ISTITUTO SPERIMENTALE PER
LA MECCANIZZAZIONE AGRICOLA
SEZIONE DI TREVIGLIO

Restricted Code
O.E.C.D. n. 1113

Test in accordance with O.E.C.D. Restricted Standard Code for the official testing of agricultural tractors

Report on test of: S + L + H Hurlimann 358 DT "4WD"



Submitted for test by: S + L + H S.p.A.
V.le Cassani 15
24047 TREVIGLIO (BG)

Date of approval O.E.C.D.: 24.12.1987

Period of test: OCTOBER 1987

I.S.M.A. - TREVIGLIO
Via Milano, 43

TEST n.039

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TABLE OF CONTENTS

- Specification of tractor ..... pag. 3
- Power take-off performance ..... " 18
- Power lift and hydraulic power test ..... " 22
- Drawbar performance ..... " 23

All stated dimension and tests referred to tyre size 12.4/24 (6plr) at front and 16.9/30 (6plr) at rear, as well as to track whiths 1600 mm at front and 1600 mm at rear.

- Tractor manufacturer's: S + L + H S.p.A. TREVIGLIO (BG)
- Submitted for test by: the manufacturer
- Selected by: the manufacturer with the agreement of ISMA
- Place of running in: TREVIGLIO
- Duration of running in: 50 hours

I - SPECIFICATIONS OF TRACTOR

TRACTOR

- Make: S + L + H;
- Model : Hurlimann 358 DT "4WD";
- Type: Wheeled tractor, unit constr.,all wheel drive tractor;
- Serial no.: 10126;
- First serial no.:10001;

ENGINE

- Make: S + L + H;
- Model: H 1000.3 W;
- Type : Watercooled 4 stroke Diesel engine direct injection;
- Serial n.: 1144;

Cylinders

- Number/disposition: 3 vertical in line;
- Bore/stroke: 105/115.5 mm;
- Capacity: 3000 cc;
- Compression ratio: 17.1/1;
- Arrangement of valves: Overhead;
- Cylinder liners: wet liners;

Supercharging: none.

Fuel system

- Fuel feed system: AC corone fuel feed pump;
- Make, type and model of fuel filter: FIAMM FNA 166/00;
- Capacity of fuel tank: 70 l;
- Make, type and model of injection pump: BOSCH PFR 1K 90 A 503, immersed pump one for cylinder,whitout serial number,in line injection pump.

- Manufacturer's production setting of injection pump:
  . flow rate 56.2 ±3 mm3/stroke at rated speed and full load;
  . timing 18 ± 0.5 before TDC;
- Make, type and model of injectors: BOSCH DLLA 150 S 925 multihole injection nozzles;
- Injection pressure: 180 ± 10 bar;

Governor

- Make: S + L + H;
- Type: mechanical variable speed;
- Model: 088.1652.4;
- Governor range of engine speed from 675 to 2690 rev/min;
- Rated engine speed : 2500 rev/min;

Air Cleaner

- Main filter
  . Make: DONALDSON;
  . Type: Dry paper element filter;
  . Model: FKG 06-5296
  . Location : front of engine;
- Maintenance indicator : with the warning lamp on the dashboard;

Lubrication system

- Type : forced feed from gear pump;
- Total oil capacity including filter: 9.2 l;
- Oil change period : 125 hrs;
- Type of filter : FIAMM FT 4803 IN;
- Number: 1;
- Filter change period: 300 hrs;
- Oil specifications (see pag.17)

Cooling system

- Type and detail: water cooling with impeller pump over pressure valve set to 0.4 bar;
- No. of fan blade : 4;
- Diameter : 400 mm;
- Coolant capacity: 11 l;
- Type oil temperature control: electrical indicator.

Starting system

- Safety device: Preventing engine start in gear;
- Make: BOSCH;
- Model: JF 12 V;
- Type: electromagnetic engagement;
- Power: 3 kW for start motor rating;
- Starting system for low temperatures: thermostarter(opt.);

Electrical equipement

- Voltage: 12 V;
- Generator
  . Make: BOSCH;
  . Type: alternator Kl 14V 55 A 20;
  . Power: 770 W;
- Battery : 1 lead acid;
  . Capacity: 110 Ah at 20 hours rating;

Exhaust system

- Make: S + L + H;
- Type: 4 chambers reflection absorption;
- Model: 255.5630.3;
- Location: on the left hand side of engine cowling, vertical position;
- Height of outlet above ground: 2570 mm.

