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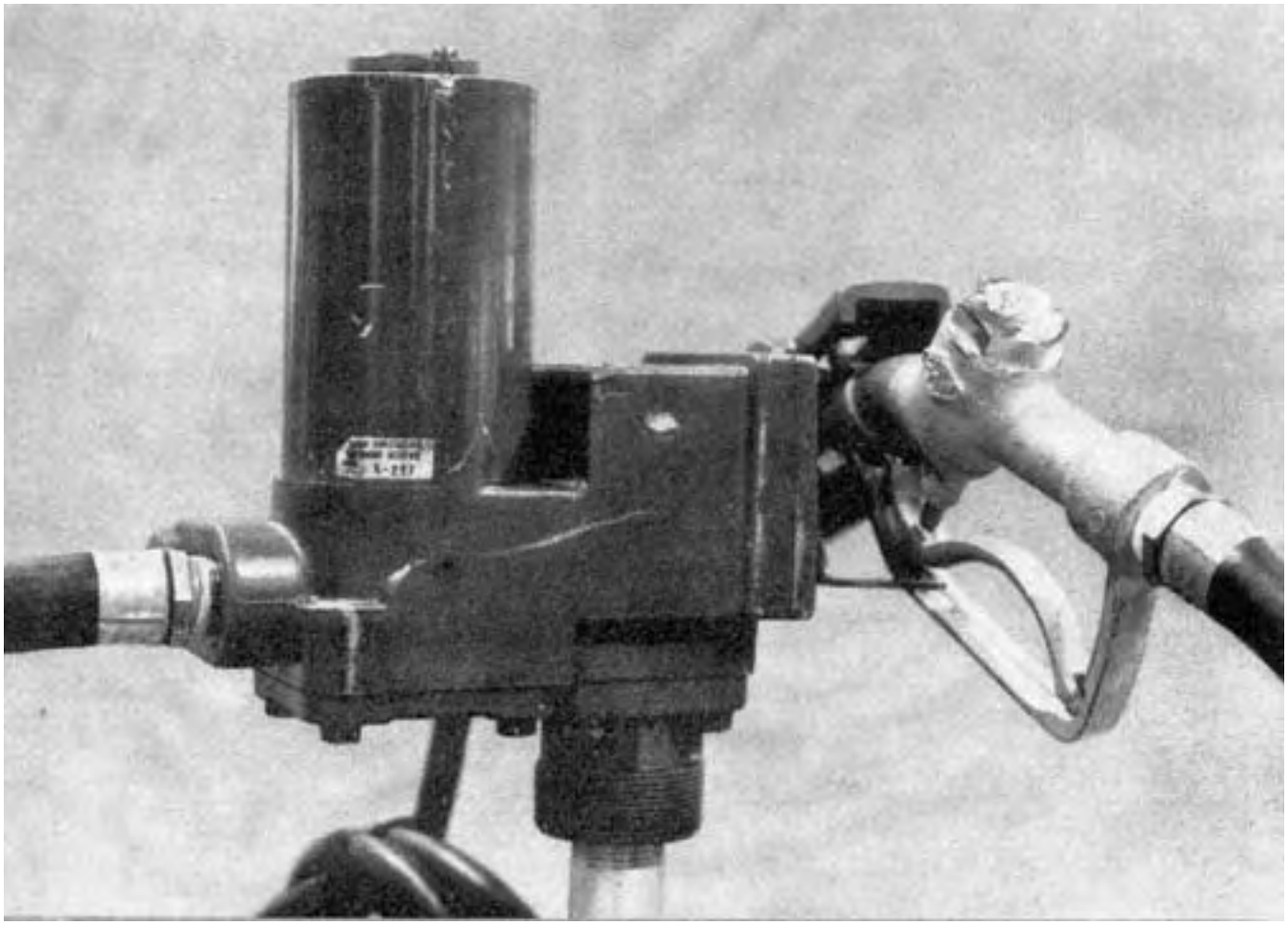

Mico Model VP-1 (02-820-100) Fuel Transfer Pump

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

MICO MODEL VP-1 FUEL TRANSFER PUMP

MANUFACTURER:

Minnesota Automotive, Inc.
1911 Lee Blvd.
North Mankato, Minnesota 56001
U.S.A.

