August 17, 1964

SERVICE BULLETIN #5

TO ALL MAJOR PUMP CUSTOMERS:

SERVICE DEPARTMENT - EM GOVERNORS

We have found in servicing the EM Governor, that on the replacement of the actuator into the body of the Governor, the "O" Ring 40-3N56 is being cut. This will give malfunction of the governor especially when operating at pressures of 250 P.S.I. and above.

We are enclosing Plate #516A and recommend that when servicing the EM Governor, a bearing scraper be used and the sharp edge in the body of the governor be smoothed. Using Plate #516A as a guide, we have marked by red arrow the area to be scraped. The edge is very small so the scraper need only be run around the opening once or twice, removing only a small amount of metal.

EM Governors beginning with Serial #G-377 need not be checked for this sharp edge. We are removing it in our machining operation.

Very truly yours,
HALE FIRE PUMP COMPANY

C. R. Shaffer
Service Manager

encl.
Operating & Service Instructions
(1-12A-2) (2-26-64)
Plate #516A
HALE MODEL EM ENGINE MASTER GOVERNOR

PRINCIPLES OF OPERATION & SERVICE CHART

FOR AUTOMATIC CONTROL

WITH REQUIRED DISCHARGE VALVES OPEN, TURN OUT THROTTLE KNOB (COUNTERCLOCKWISE) TO ABOUT 100°, ABOVE DESIRED OPERATING PRESSURE, WAIT APPROXIMATELY 3 SECONDS, THEN PULL OUT ACTUATOR KNOB TUM THROTTLE KNOB IN; GOVERNOR IS NOW OPERATING ON AUTOMATIC CONTROL.

TO SHUT DOWN, PUSH ACTUATOR KNOB IN. FOR DETAILED INSTRUCTIONS REFER TO HALE DESCRIPTION AND OPERATING INSTRUCTION SHEETS.

LEGEND

- WATER-TRAPPED RETAIN REFERENCE OR ORIGINAL SET PRESSURE
- WATER-PRESSURE VARIES WITH PUMPING CONDITION

FIG I
GOVERNOR OPERATING
(AUTOMATIC CONTROL)

HALE FIRE PUMP CO.
CONSHOHOCKEN, PA.

FIG II
GOVERNOR NOT OPERATING
(HAND THROTTLE CONTROL)
HALE MODEL EM ENGINE MASTER GOVERNOR
PATENT NO. 3,116,694
OPERATING & SERVICE INSTRUCTIONS

OPERATING INSTRUCTIONS

PRINCIPLE OF OPERATION

The Hale EM Governor is a basic design using a "balanced piston-air spring" principle to maintain relatively constant pump pressure by regulating the engine throttle.

Referring to the attached cross section (Fig. 1), trapped air pressure in the tank exerts a force (A) on the piston which tends to open the throttle and raise the pump pressure until it exerts a balancing force (B) on the opposite side of the piston. If the pump pressure tends to rise (from closing a valve) it will overcome force (A) and close the throttle. Conversely, when the pump pressure drops (from opening a valve) force (A) will overcome force (B) and open the throttle.

Following is an explanation of the function of the governor controls on the panel:

ACTUATOR

An actuator valve controls the "On - Off" condition of the governor. If this actuator is pushed in (as shown in Fig. II), the governor is "Off" because it allows pump pressure to act on both sides of the piston. Consequently, the return spring will hold the throttle closed.

When the actuator is pulled out (as shown in Fig. I), the governor is "On". This position on the actuator engages an "O" ring which seals off the pump discharge pressure so that it can only push against one side (B) of the piston. At the same time, the air pressure is trapped in the tank which results in a constant "reference pressure" pushing on the other side (A) of the piston.

THROTTLE

With the actuator pushed in, the throttle knob may be used as a conventional panel mounted hand throttle control as shown in Fig. II. That is, backing out on the knob (turning counterclockwise) will compress the return spring and open the throttle; turning it in (clockwise) will close the throttle.

