Biologische Bundesanstalt
für Land- und Forstwirtschaft

ENTAM

ENTAM - Test Report

Type of equipment:	Trailed Field Crop Sprayer
Make:	CHD
Model:	3627

Manufacturer:
C.H.D. Spuitmachines
Ruiten A Kanal Noord 6
9561 TE TER APEL
THE NETHERLANDS

Test report: D - 1680

October 2005

Assessment table

No.	Contents	Assessment
1	Spray tank surface roughness	+
2	Spray tank over volume	+
3	Volume of total residual (here max. allowed 72 l)	+
4	Spray tank contents gauge up to 20% Filling	+
5	Spray tank contents gauge from 20% Filling	+
6	Agitation system *	++
7	Width of nozzle bar section	+++
8	Boom height adjustment range	++
9	Deviation of pressure gauge	+
10	Deviation of flow meter	++
11	Regulation speed	++
12	Transverse distribution	++
13	Rinsing water tank	+
14	Deviation of volume/hectare adjustment device (spray computer) from desired value	++
15	Repeatability of volume/hectare adjustment device (spray computer)	++
16	Pressure drop between manometer and nozzle	++
17	Deviation of single nozzle output from table	++

* 3000 l tank

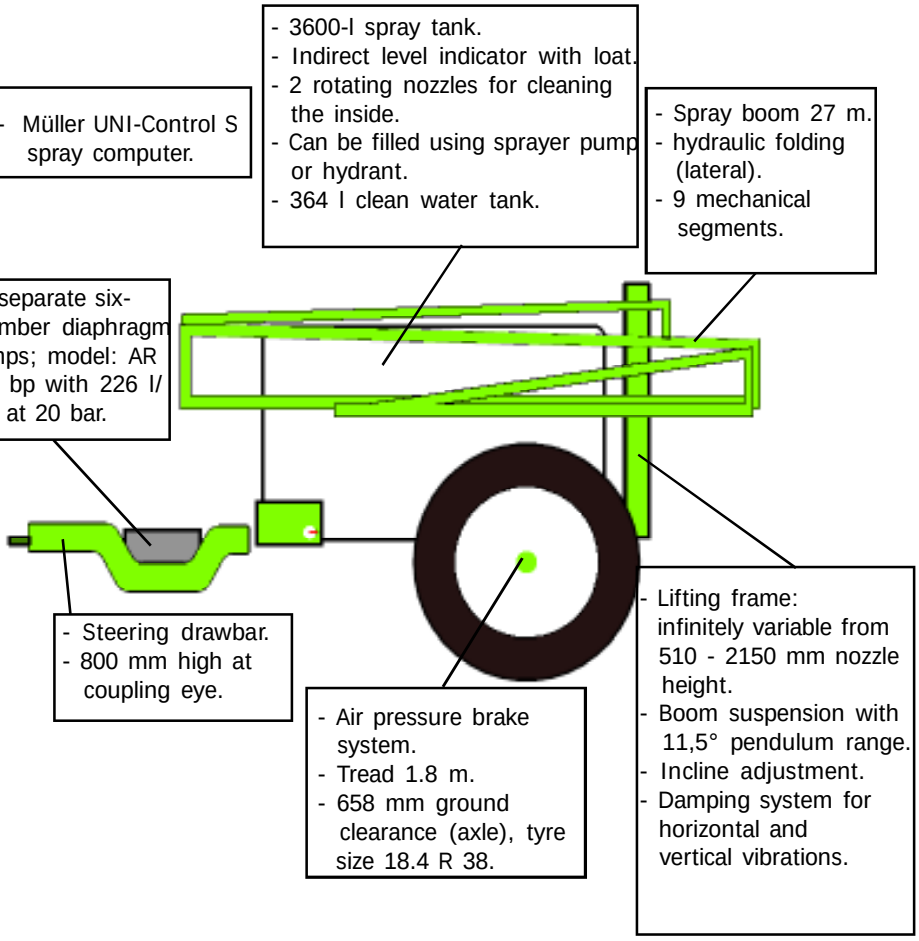
Table 1+2: assessment table and assessment keys of important test results.

