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Evaluation Report 71

Macnaught Litre-Stroke Hand Pump

A Co-operative Program Between
ALBERTA FARM MACHINERY RESEARCH CENTRE
PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

MACNAUGHT LITRE-STROKE HAND PUMP

MANUFACTURER:

Macnaught Pry. Ltd.
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Turella, (Sydney), Australia

DISTRIBUTOR:

John A. Murray Agency
1642 St. James Street
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R3H 0L3

RETAIL PRICE:

$126.00 (January, 1979, f.o.b. Lethbridge)

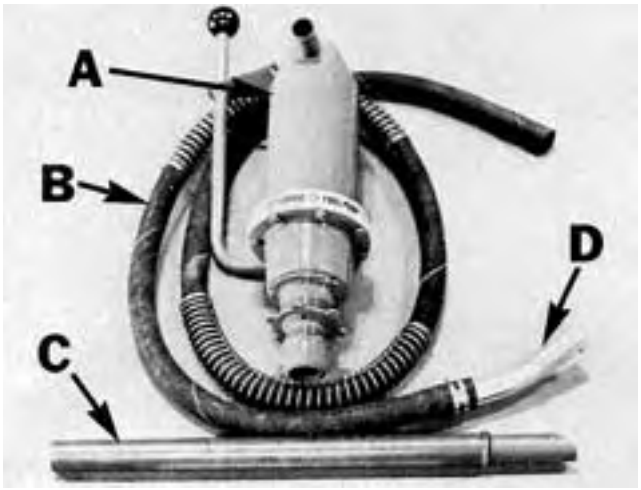

FIGURE 1. Macnaught Litre-Stroke Hand Pump: (A) Pump Body, (B) Outlet Hose, (C) Telescopic Suction Pipe, (D) Outlet Nozzle.

SUMMARY AND CONCLUSIONS

Normal pumping rates for the Macnaught Litre-Stroke hand pump were from 20 to 30 strokes per minute. The flowrate at an average pumping rate of 25 strokes per minute, at zero suction and discharge heads, was 25 L/min. (5.5 gal/min). A maximum flowrate of 48 L/min (10.6 gal/min) was obtained at 47 strokes per minute but this pumping rate could only be maintained for about 30 seconds. The manufacturer's maximum flowrate of 70 L/min (15 gal/min) was not obtainable since it was humanly impossible to pump that fast. Increasing suction and discharge heads had very little effect on the flowrate. The pump required several priming strokes to start fuel flowing after it had been idle.

Pumping effort increased significantly with increased pumping rates and suction heads. The required force at the end of the pump handle increased from 120 N (27 lb) at 20 strokes per minute to 202 N (45 lb) at 30 strokes per minute. Increasing the suction head from zero to 0.9 m (3 ft), at 25 strokes per minute, resulted in a 47% increase in pumping effort. Increasing the discharge head had no effect on pumping effort.

The Macnaught Litre-Stroke was very portable. The pump was difficult to position in a fuel supply tank since the bung adaptor did not rotate relative to the pump body and the entire pump body and hose had to be turned. The locking collar on the bung adaptor enabled the pump to be locked so the handle was in a convenient pumping position.

The Macnaught Litre-Stroke was safe to operate. When filling a tank, care must be exercised to prevent overflow.

The outlet hose was equipped with a strainer that could be easily serviced.

Operating instructions and a parts list were supplied with the pump.

A few mechanical problems occurred during the test. The inlet valve assembly came apart, causing internal damage to the pump. The inlet valve assembly was also improperly positioned on delivery and had to be straightened.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying a rotating bung adaptor.
2. Modifying the pump handle grip to permit easier hand motion while pumping.
3. Providing, as an option, an outlet spout with an automatic shut-off.
4. Modifying the inlet valve assembly to prevent it from coming apart.

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THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. A rotating bung adaptor will be supplied with future models.
2. The ball type handle was designed to reduce cost and to make it suitable for pumping from different operating positions. No other complaints have been received regarding the pump handle.
3. Designing an outlet spout with an automatic shut-off, that does not affect the pump performance, is high on our list of priorities.
4. This problem has never been reported before. However, if abused, and the whole pump assembly is dropped on to the suction pipe, it could force the suction pipe to make contact with the valve. We are looking at ways to prevent this occurrence.

