 14.28 (R) Minimum	14.72	Yes
b)	Max. drawbar pull without ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor without ballast	12.04 (D) 11.47 (R) Minimum	11.18	Yes
c)	Maximum drawbar power without ballast, (kW).	Evaluative	Min. 80% of PTO power as referred in 16.1.1 (a) of PTO performance	14.0 (D) 14.3 (R) Minimum	15.4	Yes
d)	Max. transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	130 (D)	80	Yes
17.1.3 Power lift and hydraulic pump performance :						
a) Maximum lifting capacity throughout the range of lift, (kN):						
1) At hitch points						
		Non Evaluative	[Tolerance of minus 10%] The lift capacity should at least be 18 kg/PTO hp. And it should be 16 kg/engine hp where the tractor is not provided with a PTO shaft	11.88 (D) 7.5 (D)	13.52	Yes
2) With the standard frame						
		Evaluative		4.3 (R) Minimum	11.87	Yes
b)	Maximum drop in the height of the point of application of the force after each 5 minutes interval for a total duration of 30 Minutes, (mm)	Non Evaluative	[Tolerance of plus 5 mm]	50 (D)	25	Yes
17.1.4 Brake performance at 25 kmph:						
a) Maximum stopping distance at a force, equal to or less than 600 N on brake pedal with road ballast, (m):						
1) Cold brake						
		Evaluative	10	10 (R)	8.21 to 8.71	Yes
2) Hot brake						
		Evaluative	10	10 (R)	8.34	Yes
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s ² (N)	Evaluative	600	600 (R)	282 to 302	Yes
c)	Whether parking brake is effective at a force of 600 N at foot pedal(s) or 400 N at hand lever	Evaluative	Yes / No	Yes (R)	Yes	Yes



1	2	3	4	5	6	7
17.1.5	Noise measurement :					
a)	Maximum ambient noise emitted by the tractor dB(A)	Evaluative	As per CMVR	88 (R)	84	Yes
b)	Maximum noise at operator's ear level dB(A)	Evaluative	As per CMVR	98 (R)	93	Yes
17.1.6	Amplitude of mechanical vibrations at :					
1)	Left foot rest	Non Evaluative	100 (max) microns	100 (R)	90	Yes
2)	Right foot rest			100 (R)	180	No
3)	Seat (with driver seated)			100 (R)	130	No
4)	Steering wheel			100 (R)	250	No
17.1.7	Haulage requirements :					
a)	Gross mass of the trailers, (tonnes):					
1)	Two wheel	Non	--	3.5 (D)	3.5	Yes
2)	Four wheel	Evaluative	--	4.5 (D)	4.5	Yes
b)	Distance travelled / litre of fuel consumption, (km/l):					
1)	Two wheel	Non	--	5 to 6 (D)	7.78 to 7.98	Yes
2)	Four wheel	Evaluative	--	5 to 6 (D)	6.82 to 6.89	Yes
c)	Fuel consumption (ml/km/tonne):					
1)	Two wheel	Non	--	38 to 45 (D)	35.8 to 36.7	Yes
2)	Four wheel	Evaluative	--	38 to 45 (D)	32.2 to 32.6	Yes
17.1.8	Wetland cultivation :					
	Sealing for the following assemblies:	Evaluative	The identified assemblies should essentially meet the requirement of IS: 11082. No water ingress in the identified assembly given in column-2. If tractor does not meet the requirements of wetland cultivation, it may be recommended for dry land operation only.	There should be no ingress of water and/or mud (R)	Ingress of mud and / or water was observed in Front axle hub(RHS), King pin(RHS) and Starter motor	No
1)	Clutch assembly	-do-				
2)	Brake housings	-do-				
3)	Front axle hubs	-do-				
					No ingress of mud and / or water was observed after supplementary test	Yes
17.1.9	Safety features :					
a)	Guards against moving and hot parts	Evaluative	As per CMVR	At present no requirements	Not provided for hydraulic pipe	No
b)	Lighting arrangement	Evaluative	As per CMVR	--	Provided	Yes



