



ESCORTS LIMITED, POWERTRAC 439 DS PLUS 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)

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T-887/1402/2013

ESCORTS LIMITED, POWERTRAC 439 DS PLUS TRACTOR- Commercial (Initial)

Manufacturer : M/s. Escorts Limited,
Plot No 2 & 3,
Sector-13,
Faridabad – 121 007 (Haryana)

Test requested by (applicant) : M/s. Escorts R&D Center,
15/5, Mathura Road,
Faridabad (Haryana) – 121 003

Place of running-in : At Applicant's works

Duration of said running-in, (h):
- Engine : 20
- Transmission : 30

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 : Escorts Limited
Model : Powertrac 439 DS plus
Variants, if any : None
Type : Four wheeled, rear-wheel driven, unit construction, Standard Agricultural Tractor
Year of manufacture : 2013
Chassis number : B 3183968
Tractor Serial No. : T 3184364
Country of origin : India

1.2 Engine:
Make : Escorts Ltd. (apa)
Model : E 3.234-3A
Type : Four stroke, water cooled, naturally aspirated, direct injection, diesel engine.
Serial number : E 3200007

1.2.1 Engine speed (Manufacturer's recommended production setting), (rpm):
- Maximum speed at no load : 2475 to 2525
- Low idle speed : 600 to 700
- Speed at maximum torque : 1000 to 1200

Rated speed, (rpm):
- For PTO use : 2200
- For drawbar use : 2200



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1.3 Cylinder & Cylinder Head:
Number : Three
Disposition : Vertical, Inline
Bore/stroke, (mm) : 95/110
Capacity as specified by the applicant, (cc) : 2339
Compression ratio : 17.5 ± 5% : 1
Type of cylinder head : Monoblock
Type of cylinder liners : Wet, replaceable
Type of combustion chamber : Direct injection, open chamber in piston crown.
Arrangement of valves : Overhead, inline

Valve clearance (cold):
- Inlet valve, (mm) : 0.3
- Exhaust valve, (mm) : 0.4

1.4 Fuel System:
Type of fuel feed system : Gravity and force feed

1.4.1 Fuel tank:
Capacity, (l) : 47.4
Location : Above Flywheel housing
Provision for draining of sediments/ water : Not provided, however water separator is provided between fuel tank and feed pump.
Material of fuel tank : Metallic

1.4.2 Water Separator:
Make : Hilux
Type : Inverted funnel gravity separation with swirling motion
Location : In between fuel tank & fuel feed pump
Capacity (l) : 0.50

1.4.3 Fuel feed pump:
Make : Bosch, India
Type : Plunger with hand primer
Model/Group combination No. : FP/KS22AD62, 9 440 030 029
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. : 9 450 030 120
Number : Two
Type of elements:
- Primary : Cloth
- Secondary : Paper
Capacity of final stage filter, (l) : 0.50



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:

Sl. 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	27.8 (D)	29.0	Yes
b)	Power at rated engine speed, (kW)	Non Evaluative	-do-	27.8 (D)	29.0	Yes
c)	Specific fuel consumption corresponding to maximum power, (g/kWh)	Non Evaluative	± 5%	234 (D)	237	Yes
d)	Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	± 8%	146 (D)	147.13	Yes
e)	Back-up torque, percent	Non Evaluative	7 percent, min.	7 % (D)/ 7 % (R)	16.9	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.	125 (D)	112	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.	110 (D)	92	Yes
g)	3) Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at max. power under High ambient conditions	2.39 (R)	0.417	Yes
h)	4) 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)	0.16	Yes



1	2	3	4	5	6	7
17.1.2 Drawbar performance :						
a)	Maximum drawbar pull with ballast corresponding to 15 percent wheel slip, (kN)	Non Evaluative	Minimum 65% of static mass with ballast	14.34 (R) 13.8 (D)	18.21	Yes
b)	Maximum drawbar pull without ballast corresponding to 15 percent wheel slip, (kN)	Evaluative	Minimum 65% of static mass of tractor without ballast	12.02 (R) 11.4 (D)	16.73	Yes
c)	Maximum drawbar power without ballast, (kW).	Evaluative	Min. 80% of PTO power as referred in 16.1.1 (a) of PTO performance	23.2 (R) 22.24 (D)	26.3	Yes
d)	Maximum transmission oil temperature (°C)	Non Evaluative	The declared value should not exceed the maximum value specified by oil company	125 (D)	77	Yes
17.1.3 Power lift and hydraulic pump performance :						
a)	Maximum lifting capacity throughout the range of lift, (kN):		[Tolerance of minus 10%]			
	1) At hitch points	Non Evaluative		12.75 (D)	15.0	Yes
	2) With the standard frame	Evaluative	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	6.86 (R) (Minimum) 7.80 (D)	8.7	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 (R)	198	No
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)	6.87
	2) Hot brake	Evaluative		10	10 (R)	6.91
b)	Maximum force exerted on the brake pedal to achieve a deceleration of 2.5 m/s ² (N)	Evaluative	600	600 (R)	208 to 282	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
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)	95	Yes



