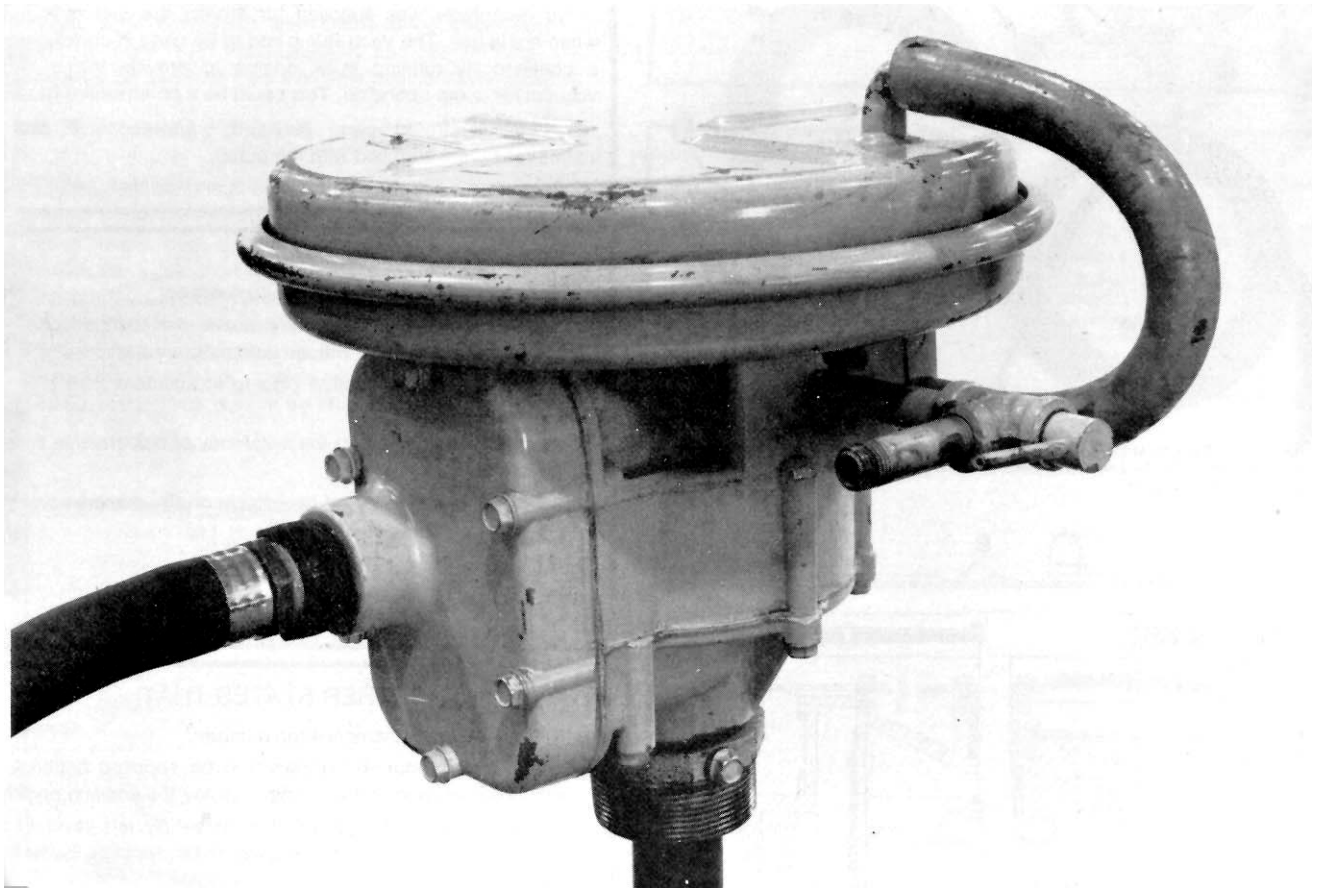


Evaluation Report 67



Scienco Model VP-15X Vacu-Pump

A Co-operative Program Between



SCIENCO MODEL VP-1 5X VACU-PUMP

MANUFACTURER:

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DISTRIBUTOR:

