ENGINE 841 & 842

DRIVER TRAINING OUTLINE

1994
SPARTAN/R.D.MURRAY
PUMPERS

2009

ENGINE 841 & 842 TRAINING OUTLINE

I. APPARATUS SPECIFICATIONS

A. Manufacturer and year of manufacture
   1. Engine 841 – 1994 SPARTAN/R.D. MURRAY
   2. Engine 842 – 1994 SPARTAN/R.D. MURRAY

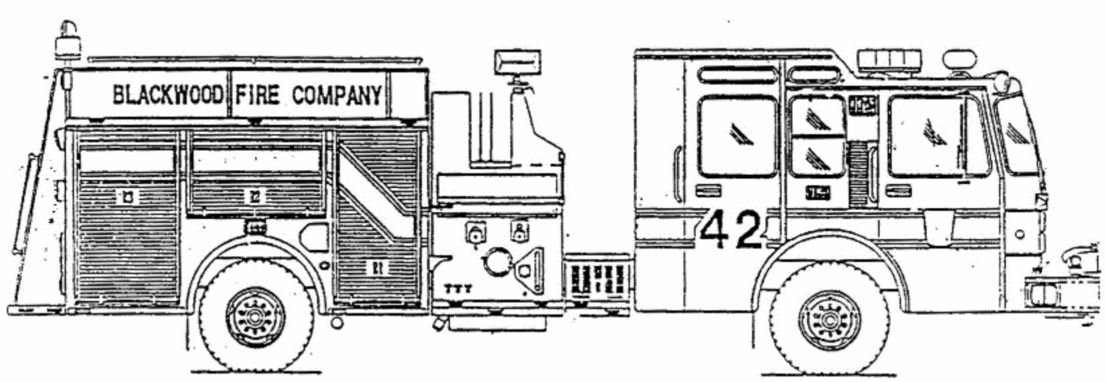
B. Drive train
   1. Engine – Cummins Diesel M11-E
      a. 320 Horsepower
   2. Transmission – Allison MD3060P
      a. 4/5 speed automatic

C. Pump
   1. Hale QSMG150-21L
      a. Centrifugal pump rated at 1500 GPM @ 150psi
      b. Single stage

D. Water tank
   1. Capacity – 750 gallons

E. Foam tank
   1. Capacity – 50 gallons

F. Dimensions
   1. Length – 32’
   2. Width – 8’4”
   3. Height – 9’10”
   4. Wheelbase – 202”
   5. Weight – 42,540 LBS. (21 Ton)



II. EQUIPMENT

A. Hose Load
   1. Hose bed (from left to right)
      a. 300’ of 1 ¾” with 1 ½” NST couplings preconnected and equipped with a 15/16” smoothbore nozzle. Flows 185 GPM @ 50 PSI (Referred to as the green line)
      b. 1200’ of 5” rubber supply hose with stortz couplings.
      c. 300’ of 3” rubber hose with 2 ½” NST couplings.
      d. 400’ line - 300’ of 3” rubber hose with 2 ½” NST couplings connected to a gated wye, one side connected to 100’ of 1 ¾” with 1 ½” couplings with a smoothbore nozzle. Flows 185 GPM @ 50 PSI, capable of adding an additional 1 ¾” handline at wye.
      e. 200’ of 3” rubber hose with 2 ½” NST couplings equipped with a 1 ½” smoothbore nozzle. 475 GPM @ 50 PSI (Referred to as the “Bomb Line”)

   2. Crosslays (Mattydales)
      a. Front – 200’ of 2 ½” hose NST couplings preconnected and equipped with a 1 ¼” smoothbore nozzle. 325 GPM @ 50 PSI (Referred to as the “Blitz Line”)
      b. Middle – 200’ of 1 ¾” hose NST couplings preconnected and equipped with a TFT nozzle. (Referred to as the blue line)
      c. Rear – 200’ of 1 ¾” hose NST couplings preconnected and equipped with a 15/16” smoothbore nozzle. 185 GPM @ 50 PSI

   3. Front bumper
      a. 150’ 1 ¾” hose NST couplings preconnected and equipped with a TFT nozzle.

   4. Pit
      a. 400’ 1” NST forestry hose rolled and stored in two bags.

B. Self Contained Breathing Apparatus
   1. 8 – 4500 PSI pressure demand 30 minute packs
      a. 1 - officers seat
      b. 4 – crew cab seats

        c. 3 – drivers side, center compartment
    2. 16 spare cylinders for above (drivers side rear compartment)

C. Large Diameter Hose (LDH) Equipment
    1. Hydrant bag
    2. Hydrant wrench
    3. Large spanner wrench
    4. 5” storz to 2 ½” female NST adapters
    5. NST to NJ American water hydrant adapter
    6. 5” storz to 2-2 ½” NST gated wye
    7. 5” storz to 4 ½” NST hydrant adapter

D. Pump Operators Equipment
    1. Adapters
    2. 2- 5” rubber hose pony lines 25’ in length
    3. 2- 3” rubber hose pony lines 25’ in length

E. Foam Equipment
    1. JS-10 95 GPM Foam Nozzle
    2. LP-9 95 GPM Foam Eductor
    3. 1 ½” NST x ¾” garden hose adapter

