

APPENDIX C

Handouts

Portable Pump Performance – National Cache Pumps

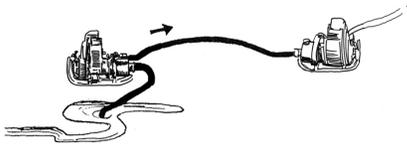
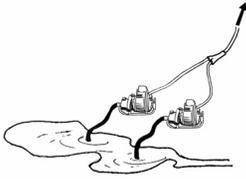
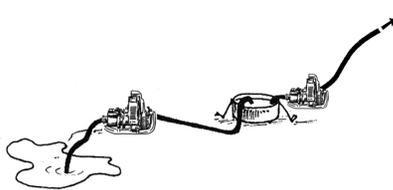
Pumps	Pump Pressure (PSI) and Gallons Per Minute (gpm)								
	Free flow	50 psi	100 psi	150 psi	200 psi	250 psi	300 psi	350 psi	400 psi
Wildfire Mark 3 ^{a,b} (High Pressure Pump)		89 gpm	78 gpm	65 gpm	52 gpm	38 gpm	25 gpm	9 gpm	0 gpm @ 380 psi ^d
Wick 375 ^b (High Pressure Pump)	90 gpm	84 gpm	78 gpm	65 gpm	48 gpm	32 gpm	18 gpm	3 gpm	0 @ 360 psi ^d
Waterous Flotopump HP ^b	60 gpm	56 gpm	42 gpm	20 gpm	0 gpm @ 175 psi ^d				
Shindaiwa GP-45 ^c (Lightweight Pump)	66 gpm	n/a	0 gpm @ 65 psi ^d						
Wildfire Mini Striker ^c (Lightweight Pump)	56 gpm	32	0 gpm @ 85 psi ^d						
Honda WX10 ^c (Lightweight Pump)	37 gpm	n/a	0 gpm @ 51 psi ^d						
Honda WX15 ^c (Lightweight Pump)	72 gpm	n/a	0 gpm @ 54 psi ^d						
Wick 100-4H ^b (4 stroke) (Lightweight Pump)	69 gpm	36 gpm	0 ^c gpm						
Wick 100G ^c (2 stroke) (Lightweight Pump)	71 gpm	40 gpm	0 ^c gpm						

- a) Mark 3 pump performance in IRPG does not correspond directly with the values in this table. Pump flows are normally given in 50 psi increments; the performance information in the IRPG is reported in 10 gpm increments.
- b) Performance data obtained from Water Handling Equipment Guide (PMS 447-1 dated October 2003).
- c) Performance data obtained from manufacturer's literature.
- d) Pump shutoff pressure is the maximum pump pressure (psi) with the discharge closed (no flow or 0 gpm).

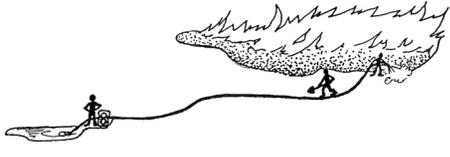
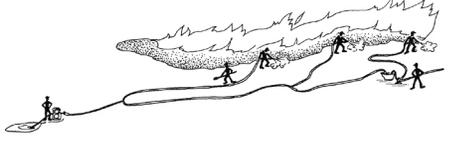
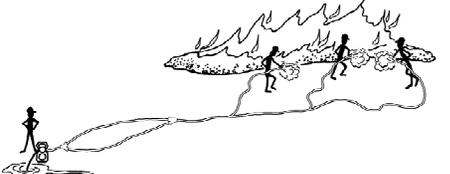
Types of Nozzles