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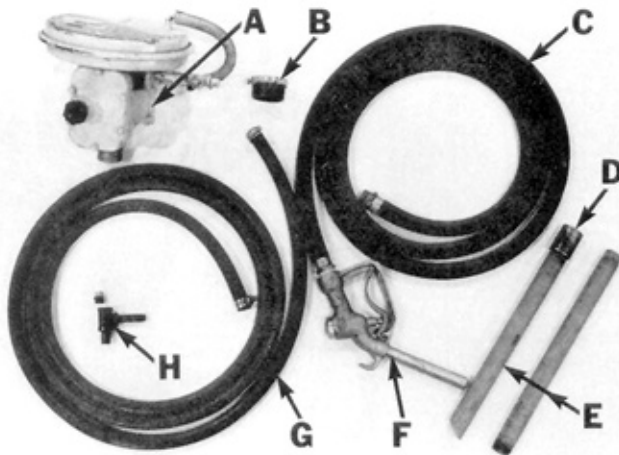


FIGURE 1. Scienco Model VP-15X Vacu-Pump: (A) Pump Body, (B) Bung Adaptor, (C) Outlet Hose, (D) Coupler, (E) Suction Pipes, (F) Outlet Nozzle, (G) Vacuum Hose, (H) Manifold Tee Adaptor.

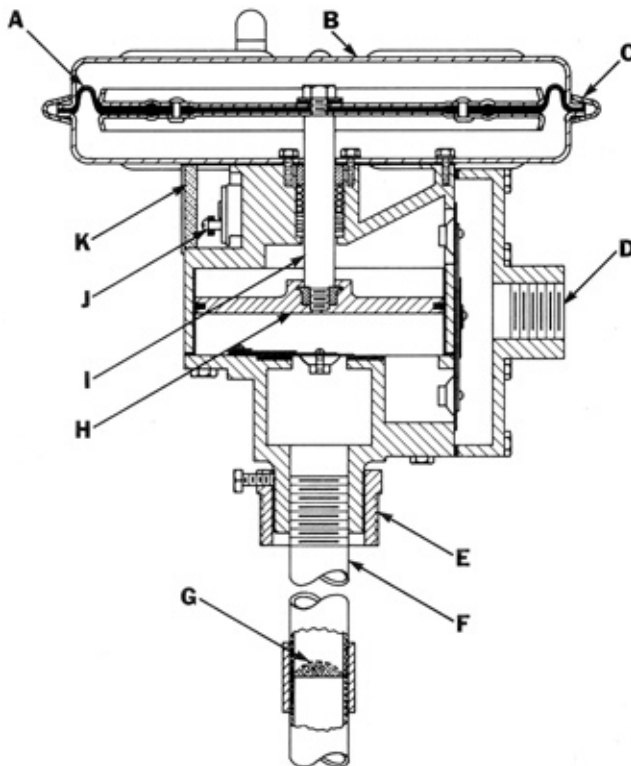


FIGURE 2. Schematic View of Scienco Vacu-Pump: (A) Diaphragm, (B) Diaphragm Housing, (C) Diaphragm Housing Band, (D) Discharge Opening, (E) Bung Adaptor, (F) Suction Pipe, (G) Strainer, (H) Piston, (I) Connecting Rod, (J) Flipper Valve Assembly, (K) Filter.

SUMMARY AND CONCLUSIONS

Flowrate for the Scienco Model VP-15X fuel transfer pump, operating from an engine intake manifold vacuum of 64 kPa (9.3 psi), when pumping diesel fuel at zero suction and discharge heads, was 44 L/min (9.7 gal/min). Increasing the suction head to 0.9 m (3 ft) and the discharge head to 2.7 m (9 ft) reduced the flowrate to 40 L/min (8.8 gal/min). Maximum measured flowrate was 23% less than the manufacturer's stated capacity. It took from 5 to 5.5 minutes to fill a 225 L (50 gal) tractor fuel tank located about 1 m (3.3 ft) above the fuel supply tank.

Flowrate decreased slightly with decreased manifold vacuum. For example, reducing the vacuum from 64 kPa (9.3 psi) to 50 kPa (7.3 psi) resulted in flowrate decreasing from 44 L/min (9.7 gal/min) to 35 L/min (7.7 gal/min).

The Scienco Vacu-Pump was very portable and easy to install in a fuel supply tank since it was equipped with a rotating bung adaptor. Connecting the vacuum hose to the pump body and truck engine was convenient. The suction strainer was easily serviced.

No receptacle was supplied for storing the fuel outlet nozzle when not in use. The Vacu-Pump had to be used in conjunction with a continuously running truck engine to provide intake manifold vacuum for pump operation. This could be a potential fire hazard.

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

No mechanical problems occurred during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying, as an option, a pump nozzle that can be locked open and which is equipped with an automatic shut-off.
2. Supplying a longer suction pipe to fit standard 205 L (45 gal) drums.
3. Supplying information on the frequency of flipper valve assembly lubrication.
4. Supplying a dust shielded receptacle on the pump body to store the nozzle when not in use.