1	2	3	4	5	6	7
17.1.10	Labelling of tractors (Provision of labelling plate):					
1)	Make	Evaluative	Should conform to the requirements of CMVR along-with declared value of PTO HP	--	International Tractors Ltd.	Yes
2)	Model	Evaluative		--	Sonalika International DI-730 II FE	Yes
3)	Year of manufacture	Evaluative		--	2012	Yes
4)	Engine number	Evaluative		--	2105DL23C283338 F6	Yes
5)	Chassis number	Evaluative		--	AZNSD282488/3S	Yes
6)	Declaration of PTO power, (kW)	Evaluative		--	17.5	Yes
17.1.11	Discard limit for:					
a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	105.07	105.06	Yes
b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative		0.35	0.158 to 0.159	Yes
c)	Ring end gap (mm):					
	- Top comp. ring.	Evaluative		-do-	2.00	0.45 to 0.85
	- 2 nd comp. ring.			-do-	2.00	0.45 to 0.85
	- Oil ring.			-do-	2.00	0.50 to 0.85
d)	Ring groove clearance (mm):					
	- Top comp. ring.	Evaluative		-do-	0.15	Taper rings
	- 2 nd comp. ring.			-do-	0.15	0.086 to 0.091
	- Oil ring.			-do-	0.13	0.044 to 0.052
e)	Clearance of main bearings (mm):					
	- Diametrical clearance	Evaluative		-do-	0.20	0.089 to 0.121
	- Crankshaft end float	Evaluative		-do-	0.60	0.25
f)	Clearance of big end bearings, (mm):					
	- Diametrical	Evaluative		-do-	0.2	0.081 to 0.125
	- Axial	Evaluative		-do-	1.00	0.30
g)	Clearance between king pin and bush, (mm)	Non Evaluative		-do-	1.00	0.094 to 0.20
h)	Clearance between centre pin and bush, (mm)	Non Evaluative		-do-	1.00	0.126 to 0.173



1	2	3	4	6	7
17.1.12 CATEGORY OF BREAKDOWNS / DEFECTS :					
S. No.	Category of breakdowns	Category (Evaluative / Non Evaluative)	Requirements as per IS: 12207-2008	As observed	Whether meets the requirements (Yes/No.)
1.	Critical	Evaluative	No critical breakdown	None	Yes
2.	Major	Evaluative	Not more than two and neither of them should be repetitive in nature	None	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, (2 major + 3 minor) or 5 minor breakdowns.	None	Yes

17.2 Optional requirements as per Clause-4 (Table-2) of IS:12207-2008:				
S. No.	Characteristic	Requirements as per IS: 12207-2008	As observed	Whether meets the requirements (Yes/No.)
1	2	3	4	5
1	Air cleaner oil pull over, max. Oil pull over (%)	0.25% (max.)	0.22	Yes
2.	Seating requirements	Should meet the requirements of IS: 12343-1998	Does not meet the requirement	No
3.	Fitment of ROPS	With a provision for fitment of ROPS.	Not provided	No
		If ROPS fitted it should meet the requirement of IS: 11821-1992	ROPS not fitted	Not applicable
4.	Technical requirements for PTO shaft	Should meet the requirements of IS: 4931 -1995	Meets the requirement	Yes
5.	Dimensions of three point linkage	Should meet the requirements of IS: 4468 (Part-I)-1997	Does not meet the requirement	No
6.	Specifications of linkage drawbar	Should meet the requirements of IS: 12953-1990.	Meets the requirement	Yes
	Specification of swinging drawbar	Should meet the requirements of IS: 12362 Part 3-1994.	Not provided	Not applicable
7.	Accessories	Trailer hitch, front tow hook, linkage drawbar may be provided.	Provided	Yes



- 17.3 Conformity with following IS:**
- i) Guidelines for declaration of power and specific fuel consumption and labelling of agricultural tractors (First revision) [IS 10273:1987 (Reaffirmed in March, 2009)] : Conforms
 - ii) Agricultural tractors – Rear mounted power take-off - Types 1, 2 and 3(third revision)[IS: 4931-1995 (Reaffirmed in March, 2009)] : Conforms
 - iii) Agricultural wheeled tractors - Rear mounted three-point linkage: Part 1 Categories 1, 2, 3 & 4 (fourth revision) [IS 4468(Part-I):1997 (Reaffirmed in March, 2007) / ISO 730-1:1994] : Does not conform
 - iv) Drawbar for agricultural tractors – Link type [IS 12953:1990 (Reaffirmed in March, 2009)] : Conforms
 - v) Agricultural tractors - Operator's seat technical requirement [IS 12343 -1998 (First revision) (Reaffirmed in March, 2009)] : Does not conform
 - vi) Guide for safety & comfort of operator of agricultural tractors: Part 1 General requirements (first revision) : [IS 12239 (PT-1) 1996 (Reaffirmed in March, 2007) /ISO 4254-1:1989] : Does not Conform
 - vii) Tractors and machinery for agriculture and forestry – Technical means for ensuring safety Part 2: Tractors (first revision) (IS: 12239 (Part-2) 1999) (Reaffirmed in March, 2009)] : Does not conform
 - viii) Tractors and machinery for agriculture and forestry, powered lawn and garden equipment - Symbols for operator controls and other displays [IS: 6283 (Part-1) – 2006 (Reaffirmed in March, 2009) and IS: 6283 (Part-2)-2007 (Reaffirmed in March, 2009)] : Conforms
 - ix) Guidelines for location and operation of operator controls on agricultural tractors and machinery (first revision) IS: 8133-1983 (Reaffirmed in March, 2009)] : Does not conform
 - x) Agricultural Tractors and Machinery - Lighting device for travel on public roads (IS: 14683-1999) (Reaffirmed in March, 2009)] : Conforms