TRANSMISSION

Clutch: utilized only for travelling of tractor
- Make: S + L + H;
- Type : single disc dry clutch;
- Model: 271.31;
- Disc diameter: 280 mm;
- Control system: hydraulically operated by pedal self readjusting;

Gear box

- Make: S + L + H;
- Type: mechanical syncromesh speed change gear with 5 speeds forward, with 3 ranges speed, and 1 reverse group;
- Model: 271.23;
- No. speeds: 15 forward and 15 reverse;
- Available options: 24 forward and 12 reverse or 12 forward and 12 reverse or 20 forward and 20 reverse.

Rear axle and final drives

- Make: S + L + H;
- Type: bevel gear differential and epicyclic final drive;
- Model: 271.44;
- Differential lock: yes;
- Model: S + L + H;
- Type: mechanical;
- Control system: engaged or disengaged with pedal;

Front axle and final drive

- Make: S + L + H;
- Type: 271.43;
- Model: original S + L + H system with central shaft bevel gear drive, differential and epicyclic final drive;
- Differential lock: yes;
  - Model: S + L + H;
  - Type: mechanical;
  - Method of engagement: with pedal;
  - Metod of disengagement: with pedal;

Transmission lubrication

- Oil capacity
  - Gear box, rear axle, final drive,power lift and hydraulic system: in common, total capacity filter including 45 l;
  - Change period: 1200 hrs;
  - Filter change period: when the filter clogging warning lamp is lighted;
  - Front axle and final drive: total capacity 6 l;
  - Changing: 1200 hrs;
- Recommended oil: see pag.17

S + L + H Hurlimann 358 DT "4WD" TEST N.039

Total ratios and speeds

Group		Number of engine revolutions for one revolution of the driving wheels	Nominal traveling speed at a rated engine speed of 2500 rev/min
FORWARD			
SLOW	1S	732.70	0.89
	2S	494.60	1.32
	3S	371.70	1.76
	4S	281.80	2.32
	5S	212.30	3.08
NORMAL	1N	230.10	2.84
	2N	155.30	4.21
	3N	116.70	5.61
	4N	88.50	7.40
	5N	66.70	9.82
FAST	1F	76.00	8.62
	2F	51.30	12.77
	3F	38.60	16.99
	4F	29.20	22.41
	5F	22.00	29.75

ISTITUTO SPERIMENTALE PER
LA MECCANIZZAZIONE AGRICOLA
SEZIONE DI TREVIGLIO

Group		Number of engine revolutions for one revolution of the driving wheels	Nominal travelling speed at rated engine speed of 2500 rev/min
REVERSE			
	1S	703.60	0.93
	2S	474.90	1.37
SLOW	3S	357.00	1.83
	4S	270.60	2.42
	5S	203.90	3.21
	1N	220.90	2.96
	2N	149.10	4.39
NORMAL	3N	112.10	5.84
	4N	85.00	7.70
	5N	64.00	10.23
	1F	73.00	8.97
	2F	49.30	13.29
FAST	3F	37.00	17.69
	4F	28.10	23.34
	5F	21.10	30.98

- Tyre size 16.9/30 inflation pressure: 1.3 bar
- Tyre radius index: 695 mm (E.T.R.T.O. norm)

POWER TAKE-OFF

Main power take-off

- Type: independent at rear of tractor, in tractor's median plane, engaged or disengaged through hand lever. Driven by multiplate wet clutch independent of travel clutch; ISO standard 500-1979;

Power take-off proportional to engine speed

540 rev/min

It is possible,through 6 screws, to mount: one take-off shaft end at 6 or at 21 splines. Changing speeds through external hand lever;
- Location:at rear of tractor;
- Diameter of power take-off shaft end: 34.9 mm;
- Number of splines: 6 in conformity with "ISO Standard 500 - 1979";
- Height above ground with tyre size 16.9/30: 710 mm;
- Distance from the median plane of the tractor 0 mm;
- Distance behind rear axle: 380 mm;
- PTO speed: 614 rev/min at rated engine speed;
- Engine speed: 2198 rev/min at standard power take-off speed 540 rpm;
- Ratio of rotation speeds (engine speed/p.t.o. speed): 4.0714
- Max power and torque trasmissible: 79 kW and 109.2 daNm;
- Direction of rotation (viewed facing driving end): clockwise;

1000 rev/min

- Location: at rear of tractor;
- Diameter of power take-off shaft end: 34.9 mm;
- Number of splines: 21 in conformity with "ISO Standard 500 - 1979";
- Height above ground with tyre size 16.9/30: 710 mm;
- Distance from the median plane of the tractor 0 mm;
- Distance behind rear axle: 380 mm;
- PTO speed at rated engine speed: 1020 rev/min
- Engine speed 2450 rev/min at standard power take-off speed: 1000 rpm;
- Ratio of rotation speeds (engine speed/p.t.o. speed): 2.45;
- Direction of rotation (viewed facing driving end): clockwise;