Chief Engineer: E. O. Nyborg

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Project Technologist: L. B. Storozynsky

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. An automatic shut-off nozzle could be supplied depending on customer demand and willingness to pay the addition price.
2. Suction pipe length has been purposefully left short to avoid pumping dirt and condensate water often found at the bottom of fuel drums.
3. Frequency of flipper valve assembly lubrication will be included in the next edition of the operator's manual.
4. This recommendation will be taken under consideration.

MANUFACTURER'S ADDITIONAL COMMENTS

It is our feeling that the maximum flowrate obtained was less than the manufacturer's rating due to one or all of the following reasons:

1. The fuel outlet port will accommodate a 25 mm (1 in) hose but only a 19 mm (0.75 in) hose was used for the tests. This could cause some restriction and reduce pumping capacity.
2. The maximum flowrates obtained in the test were at a pumping rate of 72 strokes per minute. As the pump is worn in this should increase to the 84 to 90 strokes per minute upon which we based our rating.
3. The condition of the truck engine used is of major importance so it can supply the intake manifold vacuum required to get the maximum flowrate.

GENERAL DESCRIPTION

The Scienco Model VP-15X is a self-priming, vacuum operated, double action piston pump. It is powered by intake manifold vacuum from a gasoline engine. The vacuum actuated diaphragm operates the piston through a connecting rod (FIGURE 2). The Scienco Vacu-Pump is designed for pumping gasoline, diesel fuel, or solvents from above ground tanks or drums equipped with 50 mm (nominal 2 inch NPT) openings. It is equipped with a vacuum supply valve, a 4.1 m (13.5 ft) outlet hose with standard fuel pump nozzle, a 4.6 m (15 ft) vacuum hose and an 840 mm (33 in) long suction pipe. The vacuum hose attaches to a farm truck engine intake manifold with a pipe nipple and tee.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Scienco Model VP-15X Vacu-Pump was evaluated for ease of operation, power requirements and safety. Pump performance characteristics at various engine intake manifold vacuums, suction and discharge heads were determined with diesel fuel. In addition, limited tests were conducted with the Scienco Vacu-Greaser to determine if both the Vacu-Greaser and Vacu-Pump could simultaneously be operated from the same engine intake manifold.

RESULTS AND DISCUSSION

PUMP PERFORMANCE

Flowrates: Pump performance characteristics with diesel fuel, for two suction heads, over a typical range of discharge heads, are given in FIGURE 3. Suction head is the distance the fuel level is below the pump body and discharge head is the height the outlet nozzle is held above the pump. The 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. FIGURE 3 shows flowrates at a typical truck engine intake manifold vacuum of 64 kPa (9.3 psi).

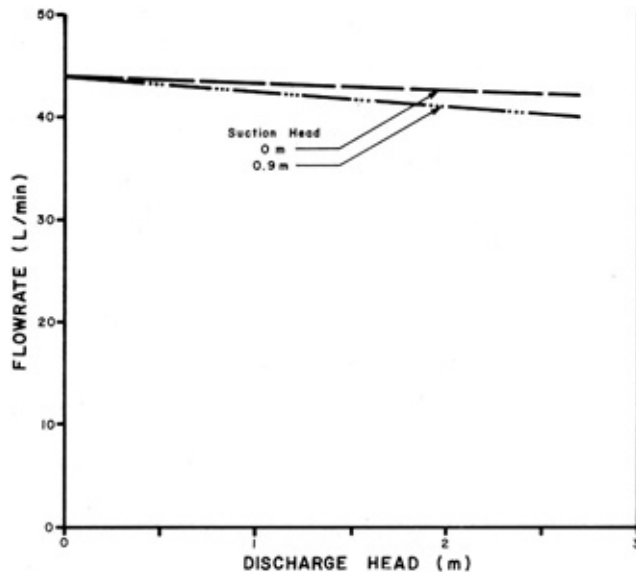


FIGURE 3. Pump Performance Characteristics with Diesel Fuel Operated at an Engine Intake Manifold Vacuum of 64 kPa.

The maximum flowrate of 44 L/min (9.7 gal/min) was obtained at zero suction and discharge heads and at a pumping rate of 72 strokes per minute. Increasing the suction or discharge heads reduced the flowrate only slightly. For example, increasing the suction head to 0.9 m (3 ft) and the discharge head to 2.7 m (9 ft) resulted in a flowrate of 40 L/min (8.8 gal/min). This combination of suction and discharge heads is more severe than would be encountered in transferring fuel to most farm machinery and represents a 9% decrease in flowrate.