GENERAL DESCRIPTION

The Macnaught Litre-Stroke is a self-priming, hand operated, single action piston pump. It is designed for pumping gasoline, diesel fuel or solvents from above ground tanks equipped with 50 mm (nominal 2 inch NPT) openings. It is equipped with a 1 m (39 in) telescoping suction pipe, a 2.5 m (8 ft) outlet hose and a 338 mm (13.25 in) pump handle. The top of the pump handle is equipped with a plastic ball grip and can be locked against the pump body to prevent theft. The pump nozzle, when not in use, is stored within a receptacle on the pump body.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Macnaught Litre-Stroke was evaluated for ease of operation and safety. Pump performance characteristics and pumping effort at various pumping rates, suction and discharge heads were determined with diesel fuel.

RESULTS AND DISCUSSION

PUMP PERFORMANCE

Priming: The pump, when first used, required priming to start fuel flowing. If the pump sat idle for longer than five minutes, several priming strokes were always needed before fuel would flow.

Pumping Rate: Pumping rates from 20 to 30 strokes per minute were determined as the normal range a farmer could continuously operate this pump when filling a large tractor tank. A maximum pumping rate of 47 strokes per minute was reached but was impossible to maintain for any reasonable length of time. The pumping rate of 50 to 70 strokes per minute, upon which the manufacturer based the maximum capacity of the pump, was unrealistic and virtually impossible to obtain.

Flowrate: Pump performance characteristics with diesel fuel for two different suction and discharge heads are given in FIGURE 2. Suction head is the distance the fuel level is below the pump intake valve while discharge head is the height the outlet nozzle is held above the pump. Suction heads of 0 and 0.9 m (0 and 3 ft) correspond to full and empty levels of typical farm truck fuel storage tanks.

Increased pumping rates increased the flowrate by about 1 L (0.22 gal) per stroke. Flowrate at the average pumping rate of 25 strokes per minute was 25 L/min (5.5 gal/min).

Increasing the suction and discharge heads had an opposite effect on flowrate than expected. Flowrates increased slightly instead

of decreasing. At zero suction head, increasing the discharge head to 1.8 m (6 ft) had no effect on the flowrate. At a suction head of 0.9 m (3 ft), when pumping at 25 strokes per minute, increasing the discharge head to 1.8 m (6 ft) caused the flowrate to increase from 25 L/min (5.5 gal/min) to 26 L/min (5.7 gal/min). This may have been caused by better seating of the foot valve at higher heads.

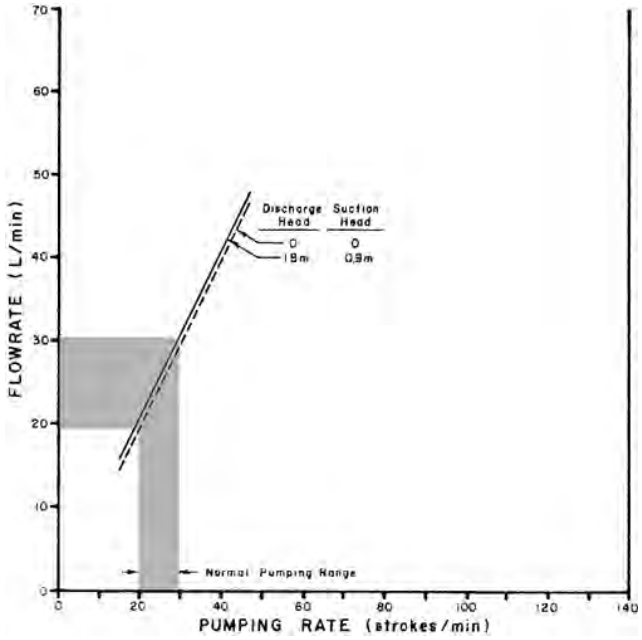

FIGURE 2 . Flowrate with Diesel Fuel at Two Suction and Discharge Heads.