Nozzle Type	General Characteristics	Tactical Use
<p>Twin tip nozzle</p> 	<ul style="list-style-type: none"> ➤ Common name is Forester nozzle. It is durable and versatile; easy to adjust from fog to straight stream; helps “conserve” water, because the flow isn’t as great as the adjustable barrel nozzle. ➤ Two types of tips on these nozzles: <ul style="list-style-type: none"> • <u>Straight stream tips</u> <ul style="list-style-type: none"> ▪ 3/16 inch tip – 7 gpm at 50 psi nozzle pressure ▪ 3/8 inch tip – 30 gpm at 50 psi nozzle pressure • <u>Spray/fog tips</u> <ul style="list-style-type: none"> ▪ 50 psi ▪ Come in different flow rates such as 3, 6, and 8 gpm ➤ All tips are rated at 50 psi but they have different flows. ➤ 50 psi is the pressure at which the tips will work most efficiently; however, they will operate at other pressures 	<ul style="list-style-type: none"> ➤ <u>Straight stream tip</u> – When the fire is too hot to get close; fire is confined to small area; to reach longer distances. ➤ <u>Fog/spray tip</u> – Hot spotting, wet lining, direct attack, mop up; when close work is needed; fire covers a larger area; smaller volume of water is required to put out the fire or water conservation is necessary. ➤ <u>Both tips</u> can be used at the same time to provide a combined stream.
<p>Adjustable barrel nozzle</p> 	<ul style="list-style-type: none"> ➤ Common names are the KK and Lexan. Provides a variable spray from straight stream to wide-angle fog. This nozzle is typically found in portable pump kits. ➤ Available in different sizes (there are no tips). Are rated and work most efficiently at 100 psi. <ul style="list-style-type: none"> • 1 inch – provides 20 gpm at 100 psi nozzle pressure. This nozzle attaches to a 1-inch discharge hose. • 1½ inch – provides 60 gpm at 100 psi nozzle pressure. This nozzle attaches to a 1½-inch discharge hose. ➤ 100 psi is the pressure at which this nozzle will work most efficiently; however, they will operate at other pressures. 	<ul style="list-style-type: none"> ➤ <u>Straight stream</u> – When the fire is too hot to get close; fire is confined to small area; to reach longer distances. ➤ <u>Fog/spray</u> – Hot spotting, wet lining, direct attack, mop up; when close work is needed; fire covers a larger area; smaller volume of water is required to put out the fire or water conservation is necessary.
<p>Adjustable barrel nozzle – garden hose nozzle</p> 	<ul style="list-style-type: none"> ➤ Commonly called a garden nozzle, because it fits on a garden hose (3/4 inch). Provides a variable spray from straight stream to wide-angle fog. Available in ¾ inch. 	<p>Most often used for mop up.</p>
<p>Sprinklers</p> 	<ul style="list-style-type: none"> ➤ Sprinkler heads typically have 360-degree coverage area. Depending upon pressure, they have a coverage distance of 40 to 60 feet in diameter. 	<p>Work well for structure protection, wetting lines down around prescribed fire units, and mop up.</p>

Portable Pump Configurations

Portable Pumping Configurations	Description	General Characteristics
<p>Single Pump</p>	 <p>One pump delivers the water.</p>	<p>A single pump is the most commonly used pump configuration; because it often meets the pressure and flow requirements.</p>
<p>Series Pumping System (multiple pumps)</p>	 <p>Water is pumped from the first pump directly into the second pump. Pumps are connected inline. Pump with the highest capacity needs to be first; flow is limited to that of first pump. If 1st pump fails, system fails.</p>	<p>Series pumping is a way to increase pump performance – it increases pressure, but not the flow. General rule is that it combines the pressure of both pumps. It is often used to overcome significant elevation rise (e.g., fire on ridgeline), long hose lay or whenever more pressure is needed.</p>
<p>Parallel Pumping System (multiple pumps)</p>	 <p>More than one pump is delivering water into one hose. Pumps should have equal capabilities (pressure and flow). If one pump fails, system will operate but at a reduced capability.</p>	<p>Parallel pumping is a way to increase pump performance – it increases flow, but not the pressure. General rule is that it doubles the flow. It is often used for filling tanks, drop tanks, or whenever more flow is needed.</p>
<p>Staged Pumping System (multiple pumps)</p>	 <p>Water is pumped to a temporary storage reservoir and relayed by a second pump. The second pump can then supply the water directly to the nozzle or supply another reservoir. There are many different types of folding or collapsible storage tanks, and they range in size from 75–6,000 gallons.</p>	<p>This system provides a more stable water supply. It is less likely to be interrupted if the pump must be shut down.</p>

Types of Hose Lays

Types of Hose Lay	Description	General Characteristics
Simple Hose Lay	 <p>Hose lay without laterals, and it has only one nozzle.</p>	<ul style="list-style-type: none"> • Often used for initial attack, small fire. • Can set up quickly. • Can easily add laterals to it (then it becomes a progressive system).
Progressive Hose Lay	 <p>Hose lay with laterals, and it has more than one nozzle.</p>	<ul style="list-style-type: none"> • Often used for direct attack at several points. Designed for speed and safety on a hot, fast-running fire where mobile attack is not possible. Also, effective during mop up stages. • If this system doesn't provide enough flow or pressure, consider parallel hose lay or multiple pump system (series or parallel pumping system).
Parallel Hose Lay	 <p>Two parallel hoses coming off a wye valve and then joined together with a Siamese wye.</p>	<ul style="list-style-type: none"> • The main advantage of using the parallel hose lay is that it reduces friction loss. Dividing the flow between two lines reduces the friction loss (because the flow in each line has been reduced) yet overall flow is maintained. • General guideline is that parallel hose lay has approximately ¼ the friction loss of a single line hose lay. • Drawback is that it requires more hose and appliances.

High Pressure Portable Pump Instructions



- Connect suction hose to foot valve and pump (wrench-tight).
- Place foot valve at least one foot under water. Do not place foot valve directly on sandy or muddy (stream/ lake) beds.
- Prime the pump head by using either the hand primer or by filling with pail. Fill to the brim of prime port and wrench tighten cap.
- Connect hose curl (pigtail) to discharge side of pump, also to check and bleeder valve.
- Utilize 1" port on check & bleeder valve to re-circulate water back to the water source.

