



**Ente Nazionale  
Meccanizzazione Agricola**

**AGRICULTURAL MACHINERY FUNCTIONAL AND SAFETY TESTING  
SERVICE**

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**TEST REPORT No. 44a – 002**



**RECIPROCATING DISPLACEMENT PUMP: APS 145**

**MANUFACTURER: COMET S.P.A.**

**Via G. Dorso, 4 - 42100 REGGIO EMILIA (RE)**

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**Rome, November 2002**

TESTS CARRIED OUT IN COMPLIANCE WITH ENAMA SPECIFICATIONS NO. 44A BY THE MECHANICS SECTION OF THE DEPARTMENT OF AGRICULTURAL, FOREST AND ENVIRONMENTAL ECONOMICS AND ENGINEERING, UNIVERSITY OF TURIN:

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To facilitate interpretation of the results, it should be remembered that:

1 revs/m = 1 min<sup>-1</sup>  
1 MPa = 10 bar  
1 kW = 1.36 CV  
1 m<sup>3</sup>/s = 3600 m<sup>3</sup>/h  
1 m/s = 3.6 km/h  
1 l = 1 dm<sup>3</sup>.

## Technical data

<b>model</b>	<b>APS 145</b>
type	piston- diaphragm
no. elements	4
hydropneumatic compensator	yes
pressure gauge on compensator	no
min. rotation speed (rpm)	400
max. rotation speed (rpm)	550
nominal flow rate (l/min)	149
max. pressure (bar)	50
safety valve	yes
inner diameter suction tube (mm)	45
empty weight (kg)	46
size:	
width (mm)	335
length (mm)	337
height (mm)	423

## Description of part

The tested part is a reciprocating displacement diaphragm pump chiefly to be used in sprayer machines.

It consists of an aluminium alloy die-cast crankcase containing 4 pumping units with pistons operated by a star-shaped connecting rod assembly, controlled by an eccentric shaft made out of a highly resistant alloy steel, hardened and tempered.

Between the eccentric shaft and the connecting rod is a large-sized needle bearing to reduce friction and increase the pump's global performance.

The aluminium alloy die-cast pistons are endowed with a segment, and slide in cast-iron jackets. The main bearings are radial ball bearings.

Each pumping unit is fitted with a circular diaphragm made out of nitrile rubber and two automatic valves (one for suction and one for delivery) with poppet, spring and stainless steel seat. The valves are housed in the heads, which are made of a die-cast aluminium alloy.

The through-shaft is splined on both sides with a male 1<sup>3</sup>/<sub>8</sub> profile. Other shaft versions and different diaphragm materials are available.

The aluminium alloy parts in contact with the product are protected by an anodising treatment.

The kinematic motion of the pump is of an oil bath type; the level can be viewed using a volumetric compensator made out of a transparent material.

On the delivery side is a

hydropneumatic compensator, made out of a die-cast aluminium alloy, and a safety valve, which comes into action if pressure exceeding 20% of the maximum nominal value is generated in the delivery circuit.

## Test method

The pump in question was installed on an ad hoc test bench to measure the following parameters: suction pressure, delivery pressure, rotation speed, torque required to operate and flow rate.

The hydropneumatic compensator was regulated according to the manufacturer's recommendations.

Tests were carried out at a temperature of 25-27°C in an environment having a temperature of 22°C and atmospheric pressure of 1007 hPa.

Flow rate and power absorption depending on rotation speed and delivery pressure were calculated, with the delivery tubing regulated so as to have a pressure of -0.25 bar, with a pump rotation speed of 550 rpm and a delivery pressure of 5.0 bar.

Flow rate with variable suction pressure was calculated at a rotation speed of 550 rpm, and the delivery circuit was regulated at 5 bar, with a suction pressure of -0.25 bar.

The priming test was conducted by determining the time required to restore correct operating conditions following the introduction of air in the suction

circuit. Tests were carried out at a rotation speed of 550 rpm, delivery pressure of 5 bar and suction pressure of -0.25 bar.

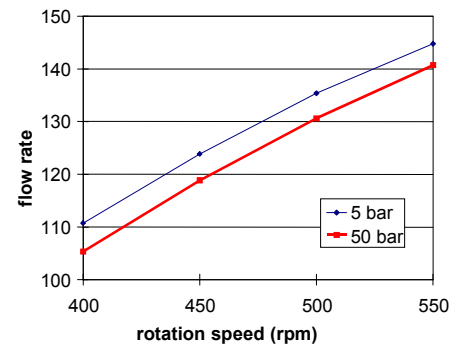
## Results

### FLOW RATE AT REFERENCE SUCTION PRESSURE

The flow rate for liquid delivered by the pump in question is directly proportional to the speed of rotation, and inversely proportional to operating pressure. At a pressure of 50 bar there is a 4.5% drop in the flow rate compared with a free discharge situation.