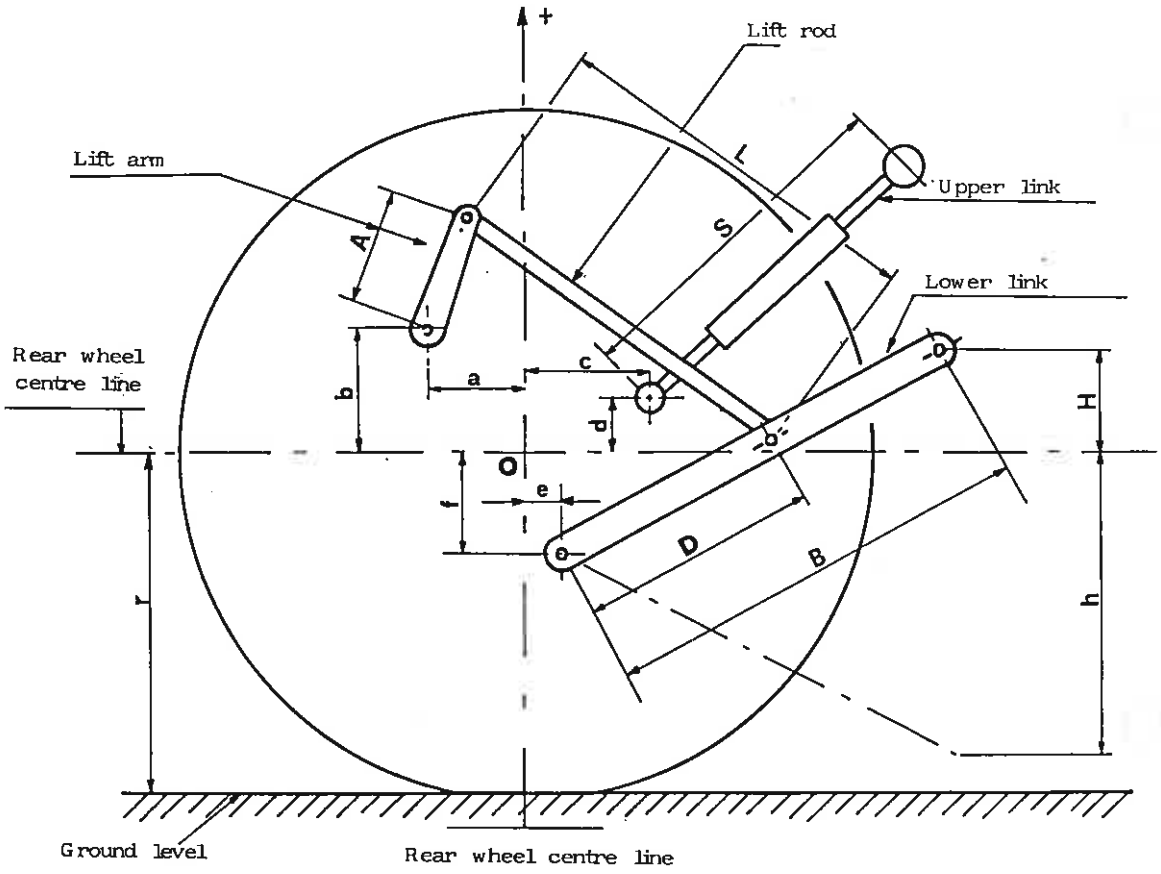
POWER LIFT

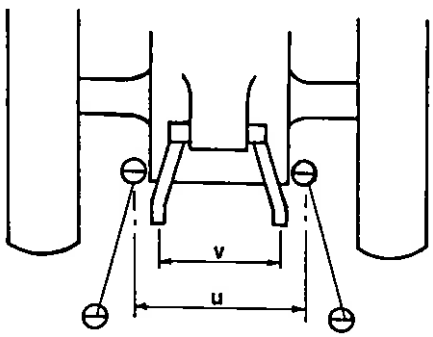
- Make: S + L + H;
- Type: LOAD SENSING open center system;
- Type and number of cylinders: 2 external hydraulic at simple effect;
- Type of locking for the transport: mechanical, with screwed tie rods that lock the lower links;
- Exercise valve pressure: 190 + 5 bar;
- Opening pressure anti-shock valve: 210 bar;
- Lift pump type: hydraulic rotary pump,driven from engine shaft;
- Transmission between pump and engine: mechanical
- Type and number of filters: 1, replaceable paper cartridge;
- Changing: when the filter clogging warning lamp is lighted;
- Oil capacity: 45 l in commonn with gear box;
- Site of oil reservoir: gear box;
- Position and No.of additional oil plugs: 3 ways distributor at rear of tractor;
- Maximum volume of oil available to external cylinders: 15 l;
- Recommended oil (see pag.17)

Three-point linkage

- Category: 2 in conformity with ISO 730/1;