F. Electrical Equipment
    1. Onan Generator model 6 DJBFL
        a. 6 KW
        b. inline diesel powered generator (runs off the trucks fuel line)
        c. supplies power to telescoping lights and outlets on sides of engine, rear beavertail, and near front compartments near pump panel
        d. Supplies 200’ cord reel with junction box
        e. Junction box – house current x 4 – 20 amp twist
    2. Lighting
        a. 2 telescoping 1500 watt quartz lights
        b. 2 portable 500 watt circle D lights
    3. Cord adapters
        a. All plugs + electrical appliances equipped with 20 amp – 3 prong twist (L5-20)

G. Tools
    1. Forcible entry
    2. Ventilation, salvage and overhaul
    3. Tool box
    4. Step blocks and wheel chocks (stabilization)

H. Portable Fire Extinguishers

1. 20 lb. ABC dry chemical
2. 2 ½ gallon AFFF foam
3. 2 ½ gallon pressurized water

I. Miscellaneous Equipment
   1. Hot stick
   2. IS M40 gas meter
   3. TIC
   4. Combustible gas detector

III. CAB FUNCTIONS AND INSTRUMENTATION

A. Gauges
   1. Air pressure
      a. Both gauges should show a pressure of >80 PSI
   2. Volt meter
      a. Gauge should show >12 volt charge
   3. Fuel gauge
      a. Apparatus should always have >1/2 tank
   4. Oil pressure
      a. Gauge should indicate >10 PSI at idle +>30 at 1200 RPM
   5. Tachometer
      a. Idle speed – 500 RPM
      b. Governed speed – 2000 RPM
   6. Transmission temperature
      a. Normal operating temperature is 160-200 degrees Fahrenheit
   7. Water temperature
      a. Normal operating temperature is 170-210 degrees Fahrenheit

B. Review of instrument panel and control functions

IV. EQUIPMENT OPERATING PROCEDURES

A. Starting Engine
   1. Insure that air and electrical shorelines have been disconnected and rewound
   2. Turn master switch to “ON”
   3. Turn ignition switch to “ON”
   4. Depress starter button
      a. Release when engine starts

B. Stopping Engine
   1. Shift transmission to neutral
   2. Engage parking brake
   3. Allow engine to run at IDLE speed for 1-3 minutes to allow engine and turbocharger to cool. (Idle outside of firehouse)
   4. Turn ignition switch to “OFF”
   5. Turn master switch to “OFF”
   6. Connect air and electrical shore lines

C. Emergency Stop of Engine
   1. In case of emergency or failure of engine stop control, raise up red safety cover and flip toggle switch up. (switch is located right of steering column)
   2. Resetting emergency stop
      a. Access reset lever on Turbocharger under the interior engine cover – push lever until it relocks into proper position

D. Generator
   1. Electric start
      a. Open generator compartment (rear of truck) to prevent overheating
      b. Preheat generator for 30 seconds to 1 minute
         i. Hold toggle switch up for 30 seconds (located on pump panel)
      c. Push up starter switch for generator to start

V. <u>Pump Operation</u>

A. Engage pump
   1. Shift transmission to neutral
   2. Engage parking brake
   3. Depress service brake
   4. Pull up on yellow locking device and move lever to lowest position and release yellow locking device
   5. Shift transmission to “DRIVE”
   6. Observe that both green pilot lights indicating pump is engaged and listen for change in engine sound.
   7. Slowly release service brake

Note: 1 pump panel light will illuminate when pump is engaged
<u>Note: WHEELS SHOULD ALWAYS BE CHOCKED WHEN TRUCK IS IN PUMP</u>

B. Review of pump panel and pump control functions

C. Review of Hale pump materials

D. General practices
   1. Circulation of water
      a. Whenever pump is engaged water must circulate to prevent overheating
      b. “water in, water out” principle
   2. Operation of valves
      a. Slow and steady
      b. Locking mechanism
   3. Operation of Total Pressure Management system (relief valve)
      a. Set pump at desired pressure
      b. Rotate crank counterclockwise until amber pilot light illuminates and pressure decreases
      c. Rotate crank clockwise until pressure rises and pilot light extinguishes
      d. Blinking pilot light indicates dump valve is open on intake side of pump behind pump access panel on officer’s side of engine. Steady light indicates valve open on discharge side.
      e. At completion of operation, when securing pump, rotate crank clockwise to full open position.
   4. Engine cooler
      a. Closed system which runs water from the discharge side of pump through tubing located within the heat exchanger of the radiator.
   5. Operation of pump primer
      a. Location of reservoir
      b. Operate 10-15 seconds when operating on tank water
      c. Operate 30 seconds when drafting
   6. Standard Pump Operating Pressures
      a. Forestry hose
         i. 180-200 PSI
      b. 1 ¾” handline
         i. 150’ = 100 PSI
         ii. 200’ = 110 PSI (SB) 135 PSI (TFT)
         iii. 300’ = 140 PSI
      c. 2 ½” 200’ Blitz Line
         i. 90 PSI
      d. 3” 200’ Bomb Line
         i. 90 PSI
      e. Deck guns

            i. Smoothbore tips on deck guns are operated at a nozzle pressure of 80 PSI. Flow is increased by increasing tip size, not pressure.