	rpm			
bar	400	450	500	550
0.8	114.1	127.0	139.5	147.8
5.0	110.8	123.9	135.4	144.8
10.0	109.4	122.6	134.4	144.4
20.0	108.2	121.4	133.4	143.7
30.0	107.2	120.3	132.4	143.0
40.0	106.3	119.3	131.5	142.0
50.0	105.4	118.9	130.6	140.8

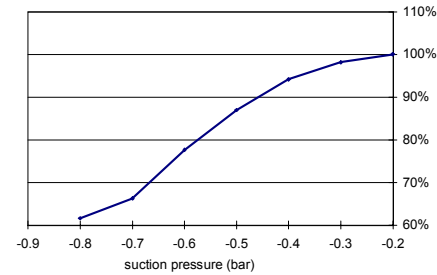
Flow rate (l/min) depending on rotation speed and operating pressure.



Flow rate depending on rotation speed.

**FLOW RATE WITH VARIABLE SUCTION PRESSURES**

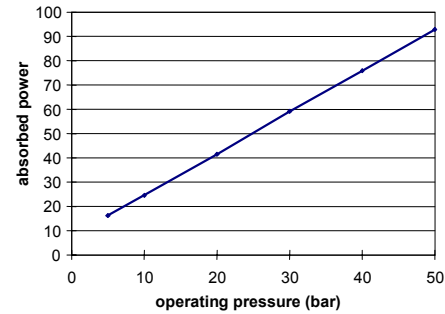
The flow rate of the tested pump is inversely proportional to the pressure present in the suction circuit. 90% of the flow rate is preserved up to pressures of -0.45 bar.



Reduction in flow rate (%) depending on pressure present in suction circuit.

**POWER ABSORPTION**

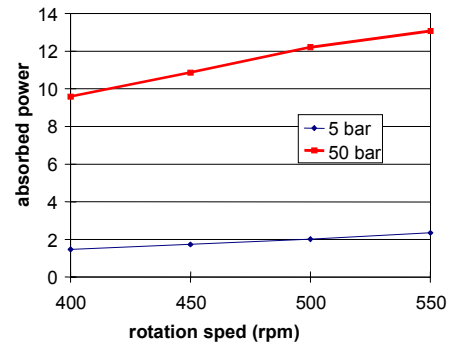
Power absorption is proportional to flow rate and operating pressure. In particular, with the rotation speed of 550 rpm at free discharge, 8 W per l/min are required, while at a pressure of 50 bar 93 W per l/min are needed.



Power absorbed depending on operating pressure, with rotation speed of 550 rpm

bar	rpm			
	400	450	500	550
0.8	0.59	0.76	1.02	1.24
5.0	1.47	1.73	2.02	2.35
10.0	2.32	2.81	3.21	3.54
20.0	4.24	4.87	5.46	5.96
30.0	6.04	6.90	7.72	8.46
40.0	7.80	8.92	9.95	10.77
50.0	9.59	10.86	12.21	13.07

Power absorption (kW) depending on rotation speed and operating pressure.



Power absorption depending on rotation speed

#### PRIMING CAPACITY

The time needed for the complete fresh

priming of the pump when air is introduced in the suction circuit is 6.0 s.

#### Notes on functionality

The pump to which the present test report refers worked properly under all the operating conditions indicated by the manufacturer. It may be used in sprayer machines used to protect crops, especially when high pressure values are required.

**THE PRESENT TEST REPORT IS VALID FOR A PERIOD OF FIVE YEARS FOR THE RECIPROCATING DISPLACEMENT PUMP MODEL APS 145 AND IS OFFICIALLY RECOGNISED BY ENAMA MEMBERS:**

**ASSOCAP (Associazione Nazionale dei Consorzi Agrari) (National Association of Farm Consortia)**  
**CIA (Confederazione Italiana Agricoltori) (Italian Farmers Confederation)**  
**COLDIRETTI (Confederazione Nazionale Coltivatori Diretti) (National Confederation of Independent Farmers)**  
**CONFAGRICOLTURA (Confederazione Generale Agricoltura) (General Farming Confederation)**  
**UNACMA (Unione Nazionale Commercianti Macchine Agricole) (National Union of Farm Machine Dealers)**  
**UNACOMA (Unione Nazionale Costruttori Macchine Agricole) (National Union of Farm Machine Manufacturers)**  
**UNIMA (Unione Nazionale Imprese Meccanizzazione Agricola) (National Union of Farm Mechanisation Enterprises)**

**AND BY MEMBERS OF THE EXECUTIVE COUNCIL OF THE ENAMA, IN WHICH THE FOLLOWING ARE ALSO REPRESENTED:**

**MIPAF (Ministry for Agricultural and Forestry Policies)**  
**Regions and Autonomous Provinces**  
**ISMA (Istituto Sperimentale per la Meccanizzazione Agricola)**  
**(Experimental Institute for Farm Mechanisation)**



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