S + L + H Hurlimann 358 DT "4WD" TEST N.039 11





Specify the settings for the lifting test

Rear tyres (size 16.9/30)	(r)	695 mm
Front tyre (size 12.4/24)	(r')	540 mm
Length of lift arms	(A)	310 mm
Length of lower links	(B)	725 mm
Distance of lift arm :horizontally	(a)	122 mm
pivot point from rear :vertically	(b)	337 mm
wheel centre line		
Horizontally distance between the 2 lower link points	(u)	480 mm
Horizontally distance between the 2 lift arm end points	(v)	490 mm
Length of upper link	(S)	from 580 to 700 mm
Distance of upper link horizontally	(c)	320 mm
pivot point from rear vertically	(d)	220 mm
wheel centre line		
Distance of lower link horizontally	(e)	215 mm
pivot point from rear vertically	(f)	190 mm
wheel centre		
Distance of lower link pivot points to lift rod pivot points on lower link	(D)	363 mm
Length of lift rods	(L)	from 625 to 765 mm
Height of lower hitch points:		
- in Low position	(h)	500 mm
- in High position	(H)	165 mm
relative to the rear wheel centre line, situated 695 mm above the ground level		

SWINGING DRAWBAR

- Type: S + L + H 97320;
- Height above ground (tyre size:16.9/30) max 450 mm
  min 375 mm
- Type of adjustment: reversible;
- Distance of hitch point from rear axle axis, horizontally: 815 mm;
- Distance of hitch point from power take-off shaft end
  . vertically: 283 - 358 mm below;
  . horizontally: 485 mm behind;
- Lateral adjustement (centre of clevis):
  (right hand) 270 mm;
  (left hand) 270 mm;
- Distance of pivot point from rear axle axis, horizontally: 485 mm forward;
- Diameter drawbar pin hole: 33 mm;

TRAILER HITCH

- Type: S + L + H;
- Height above ground: 470 - 600 - 730 mm;
- Distance of hitch point from rear axle axis, horizontally: 530 mm;
- Distance of hitch point from power take-off shaft end:
  . vertically: behind 240 - 110 mm above 20 mm;
  . horizontally: 150 mm;
- Maximun vertical permissible load: 1470 daN;
- Diameter of pinhole: 28.5 mm.

HOLED DRAWBAR

- Number of holes: 7;
- Distance between holes: 100 mm;
- Hole diameter: 28.5 mm;
- Thickness/width of the drawbar: 30 - 80 mm;
- Height above ground , minimum 220 mm;
  maximum 910 mm;
- Horizontal distance to power take-off shaft end (rear) 560 mm;
- Diameter of the pinhole: 28.5 mm.

STEERING

- Specifications: hydrostatic steering with BOSCH hydraulic gear pump HY/ZFS 11/8 L 208.
  two rams at simple effect acting directly on front axle;

- Make: DANFOSS;
- Model: ORBITROLL;
- Type: OSPC 80 OR;
- Working pressure: 120 bar;
- Oil capacity: 45 l in common with gear box;
- Oil change period: 1200 hrs;
- Filter change period: when the filter clogging warning lamp is lighted;
- Recommended oil (see pag.17)

BRAKE

Service brake

- Make: S + L + H;
- Model: 271.54;
- Type: oil bath disc, total 4 discs, mounted before 2 at front and 2 at rear differential half schafts.Front disc dia=178 mm ; rear disc dia=280 mm. FRENDO HDT 303 lining material;
- Method of operation: hydraulically acting with 2 pedals
- Trailer braking take-off: none.

Parking brake

- Type: fully independent by service brake, 2 oil bath discs mounted on the pinion shaft in the gear box ISOBOND SINTERIX lining material;
- Method of operation: mechanically by hand lever

Steering brake : divided pedal of service brake for normal use locked together;

STEERING WHEELS

- Number: 2;
- Location: at front;
- Tyres: radial;
  - . Size: 12.4/24;
  - . Ply rating: 6;
  - . Maximum permissible load on each tyre: 1177 daN;
  - . Corresponding inflation pressure: 1.7 bar;
- Track widths: 1400-1500-1600-1700-1800-1900 mm;
- Regulation: changing the position of the rims in respect of the disc;

DRIVING WHEELS

- Number: 4;
- Location: 2 at front and 2 at rear;
- Tyres:
  - Size: 16.9/30;
  - Ply rating: 6
  - Type of casing: radial;
  - Maximum permissible load on each tyre: 1863 daN;
  - Corresponding inflation pressure: 1.3 bar;
- Track widths: 1400-1500-1600-1700-1800-1900-2000 mm;
- Regulation: changing the position of the rims in respect of the disc;

WHEELBASE: 2120 mm;

PROTECTIVE STRUCTURE

Specifications

- OECD approval number: CSD 01032/1;
- Trade name: SAME C 26 A;
- Manifacturer's name: SAME;
- Protective device: cab.