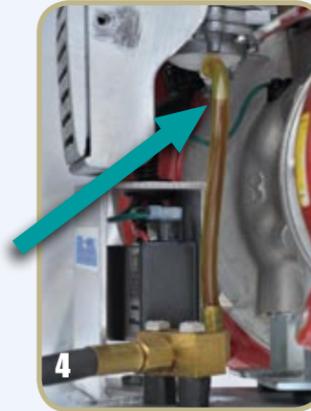


1 SET UP

- Find flat ground or create flat ground. Keep suction lift as low as possible.
- Unfold berms and ensure sides are fully extended.
- Place absorbent pads in berms. In rough/rocky terrain, use two pads in pump berm.
- Place high pressure pump in one containment berm and the fuel can(s) in the other berm. Locate fuel cans as far away from hot engine parts as possible; orient pump so exhaust does not vent directly on fuel can.
- Secure pump and fuel can if necessary to prevent creep and to maintain position.

3 START UP

- 1) Open air vent in fuel tank.
- 2) If engine is cold move choke lever to start position. If engine is warm move choke to run position.
- 3) Move throttle lever to start/ warm up position.
- 4) Slowly pump fuel bulb until fuel mixture (in clear fuel tube) is just touching bottom of carburetor.



Caution: Follow this step carefully to avoid flooding the engine.

- 5) If pump is equipped with an on/off switch, turn switch on.
- 6) On Mark III pump, ensure over-speed reset rod is pushed in.



- 7) Pull starter rope with short quick pulls (typically 2 to 4 pulls) until engine 'pops'.
- 8) Immediately set choke lever to run position.
- 9) Pull starter rope approximately 1 to 3 more times and engine should start.

Caution: Any consecutive pulls of rope with choke in start position (after engine 'pops') will flood the engine.

- 10) Allow engine 2 minutes to warm up (throttle lever should still be at start/warm up position) before moving throttle to run.

ENSURE ALL FUEL IS MIXED PROPERLY BEFORE USING PUMP

2 FUEL MIXING AND REFUELING

- If fuel is pre-mixed (red or greenish colored), then no mixing is required. (Alaska and other areas provide pre-mixed fuel.)
- If fuel is straw or clear colored then mix fuel with 2 cycle oil according to Manufactures' recommendation of 24:1 (for every 5 gallons of gas add approximately 1 quart oil):
 - Pour approximately one gallon of gas into pump-adapted can.
 - Add appropriate amount of 2 cycle oil to gas then shake can vigorously.
 - Add remainder of gas and shake can again.
- Label fuel mixture on tag and attach to pump-adapted can.
- Attach fuel line to pump adapted can.

When refueling:

- **ALWAYS** wear eye protection and gloves.
- **ALWAYS** shut the pump down first.
- Do not operate a radio or any other portable electronic device such as a cell phone.
- Replace gas absorbent pads as needed by placing them in garbage bags and dispose per local protocol.
- If a spill occurs or gas enters the "natural" water source, notify supervisor immediately. Spill containment kits are available at district office and ICPs. The resource advisor must be notified immediately.



4 OPERATE

- Water must be flowing through the pump head at all times. Crack nozzle or open check and bleeder valve.
- Grease pump head with one squirt of grease once a shift (or every 8 hours) at grease/zerk fitting.



5 SHUT DOWN

- Allow engine to idle for one minute.
- Move the throttle to the "stop" position.
- At end of shift remove male end of fuel line quick connect from base of fuel can; allow engine to run out of gas.
- In freezing conditions, drain pump head.

High Pressure Portable Pump Instructions (CONT.)

TROUBLESHOOTING

If pump will not start or run follow these steps:

- 1) On the Mark III, check the overspeed reset rod. If rod is pushed in, move on to 2. If rod is out the pump has lost its prime. Do not attempt to restart pump until the problem is located and corrected; check for these problems:
 - Suction hose connections are leaking.
 - Suction hose is defective.
 - Priming cap is loose.
 - Foot valve not fully submerged in water source (1 foot minimum)
- 2) Check the spark plug by removing it from the engine. If the spark plug electrode is dry, move on to 3. If spark plug is wet with fuel, the engine could be flooded. Follow these steps:

- Place spark plug on top of cylinder head with spark plug wire attached (spark plug is now grounded).

WARNING:
FIRE/EXPLOSION HAZARD

- Remove fuel supply line from engine.



- Remove crankcase drain plug and copper gasket from engine block to drain excess fuel.



- With choke and throttle in full open (run/run) position, pull starter cord several times until fuel is exhausted.
- Reinstall crankcase plug with copper gasket attached.



- Reinstall clean, dry or new spark plug.



- 3) If the spark plug looks normal, move on to 4. If the spark plug has an excess of carbon on the electrode replace the spark plug and try to start.

4) Check for ignition spark:

- Ensure spark plug is grounded.
- Crank engine and look for spark across spark plug gap. The plastic cover of the IRPG is approximately .020" thick and can be used to check the spark plug gap if feeder gauge is not available. Do not use a dime to check the plug gap.

If there is an ignition spark, move on to 5. If there is no spark, pump will need to be repaired.

WARNING:
FIRE/EXPLOSION HAZARD

5) Check fuel system for these problems:

- Loose connections; fuel leaking
- Fuel can is not vented
- Fuel supply line defective
- Water or dirt in the fuel system

6) Use flagging to identify any mechanical problems with pump.