7. Review of TFT and smoothbore nozzle flow charts
8. Use of foam equipment
   a. Place LP-9 foam eductor in line not more than 200’ from nozzle
   b. Set foam eductor for desired concentration of 3% or 6% depending on product involved.
   c. Supply foam eductor with an inlet pressure of 200 PSI. This pressure will deliver 95 GPM of foam solution when used with the JS-10 nozzle.

E. Disengage pump
   1. Return engine to idle speed (throttle down at pump panel)
   2. Shift transmission to neutral
   3. Lift yellow locking device and return lever to highest position.
   4. Observe that both green pilot lights extinguish and change of engine sound.
   5. Make sure pump panel lights are turned off.

<u>EXCERPTS FROM NJ TITLE 39</u>
<u>MOTOR VEHICLE CODE</u>

39:4-91 Failure to yield to emergency vehicles, Right of way of emergency vehicles; liability of drivers. The driver of a vehicle upon a highway shall yield the right of way to any authorized emergency vehicle when it is operated on official business, or in the exercise of the driver's profession or calling, in response to an emergency call or in the pursuit of an actual or suspected violator of the law and when an audible signal by bell, siren, exhaust whistle or other means is sounded from the authorized emergency vehicle and when the authorized emergency vehicle, except a police vehicle, is equipped with at least one lighted lamp displaying a red light visible under normal atmospheric conditions from a distance of at least five hundred feet to the front of the vehicle.

<u>This section shall not relieve the driver of any authorized emergency vehicle from the duty to drive with due regard for the safety of all persons, nor shall it protect the driver from the consequences of his reckless disregard for the safety of others. Nothing in this section shall be construed to limit any immunity or defense otherwise provided by law.</u>

39:4-92. Authorized emergency vehicles; clearance for; following or parking near. Upon the immediate approach of an authorized emergency vehicle giving audible signal, and equipped, as required by section 39:4-91 of this Title, and unless otherwise directed by a police or traffic officer,

(a) The driver of every vehicle shall immediately drive to a position as near as possible and parallel to the right-hand edge or curb of the highway, clear of an intersection of highways, and shall stop and remain in that position until the authorized emergency vehicle has passed and

(b) The driver or person in control of a street car shall immediately stop the car clear of an intersection of highways and keep it stationary until the authorized emergency vehicle has passed.

No driver of any vehicle other than one on official business shall follow any authorized emergency vehicle, traveling in response to an emergency call, closer than 300 feet, or drive nearer to, or park the vehicle within 200 feet of, where any fire apparatus has stopped in answer to a fire alarm.

39:4-92.1. Fire department vehicle returning to fire station; **flashing red light**. It shall be lawful for any fire department vehicle when returning to its fire station from an emergency call to display a flashing red light visible under normal atmospheric conditions from a distance of at least 500 feet to the rear of the vehicle and no driver of any vehicle other than one on official business shall follow any such vehicle displaying said light closer than 300 feet.

39:4-97. Careless driving A person who drives a vehicle carelessly, or without due caution and circumspection, in a manner so as to endanger, or be likely to endanger, a person or property, shall be guilty of careless driving.

39:4-103. Exemptions from speed regulations

Motor vehicles belonging to the military establishment, while in use for official purposes in time of riot, insurrection or invasion; all police officers, while the officers are engaged in the apprehension of violators of the law, or of persons charged with, or suspected of, a violation, are exempt from the provisions of this chapter relating to speed.

HALE MIDSHIP PUMPS

1. INTRODUCTION

A. Description

Hale single -stage and two-stage midship pumps are favorites of firefighters throughout the world. Covering a range of capacities from 750 Gallons Per Minute (GPM) (2,838 Liters Per Minute, LPM) to 2,250 GPM (8,516 LPM), Hale pumps offer the versatility, dependability, reliability, and ease of operations necessary for effective fire fighting. This section reviews the principles of operation of Hale's single -stage and two-stage midship pumps.

B. Principles of Operation

Centrifugal Force

A centrifugal pump operates on the principle that centrifugal force is created by a rapidly spinning disk. Figure 1-1 shows that an amount of water has been placed at the center of a disk. The disk is rotated at some speed, and the water is thrown from the center toward the outer circumference of the disk. The distance that the water travels from the center directly relates to the diameter of the disk and the speed of rotation. When water is confined in a closed container (such as the pump body), its pressure rises to a level that depends on the speed of rotation. There are three interrelated factors that regulate the performance of a centrifugal pump:

- SPEED (RPM). If the speed of rotation increases with flow held constant, the water pressure increases.
- PRESSURE. Pressure is usually measured in Pounds Per Square Inch (PSI) (BAR). If pressure changes with speed held constant, the flow (measured in GPM) (LPM) will change inversely, that is, if pressure increases, flow decreases.
- FLOW. Flow is usually measured in the number of gallons of water per minute (GPM) (LPM) that a pump can deliver when supplied from draft. If the pressure is held constant, the flow will increase with an increase in the speed of rotation. The centrifugal pump is preferred by the fire protection service due to its ability to fully utilize any positive suction inlet pressure, reducing the amount of work done by the pump. For example, if the required discharge pressure is 120 PSI (8 BAR), and the inlet pressure is 45 PSI (3 BAR), the pump must only produce the difference in pressures of 75 PSI (5 BAR). This contributes to low engine and pump speeds with reduced maintenance. Decreased maintenance is aided by the fact a centrifugal pump has basically only two moving parts the impeller and the shaft.