Materials used in the construction and dimensions

See OECD Test Report on Protective Stuctures.

DRIVER'S SEAT

- Make: BOSTROM;
- Model: XL;
- Type of suspension: 84422 upholstered seat with back rest;
- Type of damping: shock absorber;
- Range of adjustment, longitudinal 150 mm;
  vertical 60 mm;

PASSENGER'S SEAT

- Make: S + L + H;
- Location: on the left side of the cab.

S + L + H Hurlimann 358 DT "4WD" TEST N.039

LIGHTING

Lighting system in accordance with CEE 78/933

	Height above ground of centre with tyre mm	Size mm	Distance from out side edge of trac tor to centre at 1600 mm track width mm
Headligths	960	110*110	785
Front park.lights	1770	110*35	150
Front finger post	1805	110*35	150
Rear park.lights	1600	180*35	280
Rear finger post	1635	90*45	235
Stop	1635	90*45	325
Reflectors	1415	90*60	320

Tyre size: 12.4/24 (6 ply) front - 16.9/30 (6 ply) rear.

TEST CONDITIONS

- Overall dimensions with tyres:
- Front 12.4/24 (6 ply) - Rear 16.9/30 (6 ply).

	Length (mm)	Width (mm) min	Width (mm) max	Height (mm) at top of exaust sil.	Height (mm) at top of protec.struc.
Without ballast	3760	1790	2380	2570	2540

Ground clearance
- Clearance-limiting part: 420 mm, below front traction gear

Track setting Front: 1600 mm - Rear: 1600 mm.

Tractor mass (without driver but with tanks full with cab);

	Units	Front	Rear	Total
Without ballast	kg	1265	1510	2775
With ballast	kg	1485	1710	3195

Fuel and lubricants recommended and used in tests all in accordance with API NORM

Fuel
- Type: AGIP Diesel, DIN 51601;
- Specific gravity at 15 °C: 0.838 kg/l;

Engine oil
- Type: AGIP DIESEL SIGMA S SAE 30;
- Viscosity: 12.5 cSt;
- API: SE-CD;

Transmission oils and rear, front axle and final drive oils;
- Type: AGIP ROTRA THT;
- Viscosity: 11.5 cSt;
- Viscosity index: 95;
- API: GL-3;

Power lift oil
- Type: AGIP ROTRA THT;
- Viscosity: 11.5 cSt;
- API: GL-3;

Steering oil
- Type: AGIP ROTRA THT;
- Viscosity: 11.5 cSt;

Grease
- Type: AGIP GREASE 30;
- Number of lubrication points: 11;

S + L + H Hurlimann 358 DT "4WD" TEST N.039

II - TEST RESULTS

A. COMPULSORY TESTS RESULTS

1) MAIN POWER TAKE-OFF PERFORMANCE

- Date and location of test: 29 th oct.1987 - I.S.M.A. TREVIGLIO (BG) ITALY
- Type of dynamometer: ZOELLNER 350 AC

Power	Speed		Fuel consumption			Specific Energy
	Engine	P.T.O.	Hourly	Specific		
kW	rev/min	rev/min	l/h	kg/h	g/kWh	kWh/l
MAXIMUM POWER - 2 - HOUR TEST						
39.90	2500	1020	12.53	10.50	263	3.18
POWER AT RATED ENGINE SPEED						
39.90	2500	1020	12.53	10.50	263	3.18
STANDARD POWER TAKE-OFF SPEED (1000 ±25 REV/MIN)						
39.77	2450	1000	12.46	10.44	263	3.19
PART LOADS						
i) torque corresponding to maximum power at rated engine speed						
39.90	2500	1020	12.53	10.50	263	3.18
ii) 85% of torque obtained in i)						
34.96	2577	1052	11.15	9.34	267	3.14
iii) 75% of torque definited in ii)						
26.62	2617	1068	9.11	7.63	287	2.92
iv) 50% of torque defined in ii)						
17.86	2634	1075	7.06	5.92	332	2.53
v) 25% of torque defined in ii)						
9.00	2653	1083	5.08	4.26	473	1.77
vi) unloaded						
0	2690	1098	3.59	3.01	-	-