1	2	3	4	5	6	7
17.1.6 Amplitude of mechanical vibrations at :						
	1) Left foot rest	Non Evaluative	100 microns (max)	100 (R)	280	No
	2) Right foot rest				170	No
	3) Seat (with 75 kg weight instead of operator)				140	No
	4) Steering Wheel				160	No
17.1.7 Haulage requirements :						
a)	Gross mass of the trailers, (tones):					
	1) Two wheel	Non Evaluative	--	5.0 (D)	5.0	Yes
	2) Four wheel	Non Evaluative	--	6.0 (D)	6.0	Yes
b)	Distance travelled / litre of fuel consumption, (km/l):					
	1) Two wheel	Non Evaluative	--	8.0 to 9.0 (D)	6.62	No
	2) Four wheel				5.47 to 5.51	No
c)	Fuel consumption (ml/km/tonne):					
	1) Two wheel	Non Evaluative	--	30 to 35 (D)	30.22	Yes
	2) Four wheel	Non Evaluative	--	30 to 35 (D)	30.22 to 30.47	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.			
	1) Clutch assembly	-do-		There should be no ingress of water and/or mud	No ingress of mud and / or water was observed	Yes
	2) Brake housings	-do-				
	3) Front axle hubs	-do-				
17.1.9 Safety features :						
a)	Guards against moving and hot parts	Evaluative	As per CMVR	At present no requirements	Provided	Yes
b)	Lighting arrangement	Evaluative	As per CMVR	--	Provided	Yes
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	--	Escorts Limited	Yes
	2) Model	Evaluative		--	Powertrac-439 DS plus	Yes
	3) Year of manufacture	Evaluative		--	13-A-04 (2013, January 4 th)	Yes
	4) Engine number	Evaluative		--	E 3200007	Yes
	5) Chassis number	Evaluative		--	B 3183968	Yes
	6) Declaration of PTO power, (kW)	Evaluative		--	27.8	Yes



1	2	3	4	5	6	7
17.1.11	Discard limit for:					
(a)	Cylinder bore diameter, (mm)	Evaluative	To be specified by the manufacturer	95.30 (D)	95.03	Yes
(b)	Clearance between piston & cylinder liner at skirt, (mm)	Non Evaluative		0.50 (D)	0.143 to 0.157	Yes
(c)	Ring end gap (mm):					
	- Top comp ring.	Evaluative	-do-	3.0	0.40 to 0.45	Yes
	- 2 nd comp ring.		-do-	3.0	0.90 to 0.95	Yes
	- Oil ring.		-do-	3.0	0.40 to 0.45	Yes
(d)	Ring groove clearance (mm):					
	- Top comp ring.	Evaluative	-do-	0.50	Taper ring	--
	- 2 nd comp ring.		-do-	0.50	0.057 to 0.059	Yes
	- Oil ring.		-do-	0.50	0.057 to 0.059	Yes
(e)	Clearance of main bearings (mm):					
	- Diametrical clearance	Evaluative	To be specified by the manufacturer	0.40	0.062 to 0.074	Yes
	- Crankshaft end float	Evaluative		0.75	0.30	Yes
(f)	Clearance of big end bearings, (mm):					
	- Diametrical	Evaluative	-do-	0.40	0.064 to 0.077	Yes
	- Axial	Evaluative	-do-	0.75	0.30	Yes
(g)	Clearance between king pin and bush, (mm)	Non Evaluative	-do-	0.50	0.178 to 0.2	Yes
(h)	Clearance between centre pin and bush, (mm)	Non Evaluative	-do-	0.50	0.082 to 0.117	Yes

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 meet 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	Maximum oil pull over, (%)	0.25% (max.)	0.21 %	Yes
2.	Seating requirements	Should meet the requirements of IS: 12343-1998	Does not meets the requirements	No
3.	Fitment of ROPS	With a provision for fitment of ROPS. If ROPS fitted it should meet the requirement of IS: 11821-1992	Not provided ROPS not fitted	No Not applicable
4.	Technical requirements for PTO shaft	Should meet the requirements of IS: 4931 -1995	Does not meets the requirements	No
5.	Dimensions of three point linkage	Should meet the requirements of IS: 4468 (Part-I)-1997	Does not meets the requirements	No
6.	Specifications of linkage drawbar	Should meet the requirements of IS: 12953-1990.	Does not meets the requirements	No
	Specification of swinging drawbar	Should meet the requirements of IS: 12362 Part 3-1994.	Not provided	--
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 labeling 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)] : Does not conform
 - 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, 2007)] : Does not conform
 - 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 February,2012)/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 (PT-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 & Part-2) -2006 & 2007(Reaffirmed in March, 2009)/ ISO 3767-2:1991]] : Does not conform
 - ix) Guide lines for location and operation of operator controls on agricultural tractors and machinery (first revision) (IS: 8133 - 1983) (Reaffirmed in March, 2009)]