17.4 Salient Observations:

17.4.1 Laboratory tests:

- 17.4.1.1 PTO Performance:**
- i) The backup torque is 28.6%.
 - ii) The specific fuel consumption corresponding to maximum power was measured as 285 g/kWh against the declaration of 264 g/kWh, which meets the requirement of IS: 12207-2008 with regard to tolerance.
- 17.4.1.2 Hydraulic Performance Test:**
 The maximum tilt angle of mast fram vertical was observed as 5.4 degree against the minimum requirement of 10 degree as per IS 12224-2006. This should be looked into.
- 17.4.1.3 Mechanical Vibration:**
 The amplitude of mechanical vibration on various assemblies marked as (*) in Chapter-9 of this test report are on higher side, especially at steering control wheel & foot rests. This calls for dampening down of vibrations to improve the operational comfort and service life of components.



17.4.1.4 Three point linkage:

- i) The lateral distance from lower hitch point to centre line of tractor does not meet the requirement of IS: 4468 (Part-1)-1997. This should be looked into for necessary corrective action.
- ii) Some of the parameters of the three point linkage conform to Cat. I and some of them conform to Cat.II. Keeping in view of the spirit of standardization, the necessary improvements may be incorporated.

17.4.1.5 Linkage drawbar:

Some of the parameters of linkage drawbar conform to Cat.I and some of them conform to Cat.II. In view of the spirit of standardization, necessary improvements may be incorporated.

17.4.1.6 Operator's Seat:

Length of seat does not meet the requirement of IS: 12343-1998. This should be looked into for necessary corrective action.

17.4.2 Field performance test:

17.4.2.1 Wetland cultivation (puddling operation):

- i) Initially, ingress of mud and water was observed in king pin assembly (RHS), front axle hub(RHS) and starter motor and stub axles. Accordingly, the tractor was not found suitable for wetland cultivation (Puddling operation).
- ii) Thereafter, the firm had replaced the front axle assembly with new one under the provision of supplementary test
- iii) The supplementary wetland cultivation (Puddling operation) test was conducted and no ingress of water and/or mud was observed in various assemblies / operation) and meets the requirements of IS: 11082-1984.(Technical requirements of agricultural tractors for wetland operations). **It is therefore, recommended that, the improved quality front axle should only be used in regular production of the tractor.**

17.5 Maintenance / Service Problems:

No noticeable maintenance or service problem was observed during the test.

17.6 Recommendation with regard to safety on tractor:

- The following requirements, inter alia, may be considered for incorporation on the tractor:
- i) Provision of safety against accidental start of the engine.
 - ii) Provision for spark arresting device in exhaust system.
 - iii) Provision for retaining the fuel shut-off lever in "STOP" position.
 - iv) The working clearance between the draft control lever and mudguard may be provided as per IS: 12239 (Part-2) – 1999.
 - v) Provision of PTO shaft master shield.
 - vi) Provision of adequate guards for hydraulic pipe line, alternator and its drive belt.



17.7 Adequacy of Literature supplied with machine:

17.7.1 No literature was supplied during the course of testing for reference. It is recommended that the following literature should be developed for the guidance of user

- i) Operator's manual
- ii) Service manual
- iii) Spare part's catalogue

17.7.2 Details of all variant models and their features at a glance should be included in the operator's manual of the tractor.

18.0 Citizen charter

Duration of Test	Test duration under citizen charter	Whether the report released within time frame given in the citizen charter	Remark
May 2012 to April 2013 12 Months	14 Months (10 + 4 Months for supplementary Test)	Yes	--

TESTING AUTHORITY:

R.K. Nema
R.K.NEMA
 AGRICULTURAL ENGINEER

P.K. Verma
P.K.VERMA
 SENIOR AGRICULTURAL ENGINEER

C.R. Lohi
C.R.LOHI
 DIRECTOR