S + L + H Hurlimann 358 DT "4WD" TEST N.039

PART LOADS AT STANDARD POWER TAKE-OFF SPEED

Power	Speed		Fuel consumption			Specific Energy
	Engine	P.T.O.	Hourly	Specific		
kW	rev/min	rev/min	l/h	kg/h	g/kWh	kW h/l
i) The torque corresponding to maximum power available						
39.77	2450	1000	12.46	10.44	263	3.19
ii) 85% of torque obtained at maximum power						
34.89	2528	1032	10.61	8.89	255	3.29
iii) 75% of torque defined in ii)						
26.65	2575	1051	8.60	7.21	270	3.10
iv) 50% of torque defined in ii)						
17.92	**2597**	**1060**	**6.72**	**5.63**	**314**	2.66
v) 25% of torque defined in ii)						
9.03	2619	1069	4.84	4.06	449	1.86
vi) unloaded						
-	2641	1078	3.47	2.91	-	-

STANDARD SPECIFIC FUEL CONSUMPTION: 267/332/255/314 g/kWh

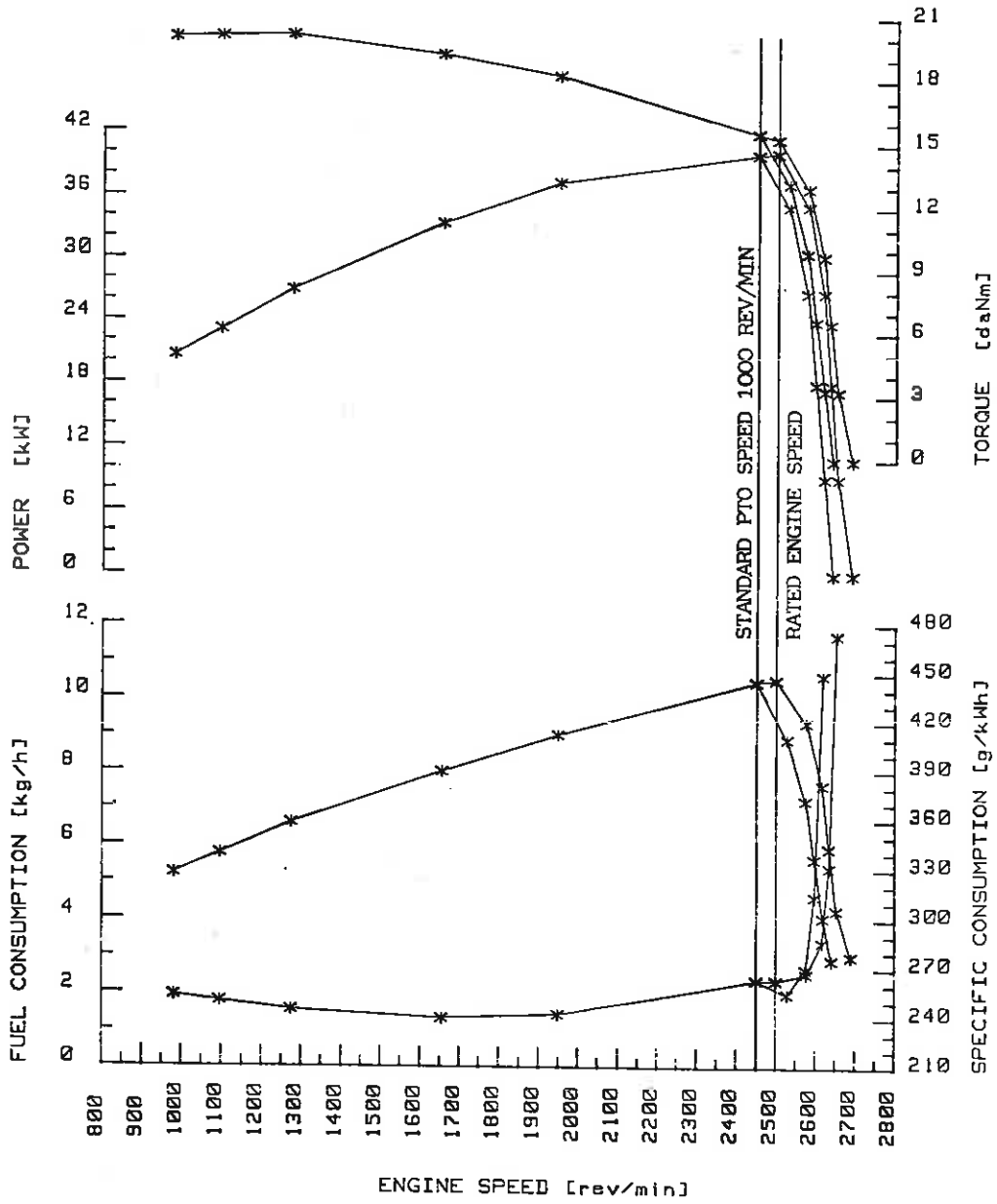
- No load maximum engine speed: 2690 rev/min
- Torque (1) at maximum power: 15.26 daNm
- Maximum torque (1) (engine speed: 1274 rev/min): 20.16 daNm
- Mean atmospheric conditions : Temperature 19°C
  Pressure 995 mbar
  Relat.humidity 83%
- Maximum temperatures : Coolant 98°C
  Engine oil 105°C
  Fuel 30°C
  Engine air intake 21°C

(1) The torque is the equivalent crankshaft torque.