DAMPENER NEEDLE

The purpose of the check valve and adjustable dampener needle valve is to minimize the tendency of the piston to override or go into a "hunting" or "surging" condition. The check valve opens on rising pump pressure to permit a fast response of the piston in closing the throttle, thus protecting the men on the hose lines. When the pump pressure drops, the check valve closes and the water leaving the cylinder is diverted through (and around) the needle valve. The needle valve contains a short length of capillary tubing. This slows down the rate of throttle opening and prevents the piston from overriding or "surging." For faster pressure recovery (or rate of throttle opening), the needle valve may be backed out (screwed counter-clockwise) a few turns; however, backing out too far may cause a tendency to hunt. Do not unscrew this needle valve all the way while pump is operating. Usually, satisfactory operation can be obtained with the dampener needle screwed all the way in.

OPERATING THE GOVERNOR FOR AUTOMATIC CONTROL

Always start pumping with the actuator knob pushed in. With the required discharge valve open, raise the pump pressure by backing out on the throttle knob to obtain about 5 or 10 psi above the desired operating pressure. Wait approximately 3 seconds (to allow the air tank to fill up to operating pressure), then pull the actuator knob. Be sure to pull the actuator all the way out to engage the "O" ring seal. Turn the throttle knob all the way in; governor is now in operation. To change the pressure setting while pumping, back out on the throttle knob until it butts the acorn nut. Push the actuator in and reset as described previously. To shut down, push the actuator in.

There is an alternate method of setting the governor which may be used for pumping conditions that have a slight tendency to hunt when all valves are closed. This is most likely to happen at low power settings; for instance, with the pump in series, low flow and low pressure. This alternate method is as follows:

With all discharge valves closed, and actuator in, open throttle to about 10 or 15 psi above desired operating pressure. Pause 3 seconds and pull out actuator, (do not change hand throttle setting); open discharge valves. The governor is now engaged and will automatically open the throttle to maintain pump pressure.
OPERATING INSTRUCTIONS CONTINUED

PRESSURE RISE

The primary purpose of the governor is to protect the man at the nozzle from a dangerous pressure rise. Without the governor, this could happen when two nozzles are used and one of them is shut down suddenly, the other one could experience an unexpected sharp pressure rise. A secondary purpose is to protect the hose and the pump.

However, at very low volumes (booster reel work, etc.), or very low power settings, the governor operation is not really necessary. Under these conditions, when the discharge valve is closed, there would be an insufficient pressure rise at the pump to damage it.

There is no minimum or maximum pressure rating on this governor, it will operate over the entire normal working range of the fire pump. The pressure rise should be from about 5 to 30 psi depending upon the pumping conditions. Generally speaking, high operating pressures and large changes in throttle setting will give the highest pressure rises.

SERVICE INSTRUCTIONS

SERVICING

Because of the simplicity of its design a properly installed EM Governor should require very little servicing. If the Hand Throttle Knob should become difficult to turn, remove the Dampener Needle (after shutting down the pump and draining systems to relieve pressure) and check for dirt blockings by running a 5 gauge (.014 in.) or smaller wire through the capillary tube. (This size wire can usually be obtained from a wire brush.) Care should be taken to relieve the pressure completely before removing the Dampener Needle. If this is not done, the check valve ball may be blown out of the Dampener Needle hole by the pump pressure when the Dampener Needle is removed for cleaning. Dirt blockage also causes very slow pressure recovery. Lubricate the threads on the Hand Throttle Knob and the ball bearing under the acorn nut occasionally with light grease.

When starting to pump (with Governor locked out) the Hand Throttle Knob may be difficult to turn rapidly at low pressure. This is a natural condition caused by the time delay required to fill the air tank and bring the piston into a balanced pressure condition. Therefore, in opening the throttle, the first few turns should be taken gradually; as the tank pressure increases, the Hand Throttle Knob will turn more freely.

If it requires considerably longer than three seconds for the air tank to fill to operating pressure, the Governor Panel Strainer may be clogged. Remove the Panel Strainer Cap and pull out Strainer Screen and flush until the screen is clear. To replace make sure two "O" Rings are on spool in Strainer Body, then slide Strainer Screen over spool and replace cap. Do not operate the Governor without this 60 mesh screen strainer in the circuit.

If there is a gradual drop in pressure while running governed, check for a leak in the air tank circuit. This situation could result from a worn or damaged "O" ring on the piston or in the actuator stem bore.

An excessive "pressure rise" could be caused by an excessive amount of water in the air tank. When the pump is not operating, there should be no water in the tank. An occasional draining of the tank might be necessary.