The maximum flowrate obtained was 48 L/min (10.6 gal/min) at a pumping rate of 47 strokes per minute. This pumping rate could only be maintained for about 30 seconds. The manufacturer's stated flowrate of 50 to 70 L/min (11 to 15 gal/min) could not be obtained, since the average person could not pump that fast.

EASE OF OPERATION

Pumping Effort: Pumping effort is the hand force that has to be exerted, perpendicular to the end of the pump handle, to operate the pump. Increasing the discharge head had virtually no effect on pumping effort. Pumping effort depended largely on the pumping rate and suction head. FIGURE 3 shows the hand forces needed at two suction heads, over a range of pumping rates. At a pumping rate of 30 strokes per minute, with zero suction head, pumping effort was 202 N (45 lb) compared to an effort of 120 N (27 lb) at 20 strokes per minute. At an average pumping rate of 25 strokes per minute, pumping effort increased from 161 N (36 lb) at zero suction head to 236 N (53 lb) at a 0.9 m (3 ft) suction head.

Pump Handle: The top of the pump handle was equipped with a plastic ball grip. The hand normally moved on the grip during each pumping stoke. Friction between the plastic ball and the hand caused the hand to become sore during continued pumping. It is recommended that the manufacturer modify the pump handle grip to allow for easier hand motion.

Fuel Tank Connection: The Macnaught Litre-Stroke was portable and was equipped with a 50 mm (nominal 2 inch NPT) bung adaptor to fit standard fuel tank openings. The bung adaptor could not be turned relative to the pump body, making it difficult to install in a fuel tank since the entire pump body and hose had to be turned. A rotating bung adaptor is recommended to eliminate this problem. The bung adaptor was equipped with a lock collar, which allowed the pump to be rotated so the handle could be fixed in a convenient pumping position.

Filling A Fuel Tank: The outlet hose was equipped with a 140 mm (5.5 in) long pipe nozzle and coiled springs. The coiled springs were located at each end of the hose and prevented the hose from kinking when used to fill fuel tanks located higher than the fuel supply tank. Pumping at 25 strokes per minute, it took from 9 to 10 minutes to fill a 225 L (50 gal) tractor fuel tank with filler opening typically located 1 m (3.3 ft) higher than the top of a typical farm truck fuel supply tank.

Servicing: The outlet nozzle was equipped with a strainer that could be easily serviced by removing the nozzle from the outlet hose.

The pump required no lubrication.

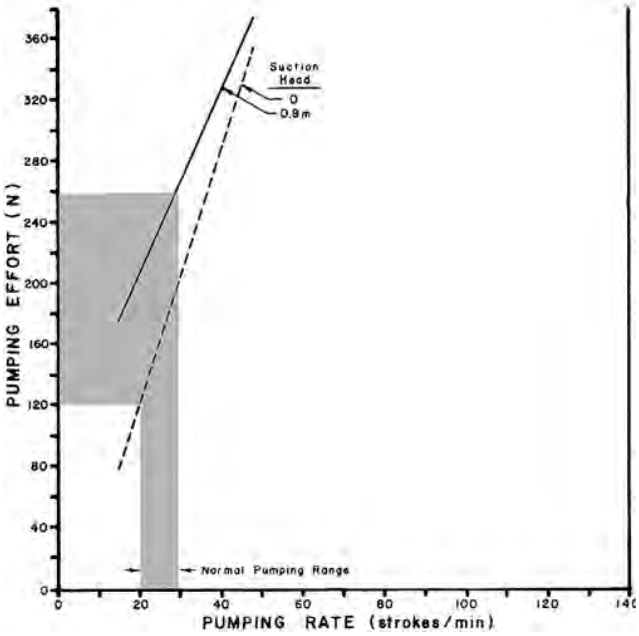

FIGURE 3. Pumping Effort with Diesel Fuel at Two Suction Heads.

SAFETY

The outlet nozzle end was slightly bent which prevented it from failing out of a filler opening when pumping. Care must be exercised to avoid overflow. To prevent overflow it is recommended that an automatic shut-off nozzle be made available as an option.

A locking bar was provided which permitted locking the pump handle in storage position.