Pump Stages

The number of impellers on a common shaft determines the number of pump stages. The Hale series of single -stage pumps provides the same normal operating and rating test pressures as the Hale series of two-stage pumps. The two-stage pump provides an additional level of operating pressures if required, but adds some operating complexity.

Figure 1-1. Centrifugal Force From a Rotating Disk

Single-Stage Pump

There are three series of single -stage pumps.

- Qpak – 500 GPM to 1000 GPM

(1,892 LPM to 3,785 LPM)
- Qflo - 750 GPM to 1,250 GPM
(2,838 LPM to 4,731 LPM)
- Qmax - 1,000 GPM to 2,250 GPM
(3,785 LPM to 8,516 LPM)
(See figure 1-2)
Hale single -stage pumps are of a size and design to attach to the chassis rails of commercial and custom chassis. The pump is driven from the truck's main driveline. Generally, the pump consists of the following major components:
- Pump body
- Impeller and Shaft Components
- Gearbox
- Priming System
- Pressure Control Device
- Valves

Single-Stage Pump Operation
Hale single -stage pumps use a single impeller to develop the required volume and pressure. Figure 1-3 shows the flow of water through the Hale Qmax single-stage pump. Water enters the suction channels on both sides of the impeller, thereby maintaining axial balance. Dual cutwaters on the Qmax strip water from the rotating impeller and direct it to the discharge path. The Qflo and Qpak pumps utilize an impeller with a single suction channel where water enters. The impeller develops discharge pressure and directs the water to a single cutwater and then to the discharge valves. The impellers are radially and axially balanced. Radial hydraulic balance in the Qmax and Qtwo is maintained by the opposed discharge volute cutwaters. The cutwaters are wedge shaped and divide the water between the volute and the pump discharge.

Priming Pump
Priming pumps are used to create a vacuum: they are designed to evacuate air in the suction hose and the pump. The vacuum created allows atmospheric pressure to push water from the open source through the suction hose and into the pump. Hale centrifugal midship pumps use Rotary Vane Positive Displacement pumps for priming. A positive displacement pump moves a specified amount of air or fluid with each revolution. As shown in figure 1-14, the priming pump has a single rotor mounted off-center (eccentric) to the pump body housing. The vanes in the rotor slide in groves and are held against the body housing by centrifugal force. As a vane turns toward the discharge, it recedes into the rotor. As the rotor continues past the discharge, the vane advances outward from its groove and against the body housing. During this cycle, the space between the rotor and housing cases fills with air, and the vanes, acting as wipers, force air out of the discharge, creating a vacuum in the main pump allowing atmospheric pressure to push water into the hose and into the suction side of the main pump. A Hale priming pump has a single control that both opens the priming valve between the midship pump and the priming pump and starts the priming motor.

Priming Valves
Hale priming valves open when the primer is operated, to allow the primer to evacuate air in the pump. There are two priming valves available. The Hale Semi-Automatic Priming Valve (SPV) can be mounted directly to the priming connection on the midship pump, or can be

remotely mounted using a universal mounting adapter. When the SPV is installed, a single electric push-button on the operator's panel starts the priming pump motor. When the primer motor starts and produces a vacuum, the SPV opens. Releasing the push-button stops the priming pump and the SPV closes. The Hale PVG Priming Valve is mounted on the operator's panel. The PVG is a combination valve and switch. When the panel handle on the PVG is pulled out the valve opens and the switch energizes the primer motor. Pushing the handle de-energizes the motor and closes the valve.

Hale Total Pressure Master (TPM) Relief Valve System

This system, figure 1-16, includes a sensing valve connected to the inlet side of the pump that works in conjunction with a Pressure Master Control on the pump panel to give complete control over the entire system. The operating point is set by the Pressure Master Control. Small changes in pump pressure are normally handled internally by the recirculating relief valve (QG). Large changes on either the inlet or discharge side of the pump are controlled by dumping excess pressure to the atmosphere from the discharge side of the pump through the PG30 Relief Valve. The Hale TPM Relief Valve System is designed to automatically relieve excess pump pressure when operating from draft or positive incoming flows. The system self-restores to the non-relieving position when excessive pressure is no longer present. The TPM relief valve system is a mechanical system, consisting of an internal relief valve (QG) which bypasses water to the suction side of the pump, an external relief (dump) valve (PG30, with sensing valve attached) to discharge water to the atmosphere, and a single panel mounted control valve (PMD) to provide control of pump pressure, within NFPA required limits, to the pump operator. The PMD control permits the pump operator to "set" a desired relief pressure for both internal and external relief valves. The panel control has an easy to read and easy to set adjustment with an approximate indication of pressure setting. This section supplies information and procedures for the operation of Hale single -stage and twostage pumps. Included in this section are procedures for pumping from a hydrant, pumping from draft, pumping from a booster tank, pumping in relay, tandem pumping from a hydrant, and post-operation procedures.