DISTRIBUTOR:

Oliver Industrial Supply Ltd.
236 - 36th Street North
Lethbridge, Alberta
T1J 4B2

RETAIL PRICE:

$321.75 (January, 1979, f.o.b. Lethbridge)

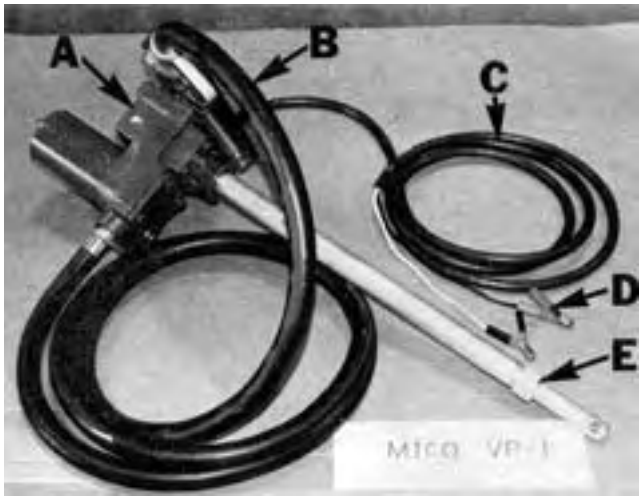

FIGURE 1. Mico Model VP-1 Fuel Transfer Pump: (A) Pump Body, (B) Outlet Hose, (C) Battery Cable, (D) Battery Clamps, (E) Telescoping Suction Pipe.

SUMMARY AND CONCLUSIONS

The flowrate for the Mico Model VP-1 fuel transfer pump, when pumping diesel fuel with a fully charged 12 volt battery at zero suction and discharge heads was 39 L/min (8.6 gal/min). Increasing the suction head to 0.9 m (3 ft) and the discharge head to 2.7 m (9 ft) resulted in a 36% reduction in flowrate. Maximum measured flowrate was 20% less than the manufacturer's stated capacity. It took from 6 to 6.5 minutes to fill a 225 L (50 gal) tractor fuel tank located about 1 m (3.3 ft) above the fuel supply tank.

Power consumption at 12 volts was 216 watts with a corresponding current draw of 18 amps. A fully charged 12 volt battery could operate the pump for several hours without recharging.

The Mico VP-1 was very portable. The pump was difficult to install 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. Electrical connections were simple. The motor had a continuous running time of 30 minutes. As a result, from 750 to 1170 L {165 to 257 gal) could be continuously pumped before the motor had to be allowed to cool.

The Mico VP-1 was equipped with a suction screen that was easily serviced by removing the bung adaptor from the pump body.

The Mico VP-1 was safe to operate if normal safety precautions for transferring fuel were observed.

A well illustrated parts list and comprehensive operating instructions were provided.

No mechanical problems occurred during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying a rotating bung adaptor.
2. Supplying, as an option, a fuel supply nozzle that can be locked open and which is equipped with an automatic shut-off.
3. Modifications to the switch lever to prevent it from accidentally turning on when the nozzle is removed from its receptacle.

Chief Engineer: E. O. Nyborg
Senior Engineer: E. H. Wiens
Project Technologist: L. B. Storozynsky

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. This has not been a common complaint. However, a standard union and short pipe nipple would satisfy this recommendation. These are readily available at hardware or plumbing supply houses.
2. Automatic nozzles are readily available from petroleum equipment supply houses and will work on this pump. We've not had any complaints on the pump being turned on accidentally. However, we shall study the feasibility of making it accident proof.

GENERAL DESCRIPTION

The Mico Model VP-1 (02-820-100) is a self-priming, positive displacement rotary vane pump driven by a 12 volt DC electric motor, adaptable to either negative or positive ground vehicle electrical systems. It is designed for pumping gasoline, kerosene, or diesel fuel from above ground tanks or drums equipped with 50 mm (nominal 2 inch NPT) openings. An optional changeover kit is available to convert the pump for pumping oil. The pump is equipped with a 1016 mm (40 in) telescoping suction pipe, a 4.1 m (13.5 ft) outlet hose with standard fuel pump nozzle and a 3.7 m (12 ft) battery cable with alligator clamps. It is supplied with an automatic bypass valve to permit intermittent pumping while the motor is running. The pump nozzle, when not in use, is stored within a dust shielded receptacle on the pump body.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Mico Model VP-1 (02-820-100) was evaluated for ease of operation, power consumption and safety. Pump performance characteristics at various voltages, suction and discharge heads were determined with diesel fuel.