During freezing weather, the Governor and its piping system will require draining. Open the drain cock on the bottom of the air tank to drain the tank. With the main pump drains open, moving the Hand Throttle Knob to its extreme positions will help drain the Governor Body. Be sure to close all drains when finished.

To disassemble the Governor, refer to its cross sectional drawing and follow these instructions. Screw the Hand Throttle Knob all the way in. Pull out on the acorn nut to uncover 3/16" hole in piston stem and insert a drift pin in the hole, and remove the acorn nut. Unscrew the Hand Throttle Knob, disconnect the 3/8 tubing lines and Governor cable; remove the Governor by unscrewing the four corner Panel Screws. Remove the Governor Cable inner wire set screws, deburr & grease these tapped holes to prevent cutting "O" ring, then unscrew the three long 3/8 cap screws, slide off Rear Cover (EM-671D). The piston stem (EM-682F) assembly can be removed after deburring and greasing the piston stem acorn nut threads, to prevent damaging "O" ring.

When pumping with the Governor operating, pushing the actuator knob in should close the engine throttle to idle. If this does not happen there is excessive friction in the mechanism. Clean and oil the throttle linkage and check for kinks in the Throttle Cable. It may be necessary to disassemble the Governor and clean the cylinder bore. A light film of oil (SAE 10 or 20) on the bore and on the piston stem will help reduce the friction.
Service Instructions Continued

threads on the Handle Throttle Knob and the ball bearing under the acorn nut occasionally with light grease.

When starting to pump (with Governor locked out) the Hand Throttle Knob may be difficult to turn rapidly at low pressure. This is a natural condition caused by the time delay required to fill the air tank and bring the piston into a balanced pressure condition. Therefore, in opening the throttle, the first few turns should be taken gradually; as the tank pressure increases, the Hand Throttle Knob will turn more freely.

If it requires considerably longer than three seconds for the air tank to fill to operating pressure, the Governor Panel Strainer may be clogged. Remove the Panel Strainer Cap and pull out the Strainer Screen and flush until the metal screen and polyethylene tubing filter are clear. To replace, make sure two "O" Rings are on the spool in the Strainer Body, then slide Strainer Screen over spool and replace cap. Do not operate the Governor without this 60 mesh metal screen strainer in the circuit. In an emergency, the governor can be operated without the tubing filter over the 60 mesh metal strainer screen. As a precaution, we recommend stocking a spare filter in case the one in use is damaged.

If there is a gradual drop in pump pressure while running with the Governor operating, check for a leak in the air tank circuit. This situation could result from a worn or damaged "O" Ring in the Governor piston or in the actuator stem bore.

An excessive "pressure rise" could be caused by an excessive amount of water in the air tank. When the pump is not operating, there should be no water in the tank. Occasional draining of the tank might be necessary. In certain applications where the pressure rise is higher than 30 PSI, it may be necessary to shorten the throttle travel or add an extra air tank or both. If an extra tank is required, it should be piped in parallel with the other tank.

During freezing weather, the Governor and its piping system will require draining. Open the drain cock on the bottom of the air tank to drain the tank. With the main pump drains open, moving the Hand Throttle Knob to its extreme positions will help drain the Governor Body. Be sure to close all drains when finished.

To disassemble the Governor, refer to its cross sectional drawing and follow these instructions. Screw the Hand Throttle Knob all the way in. Pull out on the acorn nut to uncover the 3/16" hole in piston stem and insert a drift pin in the hole, and remove the acorn nut. Unscrew the Hand Throttle Knob, disconnect the 3/8 tubing lines and Governor cable; remove the Governor by unscrewing the four corner Panel Screws. Remove the Governor Cable inner wire set screws, deburr and grease these tapped holes to prevent cutting the "O" Ring in the rear cover, then unscrew the three long 3/8 cap screws and slide off Rear Cover (EM-671D). The piston stem (EM-682F) assembly can be removed after deburring and greasing the piston stem acorn nut threads, to prevent damaging the "O" Ring in the Front Cover.