B. Operating Procedures

THE PROCEDURES IN THIS SECTION ARE GENERAL OPERATING PROCEDURES. THEY DO NOT REPLACE THE PROCEDURES AND POLICIES ESTABLISHED BY YOUR FIRE DEPARTMENT, NOR DO THEY REPLACE THE RECOMMENDATIONS AND PROCEDURES PROVIDED BY THE FIRE TRUCK MANUAL.

Pumping From a Hydrant, General Operation

1. Position the truck for the best hydrant hookup and discharge hose layout.

REFER TO THE FIRE DEPARTMENT PROCEDURES ON SETTING WHEEL CHOCKS AS WELL AS LAY OUT AND CONNECTION OF SUCTION AND DISCHARGE HOSES. ALL VALVES, DRAIN COCKS, AND CAPS SHOULD BE CLOSED. NEVER ATTEMPT TO SHIFT THE PUMP TRANSMISSION WHILE THE TRUCK TRANSMISSION IS IN GEAR. ALWAYS SWITCH THE TRANSMISSION TO "N" AND VERIFY THE SPEEDOMETER IS "0" BEFORE MAKING PUMP TRANSMISSION SHIFT.

2. Bring the truck to a complete stop before you attempt to shift from road to pump.
3. Apply the truck parking brake.
4. Shift the truck transmission to the NEUTRAL position.
5. Move the in-cab pump shift control valve from the ROAD position to the PUMP position. The shift warning lights should come on in a second or two, indicating a complete shift. If the truck manufacturer has used another incab valve to achieve pump shift or has an electric switch, follow the instructions supplied with that valve.
6. After pump shift is completed, put the truck transmission in the proper pump operating range or gear. For most pumpers this will be direct drive (1:1) ratio. In addition, the speedometer should read 5 to 15 MPH after the shift has been completed. If the shift does not seem to be completed, shift truck transmission to "N" and repeat the entire procedure. Note that some vehicles drive the speedometer from the front wheel of the chassis. In this case, the speedometer will not read 5 to 15 MPH after shifting to the pump position. See the chassis manual for details.
DO NOT LEAVE THE CAB OR ATTEMPT TO PUMP UNTIL ALL THE GREEN PUMP LIGHTS IN THE CAB AND PANEL ARE ON.

7. Exit the driving compartment only after all the above steps are completed and you are sure that the shift completed lights in the cab and panel are on.

DO NOT OPEN THROTTLE UNLESS ALL GREEN PUMP INDICATOR LIGHTS ARE ON.

8. Verify that the pump panel shift indicator green "OK TO PUMP" light is on.
9. Open the hydrant.
10. If necessary, open the suction valve.
11. If applicable, set the transfer valve to either *volume* or *pressure*, as required.
12. If necessary to eliminate air pockets open valve to let air out or prime the pump: see "Pumping From Draft" for instructions.
13. Note the intake and discharge pressures then open the engine throttle gradually until the master discharge gauge indicates the desired pressure.
14. Set the automatic relief valve according to your fire department policy. If your fire department does not have a policy to follow, see the "Relief Valve or TPM Procedures" later in this section DO NOT REDUCE THE PRESSURE ON THE INTAKE GAUGE TO ZERO; SERIOUS DAMAGE TO THE WATER MAIN COULD RESULT.
If the master intake gauge shows a vacuum before the desired discharge pressure or flow is reached, this is an indication that you are getting all the water that the hydrant will supply. To increase the pressure when this occurs, reduce the pump flow. The master intake gauge reading must be maintained at 5 PSI (.5 BAR), minimum. As the throttle is opened, the pressure gauge reading increases with the engine speed. If the engine speed increases without an increase in pressure, the pump may be cavitating. In this case, close the throttle slowly until the pressure begins to drop, and the engine returns to an idle. If this does not correct the problem you are trying to pump more capacity than is available from the hydrant.
15. Open the discharge valves.
16. If the pump overheats and is not equipped with the Hale TRV valve, open the valve to access the pump auxiliary cooling system, or slightly open the tank fill line.
17. After completion of pumping procedures, gradually reduce the pump pressure until the engine is at an idle speed. Use the "Pump to Road Shift Procedure" and "Post Operation

Procedure" provided later in this section.

TPM Operation from a Hydrant

When operating from a positive inlet pressure, during some operational conditions, it may be necessary to adjust the TPM Relief Valve to a point where water is dumping to the ground. The internal relief valve will always open first, and if it cannot handle the pressure rise, the external relief valve will dump water on the ground. When the internal relief valve opens, the panel light will be on, and when the external dump valve opens, the pilot light on the panel will flash.

Pumping From Draft, General Operation.

1. Get as close to the water source as possible. The pump can do better than its rated capacity with less than a 10-foot vertical lift. As the vertical lift increases to above 10 feet, the maximum pump capacity will be reduced.