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x) Agricultural Tractor & Machinery Lighting device for travel on : Conforms public roads (IS: 14683-1999) (Reaffirmed in March, 2009)]

17.4 Salient Observations:

17.4.1 Laboratory tests:

17.4.1.1 PTO Performance:

i) The backup torque is. **16.9 %**.

17.4.1.2 Drawbar Performance:

The tyre creeping during 10 hr test was found as 30 and 40mm on LHS & RHS tyre respectively. This is on higher side. This should be looked into.

17.4.1.3 Hydraulic performance :

- i) The lifting capacity at hitch points and on standard frame was recorded as 15.0 and 8.7 kN against the declared value of 12.75 and 7.80 kN which is 17.65 & 11.54 % higher side respectively. The lifting capacity of the tractor does not meet the requirement of IS: 12207 with regard to tolerance. This should be examined and lowering down the capacity as per standard meet for optimum moment about real axle to front axle for better stability, monoverbality in safety point of view.
- ii) During maintenance of lift of load test, the cumulative decrease in height of the point of application of the force after 30 min interval was observed as 198 mm ,which is higher and exceeded the maximum preferable requirement limit of 50 mm as per applicant's declaration. The internal leakage in the hydraulic system is assumed; this should be looked into for corrective action on production level and provided the improved strengthen quality of internal system, 'o' rings and other parts to user.

17.4.1.4 Noise Level:

Noise at By-standard and Operators ear level was measured as 84 and 95 dB(A) against the CMVR limit of 88 and 95 dB (A) which is considered as normal.

17.4.1.5 Mechanical Vibration:

The amplitude of mechanical vibration especially left and right foot rest, operator seat and steering control wheel and the various assemblies marked as (*) in Chapter-9 of this test report is on higher side. This calls for dampening down of vibrations to improve the operational comfort and service life of components.

17.4.1.6 Three point linkage:

- i) Upper diameter of hitch pin hole and lateral distance from lower hitch point to center line of tractor does not meet the requirements of **IS-4468-(Part I)-1997**. This should be looked into
- ii) Some of the parameters conform to Cat.I and some of them conform to Cat.II. Keeping in view the spirit of standardization necessary improvements may be incorporated to better suitable use for user end without fragnety.

17.4.1.7 Drawbar linkages:

The diameter of lower hitch point hole and width of ball of three point linkage is designed for cat II. However, the drawbar link provided during test (Ref. notation "A" of fig 1(b) of this report) is of cat I. The supplied linkage drawbar link does not conform to either cat.I or Cat II. Keeping in view the spirit of standardization, the suitable drawbar link as per three point linkage design should be provided to avoid conjugation during users end.



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17.4.1.8 Power take off shaft:

Master Shield of Power Take-Off Shaft [Refer Fig. 2(b)] is also not conforms to IS: 4931-1995.

The notations as BØ, AØ and W in accordance to reference of fig. 2 (a) of this report for PTO shaft does not meets the requirement of IS: 4931-1995, **Type-I**. To fit the PTO driven matching implement for this category, this needs to be looked into for corrective action for improvement at production level.

17.4.1.9 Operator's seat:

The length of seat and longitudinal distance from seat index point to the center of steering control wheel does not meets the requirement o IS: 12343-1998.In view o enhancing comfort level of operation, this may be improved essentially.

17.4.1.10 Labelling Plate:

- i) The year of manufacturer has been declared in coded form on tractor labelling plate. It should be declared in numeric form.
- ii) The make of engine, make & model of starter and generator is not available. It should be provided on production level either on the engine, starter and generator respectively or should be provided on separate labeling plate for each.

17.4.1.11 Symbols for operator controls and displays:

Engine speed- cum- cumulative run hour meter, fuel level meter and Water temperature gauge is not identifiable with symbols as per Para 5.1 of IS: 6283 (part 1 &2) -1998. This needs to be looked into for corrective action.

17.4.1.12 Location and movement of various controls:

Fuel shut-off knob does not remain in "STOP" position without application of sustainable manual effort. This is not meets the requirement of IS: 8133-1983 to avoid the operator's unexpectedly misadventure during stopping the tractor.