In filling a typical farm tractor, with filler opening about 1 m (3.3 ft) above the top of the fuel supply tank and with the fuel supply tank one-half full, the flowrate would be about 43 L/min (9.5 gal/min).

The maximum flowrate of 44 L/min (9.7 gal/min) was 23% less than the manufacturer's stated flowrate of 57 L/min (12.5 gal/min).

VACUUM REQUIREMENTS

The Scienco Vacu-Pump could be operated from any gasoline engine intake manifold. Normal intake manifold vacuum at idle, for most farm trucks, ranges from 50 to 75 kPa (7.3 to 10.9 psi). FIGURE 4 shows the effect of engine intake manifold vacuum on flowrate at zero suction and discharge heads. At an intake manifold vacuum of 64 kPa (9.3 psi) the flowrate was 44 L/min (9.7 gal/min). With an engine intake manifold vacuum of 50 kPa (7.3 psi), the flowrate was reduced to 35 L/min (7.7 gal/min).

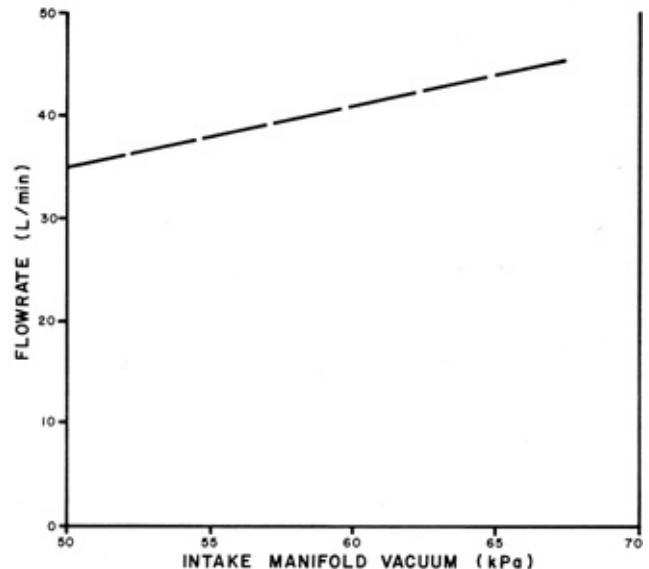


FIGURE 4. Flowrates for a Pump Operating at Different Intake Manifold Vacuums at Zero Suction and Discharge Heads.

Fuel Tank Connection: The Scienco Vacu-Pump was portable and was equipped with a 50 mm (nominal 2 inch NPT) bung adaptor to fit standard fuel tank openings. The bung adaptor turned relative to the pump body, making it very easy to install in a fuel supply tank.

The 840 mm (33 in) long plastic suction pipe could be cut to a suitable length to fit most fuel supply tanks, but was too short to reach the bottom of standard 205 L (45 gal) drums. It is recommended that the manufacturer provide a longer suction pipe to fit standard 205 L (45 gal) drums.

Vacuum Hose Connection: The manifold tee adaptor fit all standard 9.5 mm (nominal 0.375 inch NPT) engine manifold openings. The vacuum hose was easily attached to the pump body and manifold adaptor.

Filling A Fuel Tank: The on-off valve conveniently controlled pump operation. In addition, the outlet hose was equipped with a standard lever operated fuel nozzle. It took about 45 N (10 lb) hand force to hold the nozzle lever.

It took from 5 to 5.5 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. An optional fuel supply nozzle that could be locked open, equipped with an automatic shut-off when filled, would be beneficial for large tractors as it would free the operator to do other servicing while refueling.

Servicing: The Scienco Vacu-Pump was equipped with a suction fuel strainer located between the two lengths of suction pipe (FIGURE 2). It could be easily serviced by removing the bottom half of the suction pipe.

The flipper valve assembly (FIGURE 2) was factory lubricated. Further lubrication requirements were not indicated in the operating instructions. It is recommended that lubrication information be given in the operating instructions.

THE SCIENCO VACU-GREASER

The manufacturer also fabricates a vacuum operated grease pump (FIGURE 5). Although the Vacu-Pump and the Vacu-Greaser

are separate units, designed for individual use, the manufacturer indicates that both may be powered from the same truck intake manifold. Only limited tests were conducted with the Vacu-Greaser to determine if both the Vacu-Greaser and the Vacu-Pump could simultaneously be operated from the same engine intake manifold when both are used to equip a farm service truck.

