

Porto-Power Operation and Use

Instructor Guide

Session Reference: 1

Topic: Porto-Power Operation and Use

Level of Instruction:

Time Required: Four Hours

Materials:

- Complete Porto-power Set
- Assorted Cribbing
- 1-2 Acquired Vehicles

References:

- Rescue Technician, Maryland Fire And Rescue Institute, University Of Maryland, Mosby
- Rescue Intermediate, Maryland Fire And Rescue Institute, University Of Maryland
- Vehicular Rescue Manual, Fire Service Extension, West Virginia University

PREPARATION:

Motivation:

Objective (SPO):

The student will demonstrate a basic understanding of the operation and use of the porto-power by applying the material learned in a practical setting.

Overview:

Porto-power Operation and Use

- Introduction to hydraulically powered tools
- Components of a porto-power
- Operation of the porto-power
- Practical applications

Session 1**Porto-Power Operation And Use**

- SPO The student will demonstrate a basic understanding of the operation and use of the porto-power by applying the material learned in a practical setting.
- EO 1-1 Demonstrate a basic understanding of the principles and operations of hydraulically powered rescue tools as well as the care and maintenance requirements.
- EO 1-2 Identify the various components of a porto-power system.
- EO 1-3 Explain the operation of the various components of a porto-power system.
- EO 1-4 Demonstrate the operation of the various components of a porto-power system through the performance of difference vehicular access and disentanglement techniques.

I. Introduction to Hydraulically Powered Rescue Tools (1-1)

- A. Majority of hydraulic tools designed for applications other than rescue and adapted by fire and rescue service for pulling, pushing, spreading, and clamping
- B. Basic physical principle of hydraulics
 - 1. Pressure exerted on a liquid is transmitted equally in all directions
 - 2. Pressure applied to a liquid confined in a container is transmitted undiminished to all parts of the liquid and acts in all directions
 - 3. A hydraulic system with a small piston and cylinder transmits a force through hydraulic hose to a larger cylinder and piston thus increasing the force
- C. Hydraulically Powered Tools
 - 1. Hand jacks - 1 ton to 120 tons
 - 2. Remote controlled hydraulic jacks (Porto-power), 4 ton, 10 ton and 20 ton capacity used in rescue operations.
 - 3. Hurst and Amkus style tools-initially designed for the rescue service.

The remainder of this lesson guide will be limited to the porto-power.

- D. Safe Utilization of Hydraulic Power Tools
 - 1. Be familiar with equipment.
 - 2. Know limitations of tools and be aware of any power differences between pump and ram, wedgie, or spreader.
 - 3. Inspect tool periodically and maintained.
 - 4. Use safety person when operating tools.

5. Use caution when forcing an object with power tool.
6. Keep personal objects (fingers, hair, clothing, jewelry, ties, etc.) away from operating equipment.
7. Hold tools only at designated areas.
8. Maximum effectiveness is obtained when a tool has maximum contact with the surface being acted upon.
9. Utilize appropriate safety equipment while operating power tools.

II. COMPONENTS OF A PORTO-POWER (1-2)

A. Terminology

1. Clamp Toe – similar to collar toe but attaches to extension rather than cylinder; used with cylinder clamp head to create clamp.
2. Collar Clamp Head – threaded attachment for cylinder to allow extension to be connected; when used with clamp toe secured to extension creates clamp.
3. Collar Toe – threaded attachment for cylinder to permit spreading in tight areas.
4. Double Chain Plate – threaded attachment for cylinder (may also be attached to plunger) for use when ram is being used to pull with chains attached to both ends.
5. Extension – various lengths of pipe threaded on both ends and used as extension for ram; using extension with ram reduces capacity of ram by 50%.
6. Female Adapter – adapter threaded on inside of female end to permit attachment to ram plunger; male end fits inside extension.
7. Flat Base – threaded flat attachment used where larger base needed for ram cylinder or plunger.

8. Hose - transmits oil under pressure from pump to ram, wedge, or spreader; flexible and reinforced to withstand internal pressure of system.
9. Lock-on Connector – used to connect two extensions together; lock pins used to hold extensions in place on connector.
10. Lock Pin – used to hold extension onto lock-on connector or male or female adapter.
11. Male Adapter – adapter threaded on outside of male end to permit attachment inside ram cylinder; other male end fits inside extension.
12. 90-degree V-Base – threaded V-shaped base with notches on both sides for gripping on round objects.
13. Pipe Coupling – used to connect two extensions together using threads on outside of each extension.
14. Plunger Toe – threaded attachment for ram plunger to permit spreading in tight areas.
15. Pump - hand operated unit that creates hydraulic pressure in system by operating handle.
16. Ram – used primarily for spreading in all directions and in any position; complete range of capacities from 1-1/2 through 50 tons (only component of system to operate at capacity); can also be used for limited pulling; one end of the ram threaded on outside of cylinder while other end threaded on inside; end of plunger also threaded; travel distance of plunger eight inches; when used with extension, capacity of ram reduced by 50%.
17. Rubber Flex Head – threaded round rubber attachment for end of ram plunger or extension.
18. Serrated Saddle – threaded round serrated base for plunger.
19. Single Chain Plate – threaded attachment for cylinder to permit chain to be attached to each end; plunger pushes against object to create tightening.