RESULTS AND DISCUSSION

PUMP PERFORMANCE

Flowrate: Pump performance characteristics with diesel fuel, for two suction heads over a typical range of discharge heads, are given in FIGURE 2. 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. The flowrates in FIGURE 2 are for a pump powered with a fully charged 12 volt battery.

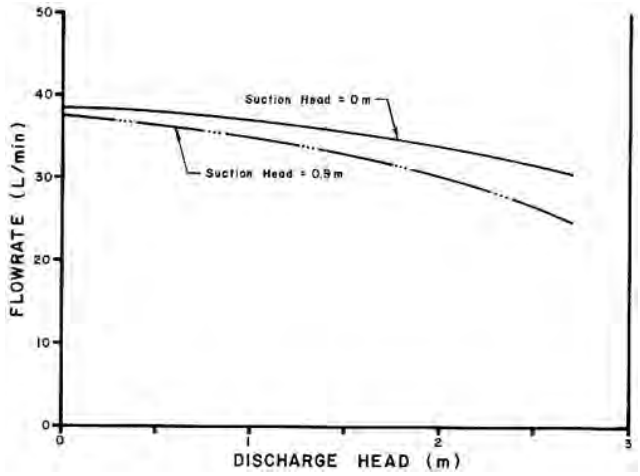

FIGURE 2. Pump Performance Characteristics with Diesel Fuel when Powered with Fully Charged 12 Volt Battery.

The maximum flowrate of 39 L/min (8.6 gal/min) was obtained at zero suction and discharge heads. Increasing suction and discharge heads reduced the flowrate significantly. 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 25 L/min (5.5 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 36% 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, flowrate would be about 36 L/min (7.9 gal/min).

The maximum flowrate of 39 L/min (8.6 gal/min) was 20% less than the manufacturer's stated flowrate of 49 L/min (10.8 gal/min).

Duty Cycle: Adequate protection was provided to prevent the pump motor from burning out due to continuous operation or operating on bypass for too long. The pump was equipped with a thermal overload protector located near the bottom of the pump motor. Tests showed that the pump could be operated longer than the 30 minute duty cycle specified by the manufacturer, before the thermal protector stopped the pump.

When operating the pump with all the fuel flowing through the bypass valve, the thermal protector stopped the pump after 15 minutes. The temperature in the vicinity of the thermal protector was about 55° C while the temperature near the top of the motor was above 65° C. This is very hot to the touch. The service instructions supplied with the pump, cautioned against handling the pump after prolonged use due to the pump casing becoming hot.

POWER CONSUMPTION

FIGURE 3 shows the effect of battery voltage on flowrates and also indicates the corresponding current draw. A fully charged 12 volt battery will deliver 12 volts. Since the current draw at 12 volts was only 18 amps, the maximum flowrate of 39 L/min (8.6 gal/min) can be expected for several hours operation with a good battery, without recharging. There should, therefore, be no need to consider charging a truck battery by running the truck motor while refueling. A running engine could result in-the exhaust igniting fuel vapours.

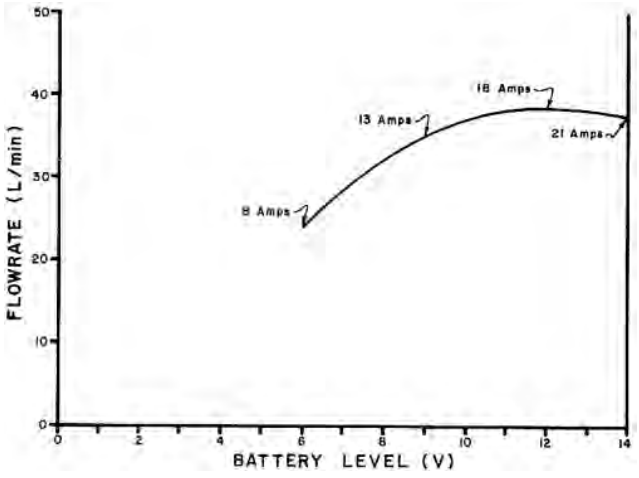

FIGURE 3. Flowrates with Diesel Fuel at Zero Suction and Discharge Heads for Various Battery Voltages.