When pumping with the Governor operating, pushing to actuator knob in should close the engine throttle to idle. If this does not happen there is excessive friction in the mechanism. Clean and oil the throttle linkage and check for kinks in the Throttle Cable. It may be necessary to disassemble the Governor and clean the cylinder bore. A light film of oil (SAE 10 or 20) on the bore and on the piston stem will help reduce the friction.
HALE MODEL EM ENGINE MASTER GOVERNOR  
Patent No. 3,116,694  
Installation Instructions

The Hale EM Governor Control will maintain relatively constant pump pressure by automatically adjusting the engine throttle to compensate for changing volume or pressures. However, its SUCCESSFUL OPERATION IS DEPENDENT ON A CORRECT INSTALLATION. Before installing the Governor, review the operating instructions, then read these instructions through thoroughly; careful adherence to them will insure proper Governor operation. We recommend furnishing the operating engineer a copy of the EM Governor Operating and Service Instructions at the time of delivery.

GOVERNOR CABLE

The attached schematic drawing shows the typical arrangement of the Governor elements. You will find it quite helpful if you detach it for reference while reading these instructions. The Governor should be conveniently located on the pump operating panel, at least one foot above the pump (for draining), and positioned for the shortest length of Governor Cable (2). Use enclosed panel cut-out template for mounting Governor, reinforce panel if necessary. Standard length of the Governor Cable is 1/4 feet - longer lengths are available on special order. This cable is especially designed with a low friction teflon plastic liner for this application. Do not use a substitute. The cable can be shortened to fit the application, thus keeping it to a minimum length with a minimum number of bends. Bends should not be less than 1/2 ft. radius, the object being to reduce the friction between control wire and the wire casing.

Keep the cable away from engine exhaust heat. If it is necessary to run the cable near engine exhaust, use automotive asbestos loom casing to protect the cable. Do not weld mounting brackets to the casing, as excessive heat will distort the plastic liner and produce friction. Be careful not to kink or twist the inner wire, as this too will result in excessive friction and cause poor governor control.

To shorten cable, retract the inner wire and cut the casing to size, deburr the casing ends. Cut the inner wire about 6" longer than the casing; deburr the wire ends to prevent cutting of the plastic when re-entering the wire. The plastic liner should not be removed from the casing as it is difficult to replace properly. Cut it about 1/2 inch longer than the casing on each end.

Start laying the Cable at the Governor by inserting the casing through the Cable Clamp (9). Then tighten this clamp. Install the metal Cable Clips (3) about every three feet and on each side of a bend. Do not fasten the Cable with friction tape as this will allow the Cable to move. Run the Cable into the engine compartment, check the inner wire for freedom of travel, then proceed to make the carburetor connections.

CARBURETOR CONNECTION

First disconnect the Foot Throttle Rod from the carburetor Butterfly Throttle Arm and assemble the Sliding Clevis (8) to the Foot Throttle Rod. (This may require some modification to the rod.) Now put the Throttle Arm Extension (4) through the Sliding Clevis (8). Attach it loosely to the carburetor butterfly arm using the two external tooth lock washers and 1/4" nuts (7). The carburetor connection must allow for a two inch travel of the cable inner wire. Select the 5/32 hole on the throttle arm extension that gives you this travel, then tighten the Throttle Arm Extension Nuts (7). Check each individual installation to see that the correct hole is used to give you
necessary travel. In certain applications where the pressure rise is higher than 15 PSI, it may be necessary to shorten the throttle travel or add an extra air tank or both. If an extra tank is installed, it should be piped in parallel with the other tank. Now adjust the Sliding Clevis so that it allows the Throttle to close fully and does not interfere with the Throttle Arm Extension. Place the Governor Cable inner wire through the selected 5/32 extension hole. With the throttle fully open attach a Cable Clip (3) two to three inches from the Throttle Arm Extension. Make a Bracket to secure this Cable Clip in a position that will allow the inner wire to move through the 5/32 hole with a maximum of freedom. Now back the Governor Hand Throttle Knob (11) all the way out. Check the Inner Wire for freedom to travel. It should require less than half a pound to move this wire. Then connect the inner wire to the Governor Piston Stem (10) with the two set screws; tighten both screws evenly by turning in both screws snugly before tightening either one. Turn the Hand Throttle Knob in all the way and back out one half turn. Then connect the Throttle Arm Spring (6) from one of the extension holes to a stationary part so that the spring is approximately six inches long when the Throttle is closed. Slide on the Wire Stop (5) and clamp it so it abuts the extension. This gives the Governor Cable Wire a sliding clevis effect. Now turn the Governor Hand Throttle Knob (11) in and out to make sure the inner wire fully opens the Throttle and the spring closes the Throttle.