Note: The assessment keys are listed below. Detailed results are in the following test report.

No.	unit	+	++	+++	No.	unit	+	++	+++
1	µm	>70-100	30-70	<30	10	%	4-5	2-4	0-<2
2	%	5-8	>8-12	>12	11	%	>7-10	>3-7	0-3
3	of allow.value	>2/3-3/3	1/3-2/3	<1/3	12	CV	>7-9	4-7	<4
4	%	7.5-5.0	5.0-2.5	<2.5	13	% of tank vol.	10-12	>12-14	>14
5	%	5.0-4.0	<4.0-2.0	<2.0	14	%	>4-6	2-4	<2
6	%	>10-15	5-10	<5	15	%	>2-3	1-2	<1
7	m	4.5-6	>3-4.5	3 or less	16	%	>7-10	3-7	<3
8	m	1-1.5	>1.5-2.0	>2.0	17	%	>7-10	3-7	<3
9	bar	>0.10-0.20	>0.05-0.10	0.00-0.05					

The complete test report can be downloaded at:
www.ENTAM.com or www.BBA.de

Technical data of sprayer



Dimensions and weights:

Length:	6600 mm	
Height:	3400 mm	
Transport width:	2910 mm	
Net weight:	3194 kg	(CHD 3027)

Fig.1: diagram of sprayer.

Description of sprayer

The chassis is made of rectangular steel profiles and has an axle with brake (dual circuit pressure system) and a steering drawbar (hydraulic steering via cylinder, rotation angle sensors for transmitting the drawbar position to the computer control). The separate pumps for spraying and mixing the spray fluid are integrated into the steering drawbar.

The spray tank is made of fibre glass reinforced plastic and is equipped with an indirect scale (float attached to gauge with wire) on the front right hand side (scale graduations of 50 l). There is an additional electronic contents indicator, Müller „Tank-Control".

The tank can be emptied completely by a ball valve at the bottom of the tank or using the pump (residues are pumped away by using a 1"-GEKA connection). For cleaning the inside of the tank there are two cleaning nozzles (rotating nozzles made of plastic) in the tank. The sprayer has two back flow agitation systems which can be switched on and off separately and an additional pressurised agitation system.

Fig.2: hydraulic drawbar steering with spray and agitation system pumps and scale showing tank contents.

Fig.3: inside of tank is cleaned by two rotating nozzles on the splash walls (baffles).

The pressurised agitation system is for use following longer periods of standing unused (spraying at the same time is not posibble). The agitation system consists of a plastic pipe with 4 injector nozzles positioned on the right directly above the tank base.

The back flow agitation system (for spray operation) can be switched to and from. By use of a flap valve, the back flow can be switched to the suction side of the pump. The agitation system consists of two plastic pipes with bore holes directed at an angle towards the bottom of the tank (each at about 40 cm from the left and right tank walls) directly above the base of the tank.
For diluting technical residues and cleaning the inside and outside of the sprayer there is a clean water tank which holds 364 l. There is a 3/4" GEKA-connection on the left of the sprayer for filling the tank. The contents of the clean water tank are fed into the suction side of the pumps. Adjustments for the respective spray application are made with a 5-way valve.

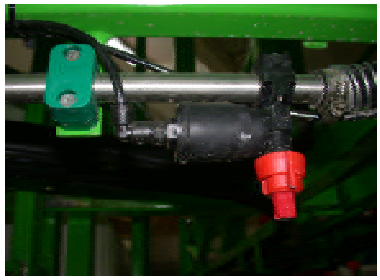
The sprayer is equipped with a set for cleaning the outside consisting of a 1/2" hose with a spray gun (Gardena).

The spray boom is a framework construction made of standard steel profiles. The height is adjusted hydraulically by means of a lifting frame (510 mm to 2150 mm, adjusting range 1640 mm and infinitely variable).
The boom is folded hydraulically: first of all it is put into the highest position possible so that the pendulum frame can be locked into position. The very outer segments can be folded inwards if required.

Fig.4: spray boom with stainless steel nozzle pipe.