ISTITUTO SPERIMENTALE PER
LA MECCANIZZAZIONE AGRICOLA
SEZIONE DI TREVIGLIO

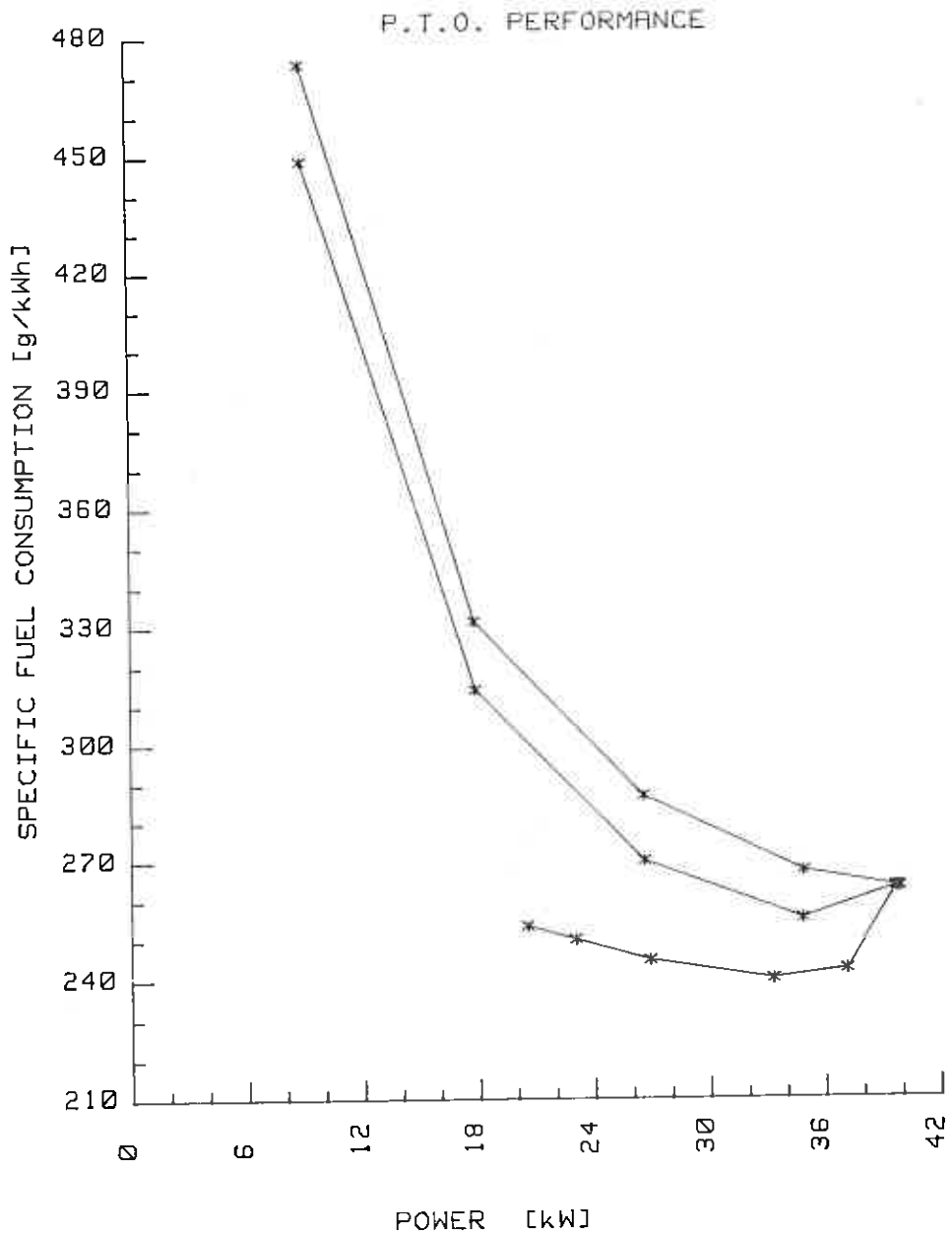
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P.T.O PERFORMANCE



ISTITUTO SPERIMENTALE PER
LA MECCANIZZAZIONE AGRICOLA
SEZIONE DI TREVIGLIO

S + L + H Hurlimann 358 DT "4WD" TEST N.039



(2) POWER LIFT AND HYDRAULIC POWER TEST

- Hydraulic fluid: AGIP ROTRA THT 11.5 CST, viscosity index 95, temperature at beginning test: 65 C°.