17.4.2

Field performance test:

17.4.2.2

Wet land cultivation (Puddling operation):

- i) No ingress of mud/or water was observed during wetland cultivation. Hence the tractor meets the requirements for wet land cultivation (Pudlling operation) as per IS: 11082-1984 and found suitable for wetland cultivation.
- ii) During puddling test half cage wheels with puddler recommended by the manufacture. However, rotavator implement is best suitable implement for puddling. Hence it is recommended that such implement should be recommended as per new age trend for saving of fuel and better satisfactory work in minimum time.

17.5

Haulage test

The distance travelled per liter of fuel consumption was observed as 6.62 and 5.47 to 5.51 km /lit for two wheels and four wheels trailer respectively against the specified value of 8 to 9 km/lit, which does not meet the declared value given by manufacturer. This should be looked into.

17.6

Maintenance / Service Problems:

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

17.7

Recommendation with regard to safety on tractor:

- The following requirements, inter alia, may be considered for incorporation on the tractor:
 - i) Provision for spark arresting device in exhaust system.
 - ii) The working clearance around draft control lever and position control lever should as per IS: 12239 (Part-2) – 1999.
 - iii) The minimum cautionary notice should be as per clause 11.2 of IS: 12239 (Part-2)-1999.



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- iv) Vertical retainers are not provided on both sides of clutch and brake pedals.
- v) Provision of protection (safety guard) should be provided to minimize the possibility of in advertent contact with hydraulic pipeline and exhaust manifold.

17.8 Adequacy of Literature supplied with machine:

17.8.1 The following literature was submitted for reference after the testing.

- i) Operator manual for Powertrac 434 DS Plus and Powertrac 439 DS Plus.
- ii) Spare parts catalogue for Powertrac 434 DS Plus and Powertrac 439 DS Plus.
- iii) Repair manual – A service guide for Powertrac 434 DS Plus and Powertrac 439 DS Plus

17.8.2 The literature submitted by the firm was found adequate. However, the following points may be re-examined & suitably incorporated in the operator's manual:

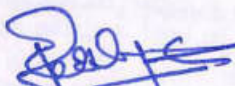
- a) All variants model of tractor along with their features at a glance may be provided.

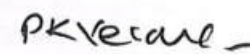
17.8.3 These literatures may also be brought out in national as well as other regional languages.

18. CITIZEN CHARTER

Time frame for Testing & Evaluation as per Citizen Charter	Duration of Test	Whether the Test Report is released within the time frame given in Citizen Charter	Remarks
10 Months	5 Months (February, 2013 to June, 2013)	Yes	None

TESTING AUTHORITY:


PRADIPKUMAR C. MESHARAM
 AGRICULTURAL ENGINEER


P. K. VERMA
 SENIOR AGRICULTURAL ENGINEER


C. R. LOHI
 DIRECTOR



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19. Applicant's Comments

Para No.	Our Reference	Applicant's comments
19.1	17.3 (ii) to (ix), 17.4.1.6, 17.4.1.7, 17.4.1.8, 17.4.1.9, 17.4.1.11, 17.4.1.12, 17.7	Your valuable comments & suggestions for improvements are well taken. Under our policy of continuous product improvement these aspects are further being looked into & will try to eliminate these deviations soon wherever necessary.
19.2	17.4.1.2, 17.4.1.3	These being studied & corrective action would be taken in near future.
19.3	17.4.2.2 (ii)	We sincerely appreciate suggestion provided by the institute & the same will be followed by us in all future products being submitted at the Institute.
19.4	17.4.1.4, 17.4.1.5	We would be looking into possibility to reduce noise & vibration levels further. However we will only follow IS & CMVR requirements wherever applicable as per IS 2007.

ANNEXURE – I

TRACTOR RUN HOURS DURING TEST

LABORATORY AND TRACK TESTS:		HOURS
A.		--
1.	Running-in	11.38
2.	PTO performance test	0.67
3.	Power lift and hydraulic pump performance test	17.69
4.	Drawbar performance test	0.50
5.	Turning ability	--
6.	Location of centre of gravity	--
7.	Operator's field of vision	2.02
8.	Brake test	1.75
9.	Noise measurement	2.50
10.	Air Cleaner oil pullover test	1.0
11.	Mechanical vibration test	0.67
12.	Nominal speed test	
B.	FIELD TEST:	9.91
1.	Mould Board ploughing	10.16
2.	Rotavation	15.3
3.	Wet land (puddling) operation (including water proof test)	9.93
C.	HAULAGE TEST:	9.87
D.	Miscellaneous test and other run hours including idle run, transportation, trials and preparation for test	
TOTAL:		93.35