In this way it is possible to reduce the working width. All hydraulic functions are controlled by solenoid valves in connection with the remote control, „Müller UNI-Control S" . The tractor therefore requires a dual-action hydraulic valve. The pendulum suspension (centrally pivoted suspension system) has a pendulum range of up to 11.5° to the horizontal. There is an additional slope compensation device driven by an electric spindle. This is regulated by means of a potentiometer on the electrical control panel with a zero mark so that the boom can be adjusted rapidly to a position parallel to the ground. Vertical and horizontal deviations are kept to a minimum by rubber silent blocs, springs and shock absorbers. The boom is divided mechanically into 9 segments of which each outer segment (2200 mm long) is flexible to avoid obstacles at the front and the back. It is not possible to fold only one side of the boom. The boom is equipped with a circular pipe, which ensures that when the sprayer is ready for application the full concentration of spray fluid is available to the nozzles. Moreover, when the sprayer is not in operation, the nozzle pipe can also be rinsed when the nozzles are closed.

The circular pipe also ensures that, in connection with indiviual nozzle regulation (pneumatic valves) differences in pressure in the boom can be kept to a minimum. The spray boom has 9



*F*ig. 5: spray boom with stainless steel nozzle pipe.

hydraulic spray sections with 6 nozzles each which are 500 mm apart. The spray line is made of stainless steel and has an interior diameter of 19.5 mm and a wall thickness of 1 mm. The nozzle bodies with pneumatic valves are attached to the control valves consist of the control unit, Müller UNI - Control S, and the attached electrical control panel for the section valves and the sprayer as a whole, for slope compensation and hydraulic functions (boom folding, lifting and lowering).

The section valves are regulated by the multiplex connection for the individual nozzle valves at the spray line (circular pipe). In addition to the possibility of regulating spray application, the operator can switch at any time to manual operation. The ball valves for selecting the suction side at the front of the sprayer („Spray" / „Fill") and the pressure side („Spray", „Power agitation", „PPP induction", „Pump residues out" and „Clean tank") are also a part of the controls.

Fig.6: control unit, UNI-Control S.

Furthermore, the sprayer is equipped with a steering drawbar (Müller „Trail Control"). It allows automatic track following, even for spraying slopes and for turning manoeuvres.

Either manual or automatic operation is possible.

The sprayer is delivered with an induction bowl. This is attached to a parallelogram arm and is swivelled downwards for filling. The filling hole is then at a height of approx. 940 mm.

Fig.7: induction bowl in working position.

The cone shaped tank has a screw-on lid and a container rinsing device via a stationary sprinkler device. The filter insert made of stainless steel (16.5 mm mesh size) is fixed with two screws to the sides and prevents foreign particles from entering. The opening is 402 mm in diameter. The ringline and container cleaning device are activated by ball valves.

Result table

tested assembly			result (measured)	
spray tank	over volume		6.7	* min. 5 %
	contents gauge	graduation marks	50	* max. 100 l
		deviation	-4.90% -3.95%	* max. 7.5 % up to 720 l filling * max. 5 % between 720 and 3600 l
	surface roughness		0.073 mm	* max 0.1 mm
rinsing tank	volume		364 l corresponding to 10.1 % of nominal volume	* min. 10 % of nominal contents
	rinsing and dilution possible?		yes	
can rinsing equipment	rinsing efficiency			* max. 0.01 % of can contents
manometer	graduation marks		0.2 bar	* max. 0.2 bar
	deviation		0.1 bar	* max. 0.2 bar
agitation system	deviation from even concentration		-7.20%	*max. 15 %
residual in l		dilutable	57.68 l	* max. 72 l
		non delutable		
spray boom	height adjustment range from - to		510 mm - 2150 mm	
	nozzle ground contact protection		yes	
	pressure loss between manometer and nozzle at 3 bar pressure		6.0 % (with IDK 120 04 POM)	* max. 10 %
	nozzle dripping after switch off		0 ml	* max. 2 ml
	single nozzle flow rate			
	type of nozzle: Lechler IDK 120 04 POM			
	pressure (bar)	flow rate (l/min)	max. deviation from table in % *(max. 10 %)	max. deviation from mean in % *(max. 5 %)
	1.0	0.938	7.88	4.70
	3.0	1.550	3.55	3.80
	5.0	1.910	5.63	3.50
	transverse distribution			
	type of nozzle: Lechler IDK 120 04 POM			
	pressure (bar)	distance (cm)	coefficient of variation (%) *(max. 9 %)	
	1.0	50	4.78	
	3.0	50	6.40	
	5.0	50	4.16	

Table 3: test results, Part 1.