For best operation, as with any governing device, friction must be kept at a minimum. Be sure the carburetor linkage is free from dirt, lubricated and working freely.

PIPING

To prevent freezing damage, the Air Tank (1) should be located (with open end down) lower than the Governor and as close to it as practical. Do not mount the tank close to the exhaust, this will cause the pressure setting to go up with increasing tank temperature. It could also eventually result in the air in the tank being replaced by water. Two 1/4" "U" bolts are provided for mounting the tank. Use 3/8" copper tubing (or larger) from the Air Tank to the connection marked "Tank" on the governor body.

Mount the Governor Panel Strainer (12) using the attached template for panel cutout dimensions. The strainer should be mounted on the panel with the inlet tap on the bottom, and located in height between the Governor and the main pump, so the complete system will drain back through the pump. Now run 3/8 O.D. tubing (or larger) from the pump discharge to the Panel Strainer "inlet". Next run 3/8 O.D. tubing from Panel Strainer "outlet", on end of strainer, to the Governor connection marked "Pump". Do not use fittings with inside openings smaller than 5/16" diameter.

Excessive friction loss in these tubing lines will slow down the filling rate of the air tank, consequently the Governor would require more than three seconds to set. It also slows down the Governor's operating response.

All the tubing used on the Governor should be cleaned internally, as a small particle of dirt can cause malfunction. Do not, under any circumstances, install the Governor without the Governor Panel Strainer.

The capillary Tube in the Dampener Needle has a 1/64" hole in it; therefore, caution must be exercised in piping the Governor to eliminate any dirt between the Governor Strainer and the Governor.

Since any weepage out of the air tank will change the pressure setting of the Governor, the tank drain cannot be connected to a multiple drain valve but must be drained independently. Moving the Hand Throttle Knob to its extreme positions will help drain the Governor Body.
The Cummins Diesels being supplied to truck builders are normally equipped with the automotive-type (maximum speed) governor; the foot throttle is attached to this governor. The throttle shaft position in this governor determines the engine speed between idle and maximum for "over the road operation". Where a constant speed control is necessary, such as pumping operations which require close engine speed control, it is necessary to use an auxiliary governor which is referred to as the MVS (Mechanical Variable Speed) Governor in conjunction with the automotive-type. It has been our experience that for the best "Engine Master" controlled pumping operation both the automotive-type and the MVS governors should be installed. These should be set up so that for "over the road" operation the engine speed is controlled by the foot throttle attached to the control arm of the automotive-type governor, while the MVS governor is in "full open" position. For pumping operation the reverse set-up is used, i.e., the engine speed is controlled by the E.M.Governor attached to the control arm of the MVS by means of the E.M.Governor cable, while the automotive-type governor is in the "full open" position. The opening of one governor and engaging of the other can be accomplished by air operated power cylinders (or by hand throttle controls). If the air operated cylinders are used, and pump is equipped with the air operated pump power shift, the change from actuating one governor to the other can be made simultaneously with the Road to Pump air shifting.

The control arm of the MVS governor (to which E.M.Governor cable is attached) should be of sufficient length for the cable to be selectively attached (various locations from fulcrum) to utilize full travel of the E.M.Governor (in relation to MVS Governor travel). The E.M.Governor cable installation must be as covered in Hale's "Installation Instructions", so there is no binding or lost motion.

NOTE: When MVS Governor has been added to an existing engine it may require recalibration of the fuel pump by the Cummins representative.

DETROIT DIESEL

The Detroit Diesel engine supplied to truck builder will normally be equipped with the correct type of "Limiting Speed" mechanical governor. To ascertain that the correct type governor has been supplied, it can be identified by a tag attached to side of governor; the letters DW-LS means double weight-limiting speed and any other type governor on the Detroit Diesel will not work with the Hale E.M.Governor.

The control arm of the "Limiting Speed" Governor (which the E.M.Governor cable is attached to) should be of sufficient length for the cable to be selectively attached (various locations from fulcrum) to utilize full travel of the E.M.Governor (in relation to limiting speed governor travel). The E.M.Governor cable installation must be as covered in Hale's "Installation Instructions" so there is no binding or lost motion.

4/23/70