REFER TO THE FIRE DEPARTMENTPROCEDURES IN SETTING WHEEL CHOCKS AS WELL AS LAY OUT AND CONNECTION OF SUCTION AND DISCHARGE HOSES. ALL VALVES, DRAIN COCKS, AND CAPS SHOULD BE CLOSED. NEVER ATTEMPT TO SHIFT THE PUMP
TRANSMISSION WHILE THE TRUCK TRANSMISSION IS IN GEAR. ALWAYS SWITCH THE TRANSMISSION TO "N" AND VERIFY THE SPEEDOMETER IS "0" BEFORE MAKING PUMP TRANSMISSION SHIFT.

2. Bring the truck to a complete stop before you attempt to connect suction hoses or shift from road to pump.
3. Apply the truck parking brake.
4. Shift the truck transmission to the NEUTRAL position.
5. Move the in-cab pump shift control valve from the ROAD to the PUMP position. The shift warning light should come on in a second or two, indicating a completed shift. If the truck manufacturer has used another in-cab valve to achieve pump shift, follow the instructions supplied with that valve
6. After pump shift is complete, put the truck transmission in the proper pump operating range or gear. For most pumpers this will be direct drive (1:1) ratio. In addition, the speedometer should read 5 to 15 MPH after the shift has been completed. If the shift does not seem to be completed, shift truck transmission to "N" and repeat the entire procedure. Note that some vehicles drive the speedometer from the front wheel of the chassis. In this case, the speedometer will not read 5 to 15 MPH after shifting to the pump position. See the chassis manual for details.

DO NOT LEAVE THE CAB OR ATTEMPT TO PUMP UNTIL ALL THE GREEN PUMP LIGHTS IN THE CAB AND PANEL ARE ON.

7. Exit the driving compartment only after all the above steps are completed and you are sure that the shift completed lights in the cab and panel are on.

DO NOT OPEN THROTTLE UNLESS ALL GREEN PUMP INDICATOR LIGHTS ARE ON.

8. Verify that the pump shift indicator light is on.

9. Activate the priming pump by pulling the control handle located on the pump panel or depressing the push button. The departmental manual for pumping should specify the correct RPM for priming, but in general, for priming the pump should be operated at idle with an engine speed of about 1,000 to 1,200 RPM.
10. Watch the intake and discharge master gauges. When the pump is primed, the intake indication reading falls below zero, and the discharge pressure starts to increase. You may also hear water discharging on the ground, indicating that the pump is primed.
Running the engine at speeds higher than 1,200 RPM during priming is not recommended, because it will not improve priming operation. Running the pump at higher RPM will increase wear.

IF THE DISCHARGE GAUGE READING DOES NOT INCREASE, THE INTAKE GAUGE READING DOES NOT FALL BELOW ZERO, OR THE PRIMING PUMP DOES NOT DISCHARGE WATER ON THE GROUND IN 30 SECONDS, DO NOT CONTINUE TO RUN THE PRIMING PUMP. STOP THE PUMP, AND CHECK FOR AIR LEAKS OR POSSIBLE PUMP TROUBLE.

11. After priming, select the desired transfer valve position (for two-stage pumps).
12. Gradually open the discharge valve until the water emerges as a steady stream. Then open the other discharge valves to the desired setting.
13. Open the engine throttle gradually until the desired pressure or flow is reached.

DO NOT PUMP ENOUGH WATER TO CAUSE A WHIRLPOOL AT THE STRAINER. THIS ALLOWS AIR INTO THE PUMP, RESULTING IN ROUGH OPERATION AND PULSATION. REPOSITION THE STRAINER OR REDUCE FLOW TO CORRECT THE SITUATION.

As the throttle is opened, the pressure gauge reading increases with the engine speed. If the engine speed increases without an increase in pressure, the pump may be cavitating. If the pump is cavitating, warn personnel that the pressure is being dropped. In this case, close the throttle slowly until the pressure begins to drop, and the engine returns to an idle. If this does not correct the problem, here are two possibilities that can also lead to this condition:
a. Cavitation can occur with large nozzle tips. Solve this problem by reducing flow.
b. Cavitation can also occur when you are pumping if air enters with the water. Even though the pump may be primed, air leaks can cause rough operation and an increase of engine speed without an increase in pressure or flow. If an air leak is suspected, discontinue pumping and refer to Section 4 for maintenance.
14. If a pump shutdown is desired while pumping from draft, reduce the engine speed to idle, and close the discharge valves. To resume pumping, open the throttle and discharge valves. If the pump overheats from continued churning without water flow, open the discharge valves periodically to release hot water.
15. Set the automatic relief valve according to your fire department policy. If your fire department does not have a policy to follow, see the "TPM or Relief Valve Procedures" later in this section.
16. If the pump overheats and is not equipped with the Hale TRV valve, open the valve to access the pump auxiliary cooling system, or slightly open the tank fill line.
17. After completion of pumping procedures, gradually reduce the engine RPM until it is at an idle speed. Use the "Pump to Road Shift Procedure" and "Post Operation Procedure" provided later in this section.

Pumping From the Onboard Water Tank

1. Position the truck for convenient discharge hose layout, and bring the truck to a complete stop.

REFER TO THE FIRE DEPARTMENT PROCEDURES ON SETTING WHEEL CHOCKS AS WELL AS LAY OUT AND CONNECTION OF SUCTION AND DISCHARGE HOSES.