Result table

volume/hectare adjustment device		
repeatability of adjustment		
adjusted flow rate in l/ha	deviation from adjusted value % *(max. 6 %)	CV *(< 3 %)
175	3.35	0.46
250	1.03	0.51
325	-0.35	0.42
procedure	regulation time (s) with deviation > 10 % to adjusted value	
switching on / off	4.35	* max. 7 s
switching of single sections	3.75	* max. 7 s
change of driving speed by changing gears		
1.5 m/s to 2.0 m/s	1.7	* max. 7 s
2.0 m/s to 2.5 m/s	1.4	* max. 7 s
2.5 m/s to 2.0 m/s	1.2	* max. 7 s
2.0 m/s to 1.5 m/s	3.3	* max. 7 s

Table 4: test results, Part 2.

Assessment

The single-axle chassis is for rear hitching to the tractor clevis. In connection with the steering drawbar, this type of hitching enables automatic track following with the trailed sprayer. The steering drawbar can be guided either manually or automatically („Müller Trail Control" system). The position of the drawbar in relation to the pulling vehicle is noted by the trailor via rotation angle sensors. The drawbar axle must be put rigid for transport. Furthermore, the chassis is equipped with a pressurised brake and may drive up to a speed of 40 km/h. The platform, which is to the left of the tank, allows easy access to the filling and cleaning opening with its extendable ladder.

The tank is made of fibreglass-reinforced plastic, is sufficiently smooth on the inside and outside and the corners are rounded off satisfactorily. Two integrated splash walls (baffles) prevent excessive reactions due to load alternation when the tank is partly full. The opening for filling is sufficiently large. If the side filling connection is used, the sprayer can be filled with a pump capacity of max. 2 x 230 l/min. The filling connection on the sprayer has a back flow valve which prevents fluid from being sucked back out of the spray tank if the sprayer is not in spraying mode. The generous tank opening and the two nozzles for cleaning the inside of the tank mean that it is easy to clean.

The tank lid closes tightly enough. The height of the spray tank contents is easy to read using the indirect scale (float attached to gauge with wire). The volume scale is sufficiently accurate. The tank has an oversize of 6.7 % and therefore enough spare volume for any resulting foam. The agitation devices are very effective (pressurised agitation system in connection with agitation device); they can be switched off to reduce technical residues. The clean water tank integrated into the spray tank can hold 364 l, which is sufficient (10.1 % of the nominal content).

The boom can be adjusted to the respective slope via the potentiometer which has a neutral position. The boom can avoid obstacles to the front and the back thanks to flexible suspended outer boom segments. In addition, the supporting frame has horizontal spring loaded dampers which compensate effectively for the horizontal impact from the sprayer. A circular pipe on the sprayer with individually controlled diaphragm valves (electropneumatic) and a back flow system result in even distribution in the nozzle pipe. The spray liquid is therefore available in full concentration to each individual nozzle before these are even switched on. Increases and decreases in pressure when the sprayer is switched on and off are achieved in a much shorter time so that also when injector nozzles are used, the spray jet reacts very quickly. The control unit enables speed-dependent adjustment of spray activity. Changes such as opening and closing the spray sections, changes in speed within one gear, or switching gears is compensated for within a sufficiently short space of time by the control unit. The accuracy of the flow meter (Pollmac 1" - impeller sensor) should be checked before first use and several times during the season, and calibrated anew if necessary. The induction bowl is effective in facilitating the filling of larger amounts of plant protection products. When using the container rinsing device, care must be taken that the valve of the container rinsing device is only activated when a container is placed over the nozzle or when the lid is closed.