- Date and location of tests: 20 th oct. 1987 - ISMA Treviglio (BG)

		at hitch point	on the frame
Height of lower hitch point above ground in down position	mm	200	200
Vertical movement	mm	665	815
Maximum corrected force exerted through full range	daN	1667	1402
Corresponding pressure of hydraulic fluid	bar	191	191
Moment about rear axle	daNm	1567	2173
Maximum tilt angle of mast over range of lift	Degrees	--	-9

Lifting heights relative to the horizontal lower links

mm	-310	-300	-200	-100	0	100	200	300	355	400	500	505
Lifting forces at hitch points												
daN	1667	1671	1716	1765	1814	1863	1937	2030	1839	----	----	----
Lifting forces at test frame												
daN	1446	1449	1461	1492	1515	1529	1517	1471	----	1441	1410	1402

HYDRAULIC POWER TEST

Sustained pressure with relief valve open: 195 bar;
Pump delivery rate at min pressure: 28.5 l/min;

Hidraulic power	kW	flow rate l/min	pressure bar	oil temp. °C
At 90% of the actual relief valve setting	8.00	28	175	60
Maximum	8.00	28	175	60

Tapping point used for test : at rear of tractor
Hydraulic fluid: see pag. 17

ISTITUTO SPERIMENTALE PER
LA MECCANIZZAZIONE AGRICOLA
SEZIONE DI TREVIGLIO

(3) MAXIMUM POWER TRANSMISSION AND FUEL CONSUMPTIOM AT THE DRAWBAR
(Unballasted tractor)

- Date of tests: 30/10/1987 I.S.M.A. - TREVIGLIO
- Type of track: concrete
- Type and size of tyres front: 12.4/24 6 plr
  rear : 16.9/30 6 plr
- Heigth drawbar above ground: 580 mm
- Tyre inflation pressure: front 1.7 bar
  rear 1.3 bar

1) MAXIMUM DRAWBAR IN TESTED GEARS

Gear	Pow.	Draw. pull	Speed	Engine speed	Slip of wheel	Specific ener.cons.	fuel	Temperat. cool.	eng.	Atm. condit. temp.	hum.	pres.
n.	kW	daN	km/h	rev/min	%	kWh/l	g/kWh	°C	°C	°C	°C	%	mbar
1S	5.91	2564	0.83	2680	15	1.44	582	26	55	93	21	72	996
2S	9.01	2639	1.23	2673	15	2.07	405	26	55	93	21	72	996
3S	12.02	2672	1.62	2654	15	2.22	378	26	56	93	21	72	996
4S	15.79	2669	2.13	2641	15	2.41	348	27	57	93	21	72	997
1N	19.18	2666	2.59	2630	15	2.51	334	27	58	93	22	72	997
5S	20.67	2668	2.79	2614	15	2.55	329	28	58	94	22	71	997
2N	27.79	2647	3.78	2590	15	2.61	321	29	58	95	23	72	997
3N	33.10	2292	5.20	2506	9	2.64	317	29	60	97	24	73	997
4N	33.68	1680	7.22	2504	4	2.65	317	29	60	97	24	73	997
1F	34.50	1465	8.48	2501	3	2.70	310	29	62	98	24	73	997
5N	33.15	1223	9.76	2500	2	2.59	324	29	62	100	24	73	997

S = slow - N = normal - F = fast.

ISTITUTO SPERIMENTALE PER
LA MECCANIZZAZIONE AGRICOLA
SEZIONE DI TREVIGLIO

Gear	Pow.	Draw. pull	Speed	Engine speed	Slip of wheel	Specific ener.cons.	fuel	Temperat. cool.eng.		Atm.condit. temp.	hum.	pres
n.	kW	daN	km/h	rev/min	%	kWh/l	g/kWh	°C	°C	°C	°C	%	mbar
TRANSMISSION AND FUEL CONSUMPTION CHARACTERISTICS													
(i) SELECTED GEAR: 1F													
1F	34.50	1465	8.48	2501	3	2.70	310	29	62	98	24	73	997
(ii) - 75% of pull at maximum power.													
1F	27.38	1099	8.97	2636	2	3.99	210	30	62	100	24	73	997
(iii) - 50% of pull at maximum power.													
1F	18.56	732	9.13	2655	1	3.62	231	30	63	100	26	73	997
(iv) - higest gear giving the same pull as in (ii), reduced engine speed													
5N	27.44	1099	8.99	2318	2	4.70	178	30	63	102	27	73	997
(v) - higest gear giving the same pull as in (iii), reduced engine speed													
5N	18.70	732	9.20	2349	1	4.34	193	30	6	102	27	74	997

S + L + H Hurlimann 358 DT "4WD" TEST N.039 25

REMARKS: none

TEST CARRIED OUT BY
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