2. Bring the truck to a complete stop before you attempt to shift from road to pump.
3. Apply the truck parking brake.
4. Shift the truck transmission to the NEUTRAL position.
5. Move the in-cab pump shift control valve from the ROAD position to the PUMP position. The shift warning light should come on in a second or two, indicating a completed shift. If the truck manufacturer has used another in-cab valve to achieve pump shift, follow the instructions supplied with that valve.
6. After pump shift is complete, put the truck transmission in the proper pump operating range or gear. For most pumpers this will be direct drive (1:1) ratio. In addition, the speedometer should read 5 to 15 MPH after the shift has been completed. If the shift does not seem to be completed, shift truck transmission to “N” and repeat the entire procedure. Note that some vehicles drive the speedometer from the front wheel of the chassis. In this case, the speedometer will not read 5 to 15 MPH after shifting to the pump position. See the chassis manual for details.

DO NOT LEAVE THE CAB OR ATTEMPT TO PUMP UNTIL ALL THE GREEN PUMP LIGHTS IN THE CAB AND PANEL ARE ON.

7. Exit the driving compartment only after all the above steps are completed and you are sure that the shift completed warning lights in the cab and panel are on.

DO NOT OPEN THROTTLE UNLESS ALL GREEN PUMP INDICATOR LIGHTS ARE ON.

8. Verify that the pump panel shift indicator light is on.
9. Open the tank suction valve.
10. For two-stage pumps, select the desired transfer valve position.
11. Check the master discharge gauge to see if priming is necessary. If necessary, start the priming pump by pulling the control handle located on the pump panel or depressing the prime push button or just crack the tank fill valve.

IF THE DISCHARGE GAUGE READING DOES NOT INCREASE, THE INTAKE GAUGE READING DOES NOT FALL BELOW ZERO, OR THE PRIMING PUMP DOES NOT DISCHARGE
WATER ON THE GROUND IN 30 SECONDS, DO NOT CONTINUE TO RUN THE PRIMING PUMP. STOP THE PUMP, AND CHECK FOR AIR LEAKS OR POSSIBLE PUMP TROUBLE.

Watch the intake and discharge pressure gauges. When the pump is primed, the compound gauge indication falls below zero, and the pressure starts to increase. You may also hear water splashing on the ground, indicating that the pump is primed.
12. Open the engine throttle gradually until the desired pressure or flow is reached. As the throttle is opened, the discharge pressure gauge reading increases with the engine speed. If the engine speed increases without an increase in pressure, the pump may be cavitating.
If the pump is cavitating, warn personnel that the pressure is being dropped. In this case, close the throttle slowly until the pressure begins to drop, and the engine returns to an idle. If this does not correct the problem, reduce flow.

DO NOT OPEN THROTTLE UNLESS ALL GREEN PUMP INDICATOR LIGHTS ARE ON.

13. Gradually open the discharge valves until the water emerges as a steady stream. Then open the discharge valves to the desired setting.
14. Set the automatic relief valve according to your fire department policy. If your fire department does not have a policy to follow, see the “TPM or Relief Valve Procedures” later in this section.
15. If the pump overheats and is not equipped with the Hale TRV valve, open the valve to access the pump auxiliary cooling system, or slightly open the tank fill line.
16. After completion of pumping procedures, gradually reduce the engine RPM until it is at an idle speed. Use the “Pump to Road Shift Procedure” and “Post Operation Procedure” provided later in this section.

Pumping In Relay

Relay operations are necessary when the water source is too far away from the fire to be pumped efficiently by one pumper. Relay pumping is the movement of water through a number of consecutive pumpers, from suction to discharge. The number of pumpers is determined by how far the water source is from the fire. In some cases, when you are on the receiving end of a relay, it may help to set the suction dump or TPM (if available) very low in order to limit the incoming pump pressure by dumping water on the ground before you have discharge hose lines connected and are flowing water. Then, as you are able to use the incoming water, the relief valve control can be moved up to the desired operating pressure and set as instructed. This technique will also help you to purge the air from the incoming hose and the pump before it can get to a dangerously high pressure.
Use this procedure after the hose is laid, the apparatus are in position, and the pumps are engaged. See the “Pumping from a Hydrant” procedure for setup and engagement instructions for apparatus receiving pressurized water.
1. Open two discharge gates on all pumps, except on the pump at the source, to get rid of air from hose lines and pumps.
2. On each pump, attach the hose lines to one of the discharges, and leave the other discharge uncapped (only for trucks without a relay valve).
3. Watch the intake gauge for a high-pressure reading. If this is reached, open the gate controlling the uncapped discharge to remove excess water.
4. Supply the pump at the water source with water; prime if necessary. The discharge pressure must not be over 150 PSI (10 BAR) or the maximum pressure rating of the relay hose to start water moving. Use either the “Pumping From Hydrant” or “Pumping From Draft” procedures that appear earlier in this section.
5. When the water reaches the second pump, close the uncapped discharge gate. Repeat this

step for all pumps until the water reaches the fire ground.
6. Adjust the throttle on the pump at the water source for the required operating pressure. Watch the gauges to avoid cavitation. (The pump operator at the fire scene will advise all other pump operators of the amount of water needed at the fire ground).
7. Adjust the discharge pressure or flow at the fire scene to supply the lines being used.
8. Observe the gauges carefully, and adjust the pressure or flow as needed.
9. Shutdown starts from the fire ground pump and works toward the water source. Gradually reduce pressure at the fire ground pump until you can disengage it. Follow this procedure for every pump in the relay until the pump at the water source is shut down.