Safety Tests

The sprayer is equipped with safety pictograms (stickers) on the sprayer and operating instructions in the operator's native language, which include further safety information. The sprayer carries a CE-mark and a vehicle identification plate.

The CE-mark shows that a product fulfils the requirements defined for the respective EC-directives and that the supplier has carried out the appropriate procedures to achieve conformity. The CE-mark is mounted on the equipment by the manufacturer. The manufacturer confirms by doing so that the sprayer was designed and built in accordance with harmonised EC Directive 98/37/ EEC and that standard EN 907 has been complied with.

Diagram of the liquid system

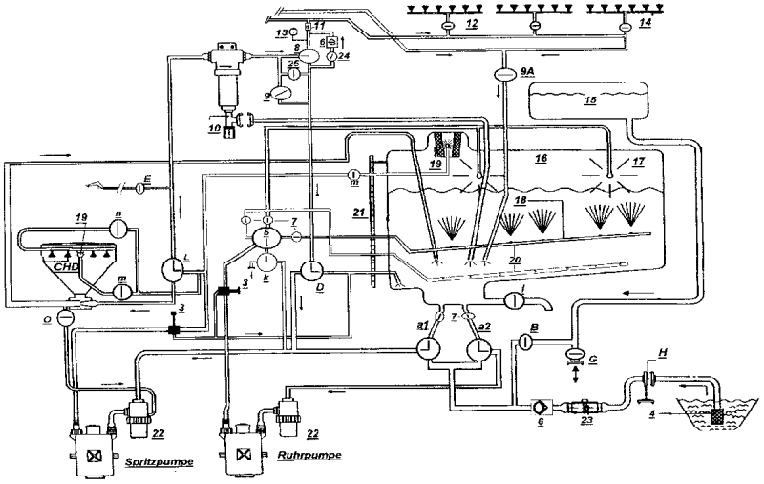


Fig. 8: diagram of the pipe/hose system

A1- valve, A2 - ball valve, H - filling connection, K - pump connection,L - 3-way valve, O - ball valve, 3 - pressure control valve, 5 - 5-way valve, 6 - reflux valve, 9 - pressure regulation device, 9A - circular pipe for reflux, 10 - central pressure filter, 11- flow meter, 13 - pressure gauge, 15 - clean water tank, 16 - spray tank, 17 - cleaning device for inside of tank, 18 - pressurised agitation device, 20 - agitation device for reflux, 22 - suction filter, 24 - circular pipe for pressure regulation.

Explanation on testing:

Testing takes place according to the Technical Instructions for ENTAM-Tests of field crop sprayers. This procedure was developed by the competent testing authorities of the European countries participating in ENTAM and is based on the CEN standard EN 12761 „Agricultural and forestry machinery – Plant protection equipment for the application of plant protection products and liquid fertilisers". This test is only a technical performance test which takes place without an accompanying field test. The test results apply only to the tested appurtenances of the sprayer. Statements on the behaviour of the sprayer with different appurtenances cannot be derived from these results.

Responsibility and recognition

Performing competent authority:
Federal Biological Research Centre for Agriculture and Forestry (BBA) (Germany)
Application Techniques Division; Messeweg 11-12; D-38104 Braunschweig

This test is recognized by the ENTAM members:

HIAE Hungarian Institute of Agricultural Engineering (Hungary)	D-4/2005
NAGREF National Agricultural Research Foundation (Greece)	LE/63/01/ZZ
ENAMA Ente Nazionale per la Meccanizzazione Agricola (Italy)	ENTAM „Rapporto di prova prestazionale" 02/2005
CMA Generalitat de Catalunya Centre de Mecanització Agrària (CMA) (Spain)	EPH002/05
HBLuFA FRANCISCO JOSEPHINUM WIESELBURG (Austria)	BLT-Prot.-Nr. 028/05
PIMR - Przemyslowy Instytut Maszyn Rolniczych Industrial Institute of Agricultural Engineering (Poland)	PIMR - 8/ENTAM/05
D.I.A.S. - Danish Institute of Agricultural Sciences (Denmark)	DIAS recognition 955
CRA-W Centre de Recherches Agronomiques de Gembloux; Département de Génie rural (Belgium)	D-1680