Operating both units simultaneously, from the same engine intake manifold, reduced the Vacu-Pump output by about 14% and reduced the Vacu-Greaser output by about 90%. For example, at a typical 64 kPa (9.3 psi) manifold vacuum, Vacu-Pump output decreased from 44 to 38 L/min (9.7 to 8.8 gal/min) when the Vacu-Greaser was used at the same time that fuel was being pumped. Similarly, at the same manifold vacuum, Vacu-Greaser output decreased from 31 to about 3 strokes per minute, when fuel was being pumped at the same time that the Vacu-Greaser was used.

It may be concluded that, although both the Vacu-Greaser and Vacu-Pump may be powered from the same engine intake manifold, attempting to use the greaser during re-fueling is impractical since the greaser output is severely reduced. For one person to operate both units simultaneously, the fuel pump nozzle should also be equipped with an automatic shut-off that locks open to prevent overfilling.

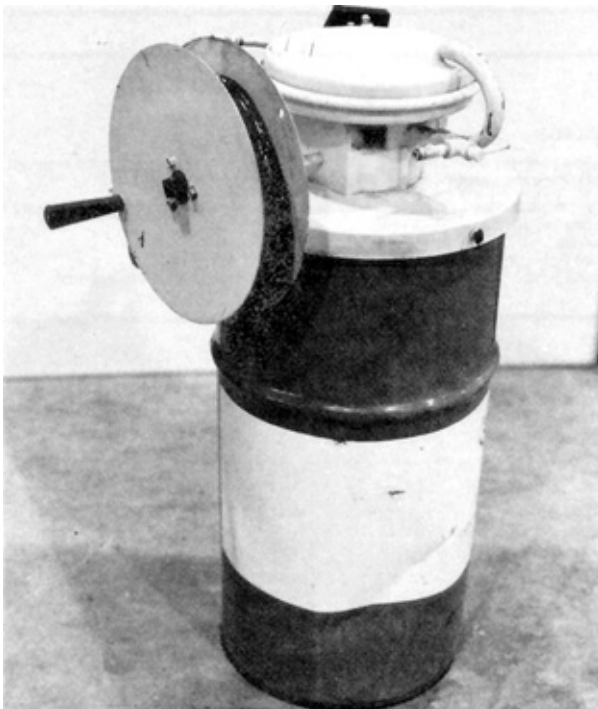


FIGURE 5. Scienco Vacu-Greaser.

SAFETY

The outlet nozzle, when not in use, had to be placed on top of the fuel supply tank or in the fuel supply tank, as no storage receptacle was provided. This was inconvenient and could also result in dirt accumulating on the nozzle. It is recommended that the manufacturer supply a dust shielded receptacle on the pump body to store the nozzle when not in use.

Since it was necessary to run the truck engine while refueling, extreme caution should be observed to prevent possible fuel vapour ignition from engine exhaust.

OPERATOR'S MANUAL

The operator's manual contained clearly illustrated installation, operation, and servicing instructions. A comprehensive, well illustrated parts list was also provided.

MECHANICAL PROBLEMS

The Scienco Vacu-Pump was operated for about 5 hours. The intent of the test was evaluation of functional performance and an extended durability evaluation was not conducted. No mechanical problems occurred during testing.

APPENDIX I	
SPECIFICATIONS	
MAKE:	Scienco Vacu-Pump
MODEL:	VP-15X
POWER SOURCE:	Gasoline Engine Intake Manifold Vacuum
DUTY CYCLE:	Continuous Duty
OVERALL DIMENSIONS:	
- height	280 mm (11 in)
- width	349 mm (13.7 in)
- length	288 mm (11.3 in)
TOTAL WEIGHT:	12.7 kg (28 lb)
SUCTION PIPE:	
- size	25 mm (nominal 1 inch NPT)
- length	840 mm (33 in)
- storage tank bung adaptor	50 mm (nominal 2 inch NPT)
DISCHARGE HOSE:	
- size	20 mm (0.75 in)
- length	4.1 m (13.5 ft)
VACUUM HOSE:	
- size (inside diameter)	13 mm (0.5 in)
- length	4.6 m (15 ft)
MAINFOLD ADAPTOR:	
- tee	9.5 x 9.5 x 6.4 mm (nominal 0.375 x 0.375 x 0.250 inch NPT)
- pipe nipple	9.5 mm (nominal 0.375 inch NPT)
VACUUM HOSE ADAPTORS (2):	
- length	50 mm (2 in)
- size	6.4 mm (nominal 0.25 inch NPT)

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)
1 kilopascal (kPa)	= 0.145 pounds per square inch (psi)



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