A typical battery under charge will deliver more than 12 volts. Tests indicated that the maximum flowrate was obtained at 12 volts and that pump capacity levelled off or decreased slightly at higher voltages. At 14 volts the flowrate decreased to 38 L/min (8.4 gal/min) with a corresponding current draw of 21 amps. This means that while the flowrate decreased., the current draw increased 17% while charging the battery during pumping. As a result, power consumption increased from 216 watts at 12 volts to 294 watts at 14 volts. Since most of the additional power has to be dissipated as heat in the pump motor, operating the pump with the battery under charge would serve to decrease the pump duty cycle, due to motor overheating. This further substantiates that the pump not be operated while vehicle engines are running.

EASE OF OPERATION

Fuel Tank Connection: The Mico VP-1 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.

Electrical Connection: Electrical connections were simple. The Mico VP-1 battery cable was equipped with two alligator clamps for connecting the pump to a battery. The pump could be operated on either positive or negative ground vehicle electrical systems. However, care had to be taken to install the black cable lead to the ungrounded battery terminal in order for the pump to operate. A circuit breaker, to be connected adjacent to the battery clamp on the ungrounded battery terminal, was made available as an option.

Filling A Fuel Tank: 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. The automatic bypass valve in the pump permitted intermittent closing of the nozzle lever while the motor was running.

It took from 6 to 6.5 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. The pump had a 30 minute duty cycle. As a result, from 750 to 1170 L (165 to 255 gal) could be continuously pumped before the electric motor had to be allowed to cool.

Servicing: The Mico VP-1 was equipped with a suction screen, which could be easily serviced by removing the bung adaptor on the pump body. The pump and motor required no lubrication.

SAFETY

The on-off switch lever could be turned on with the nozzle in its receptacle and also could be accidentally turned on when removing the nozzle from its receptacle. This could result in fuel being accidentally pumped, which would be a safety hazard near running engines. It is recommended that the manufacturer make modifications to prevent the switch lever being accidentally turned on. A hole in the nozzle receptacle was provided to permit locking the nozzle in storage position.

To prevent possible ignition of fuel vapours from engine exhaust, it is advised when using the pump that the vehicle engine be shut off. Since the current draw of the pump was only 18 amps at a battery voltage of 12 volts, there was no need to charge the battery while pumping. A fully charged battery would provide several hours of pumping before recharging was necessary.

OPERATOR'S MANUAL

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

MECHANICAL PROBLEMS

The Mico VP-1 was operated for about 4 hours. The intent of the test was an evaluation of functional performance and an extended durability evaluation was not conducted.

No mechanical problems occurred during the functional evaluation.

APPENDIX I
SPECIFICATIONS

MAKE:	Mico Fuel Transfer Pump
MODEL:	VP-1 (02-820-100)
SERIAL NUMBER:	V6188
DUTY CYCLE:	
-- normal operation 3	0 minutes
OVERALL DIMENSIONS:	
-- height	270 mm (10.6 in)
-- width	282 mm (11 in)
-- length	215 mm (8.5 in)
TOTAL WEIGHT:	11.8 kg (26 lb)
SUCTION PIPE:	
-- size	25 mm (nominal 1 inch NPT)
-- telescoping length	527 to 1016 mm (20.75 to 40 in)
-- storage tank bung adaptor	50 mm (nominal 2 inch NPT)
DISCHARGE HOSE:	
--- size	20 mm (0.75 in)
-- length (with nozzle)	4.1 m (13.5 ft)
MOTOR:	
-- power requirement	12 V DC
-- polarity	either negative or positive
-- battery cable length	3.7 m (12 ft)
-- battery connectors	alligator clamp

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)

ALBERTA FARM MACHINERY RESEARCH CENTRE

3000 College Drive South
Lethbridge, Alberta, Canada T1K 1L6
Telephone: (403) 329-1212
FAX: (403) 329-5562
http://www.agric.gov.ab.ca/navigation/engineering/afmrc/index.html

Prairie Agricultural Machinery Institute
Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-2555

Test Stations:

P.O. Box 1060
Portage la Prairie, Manitoba, Canada R1N 3C5
Telephone: (204) 239-5445
Fax: (204) 239-7124

P.O. Box 1150
Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-5033
Fax: (306) 682-5080