LOCAL TRAINING PROCEDURES MAY VARY SLIGHTLY FROM ABOVE.

Tandem Pumping Operation From a Hydrant

1. Using the large intake hose, connect the first pumper to the hydrant steamer. Open the hydrant until the pump is primed, then partially close the hydrant.
2. Position the second pumper intake-to-intake with the first pumper.
3. Open a discharge to flow water.
4. With the hydrant partially closed, adjust the throttle on the first pumper until the intake gauge reads about 5 PSI (.5 BAR)
5. Remove the unused intake cap.
6. Connect the second pumper to the unused steamer intake of the first pumper, using a large intake hose.
7. Open the hydrant completely. Both pumpers pump water to the fire, (refer to the procedure on “Pumping From a Hydrant”). LOCAL TRAINING PROCEDURES MAY VARY FROM ABOVE.

Pump To Road Shift Procedures

1. Verify that the operator’s hand throttle or governor control has returned to idle speed.
2. Shift the truck transmission into the NEUTRAL position, and wait four seconds. Check to make sure the speedometer reads 0.
3. Moving pump shift control valve lever to the ROAD position. The in-cab and panel pump indicator lights should go out when the pump transmission starts to shift into the ROAD position.

REFER TO THE FIRE DEPARTMENT PROCEDURES ON REMOVING WHEEL CHOCKS AS WELL AS LAY OUT AND CONNECTION OF SUCTION AND DISCHARGE HOSES.

Standard Relief Valve Procedures

These procedures are for setting the operating point of the standard relief valve.
1. Increase the engine RPM to reach the desired pump operating pressure while reading the discharge pressure gauge.
2. Turn the hand wheel slowly counterclockwise until the relief valve opens, the pilot light comes on, and the master pressure gauge drops a couple of PSI (BAR).
3. Turn the hand wheel slowly clockwise until the master pressure gauge rises to the desired pressure and pilot light goes out. The relief valve will now operate at the set pressure.
4. When the pump is not in operation, turn the hand wheel clockwise so that the control is set slightly above the normal operating pressure. When the pump is put into operation again,

reset the control valve to the desired operating pressure.

TPM Relief Valve Procedures

These procedures cover the Hale TPM Relief Valve System. Be sure to select the correct procedure, according to relief valve. TPM System (only)

1. Set the pressure indicator on the PMD control valve to a position slightly above the normal operating pressure (even before water starts to flow).
2. After normal operating pressure has been achieved (as indicated on the master pressure gauge and with the pump discharging water), slowly move the adjusting handwheel counterclockwise until the relief valve opens, the amber pilot light comes on, and the master pressure gauge reading drops a couple of PSI (BAR).
3. Turn the handwheel slowly clockwise until the master pressure gauge reading is at the correct operating pressure and the pilot light goes out. The relief valve will operate at the set pressure.

THE INDICATOR ON THE PANEL IS ONLY A ROUGH INDICATION OF TPM SETTING. ALWAYS USE THE ABOVE PROCEDURE TO PROPERLY SET THE TPM RELIEF VALVE SYSTEM.

Emergency Pump Shift Procedures

Before implementing manual override shift procedures, repeat recommended procedures. If the shift fails to take place, follow these procedures.

1. Bring the truck to a complete stop.
2. Apply the truck parking brake, and chock the wheels.
3. Shift the truck transmission to the NEUTRAL position.
4. For Pump or Road position, put the in-cab shift control in the Neutral position. (Neutral position is exactly in the middle of the road and pump position.
5. Shut down the engine.

DO NOT ATTEMPT EMERGENCY SHIFT PROCEDURES WHILE THE ENGINE IS RUNNING.

6. Employ manual override procedure at the shift cylinder on the pump gearbox as follows: An eyebolt is provided in the shift shaft to accept a drift punch or screwdriver. By inserting this tool into the hole provided, it will enable you to pull or push the shaft manually.
Pull the shift shaft Out for Pump Position (after in-cab control valve selection), or push shift shaft for Road Position (after in-cab control valve selection). If the shift stroke cannot be completed manually, turn the driveshaft slightly by hand to realign the internal gears and repeat the manual shift effort.

Post Operation Procedures

1. If you have been pumping seawater, dirty water, alkaline water, or using an around the pump proportioner, flush the pump with clean water.
2. After using the pump, drain the pump as follows (especially important in freezing weather):
a. Open discharge valves, remove suction tube caps, and discharge valve caps.

b. Open the pump body drain cocks or Hale multiple drain valve. If a multiple drain valve is used, all pump drain lines should be connected to this valve.
c. On two-stage pumps, move the transfer valve back and fourth to both the *volume* and *pressure* positions.
d. If installed, drain the gearbox cooler.
e. After the pump is completely drained, replace all caps and close all valves.
3. Fill out the pump run log, indicating total pumping time and total out-of-station time.
4. Report all pump, vehicle equipment malfunctions, and irregularities to the proper authority.