OPERATOR'S MANUAL

A well illustrated, comprehensive parts list and operating instructions were supplied with the Macnaught hand pump.

MECHANICAL PROBLEMS

The Macnaught Litre-Stroke was operated for about 3 hours. The intent of the test was an evaluation of functional performance and an extended durability evaluation was not conducted.

A few mechanical problems occurred during the functional evaluation. The ratchet plate, spring and circlip (FIGURE 4) came off the inlet valve assembly, causing the pump handle to jam. This damaged the inlet valve stem and lower body assembly, which had to be replaced. It is recommended that the manufacturer investigate the possibility of modifying the inlet valve assembly to eliminate this problem.

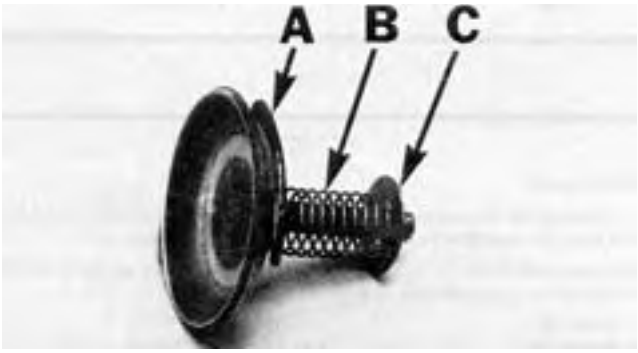

FIGURE 4. Inlet Valve Assembly: (A) Circlip, (B) Spring, (C) Ratchet Plate.

The pump was received with the inlet valve assembly improperly positioned in the lower body assembly (FIGURE 5), necessitating repositioning before the pump would operate.

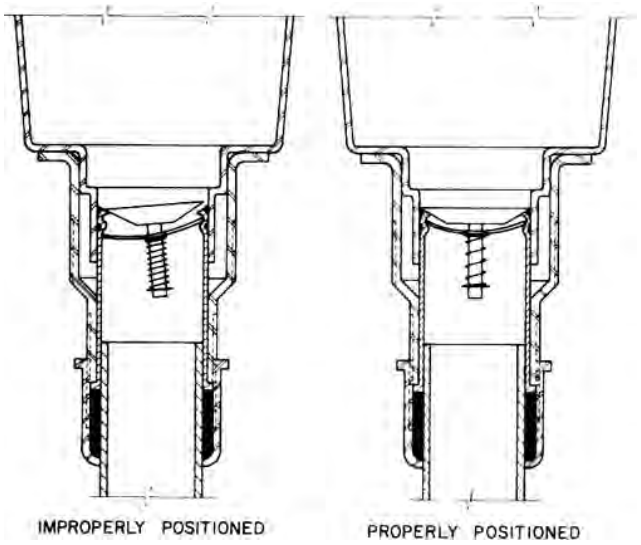

FIGURE 5. Inlet Valve Assembly.

APPENDIX I
SPECIFICATIONS

MAKE:	Macnaught Litre-Stroke
MODEL:	HM
OVERALL DIMENSIONS:	
-- height	533 mm (21 in)
-- width	210 mm (825 in)
-- length	152 mm (6 in)
-- pump handle length	338 mm (13.25 in)
TOTAL WEIGHT:	7 kg (15 lb)
SUCTION PIPE:	
-- size	25 mm (nominal 1 inch NPT)
-- telescoping length	520 to 1000 mm (20 to 39 in)
-- storage tank bung adaptor	50 mm (nominal 2 inch NPT)
DISCHARGE HOSE:	
-- size	25 mm (1 in)
-- length	2.5 m (8 ft)

APPENDIX II
METRIC UNITS

In keeping with the Canadian metric conversion program this report has been prepared in SI units. For comparative purposes, the following conversions may be used:

1 litre per minute (L/min)	= 0.22 Imperial gallons per minute (gal/min)
1 metre (m) = 1000 millimetres (mm)	= 39.37 inches (in)
1 Newton (N)	= 0.22 pounds force (lb)
1 kilogram (kg)	= 2.20 pounds mass (lb)

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