20. Slip Lock Extension - adjustable extension inserted inside extension and secured with lock pin; adjustment mechanism threaded with quick release to extend.
21. Smooth Saddle – threaded round smooth base for plunger.
22. Spee-D-Coupler – threaded coupling used to connect hose to ram, wedgie, or spreaders.
23. Spreader – device used for widening opening; spreader has opening distance of approximately twelve inches and capacity of approximately 1,200 lbs.
24. Wedge Head – threaded wedge-shaped attachment for ram plunger or extension with notch in center for gripping.
25. Wedgie - small spreader (sometimes called a duckbill) has opening distance of approximately three inches; capacity of approximately 600 lbs.

B. Care and Maintenance

1. Protect threads and couplings with proper protective devices or caps
2. Avoid overpowering attachments
3. Hydraulic lines should never be disconnected while under pressure
4. Attachments tightened by hand utilizing Spee-D-Couplers
5. When utilizing extension tubes, utilize lock on connectors or lock pins
6. Tape measurements should be taken to ascertain desired extension reach prior to assembly
7. Check jack oil level - add SAE 10 motor oil if needed to level of notch on stem of filler plug
8. Do not overfill pumps beyond recommended capacity

III. OPERATION OF THE PORTO-POWER (1-3)

A. Principles of Operation

1. Do not overpower pump with pipe attachments or additional weight application; stop pumping when pumping becomes more difficult
2. Spreaders and wedgies normally are the most misused piece of equipment utilized with porto-power pumps
3. Pump handle for application of force. When using spreader or wedgie, hold pump in hands with hose pointing down, and squeeze pump handle against pump housing. Stop pumping when resistance is felt.

B. Protection of Equipment

1. Do not overload rams, use largest ram and base as possible within available space
2. Do not overextend ram. Empty space should be filled prior to application of force. (This assures most efficient use of force)
3. Spring retaining screws on 20 and 50 ton rams should never be tampered with
4. Refrain from utilizing excessive off center loads; try to work at right angle of load
5. Do not abuse hose by dropping heavy equipment or kinking lines in such manner as to damage equipment
6. Provide adequate clearances while working with equipment and do not drag hose lines across jagged materials
7. Maintain clean oil lines by utilizing dust caps
8. Dress damaged threads and protect from additional damage by utilizing guards
9. Keep equipment away from fire and heat sources as it will break down packing and weaken equipment

10. Never attempt to lift a load that exceeds the capacity of your ram. Overloading causes cracked cylinders, blown cups, bent plungers
11. Pump carefully. When you feel that you have to pump unusually hard - stop operation. Adjust set-up so that off-center load is not as great. Excessive off-center loads produce considerable strain on the ram plunger and extension tubes.
12. Do not carry Porto-power unit by hose.
13. Collapse ram if connected to pump, permitting oil to flow back into pump. Clamp pump at foot bracket in vise as shown. Remove filler plug at end of pump. Add hydraulic oil until it is level with notch on stem of filler plug, using the stem as a dipstick.

C. Operation of Porto-power Units

1. Porto-power attachments can be threaded to the top of the ram plunger, top of the ram or into the ram base. While assembling combinations always screw attachments as far down as possible.
2. When using Lock-On tubing for push operations slip speedy Lock-On Connectors and Lock-On Adapters between extensions or extensions and ram. For direct pull operations slip Lock Pins through drilled holes.
3. Operation
 - a. Close release valve finger-tight by turning knob near hose end of pump clockwise.
 - b. Hold pump in any position, horizontal to vertical with hose end down.
 - c. Release valve for lowering load by turning knob near hose end of pump counter-clockwise.

IV. APPLICATIONS FOR THE PORTO-POWER (1-4)

- A. The Porto-power is a device used primarily to displace members of a wrecked motor vehicle. By exerting a force between two members of a wreck, one or both will generally distort or displace allowing better access to an entangled victim.
- B. The most widely used accessory for the porto-power is the spreader or wedgie. The device allows a good deal of displacement with application of force. Most spreaders or wedgies are levered so that cylinder ram travel is amplified. Of course, when this is the case there is reduction of force at the tips.
- C. The hydraulic hose and couplings are generally self-sealing ball and needle connectors to limit the amount of hydraulic fluid lost during connection and disconnection and the amount of air entering the system. Usually the ball is spring mounted and must be displaced by the needle before the couplers mate. After the couplings are attached, they must be secured by tightening the coupling nut so that the system will not leak.
- D. To use the porto-power, there must be an adequate amount of hydraulic oil supplied to the pump. If this is present, the pressure release valve must be closed, usually by turning a relief valve clockwise until it seats.
- E. Use Tips
 - 1. There should always be at least two persons operating the device, one with the ram to monitor the progress, the other with the pump.
 - 2. When using the spreaders to pop open a door, remember that the door will release only after considerable stress is placed on the vehicle frame. When the door finally does open, it does so with much force. The pump operator should lean against the door to reduce the violence of the door opening. The pump operator should be positioned behind the jaw operator and slightly to the side away from the swing of the door. The jaws tend to move out of their position if the members being stressed do not distort or displace. The hand

closest to the tips should be placed on top of the cylinder, palm down. The other hand, placed at the other end of the cylinder, palm up. By doing this, should the jaws jump out they will be directed down toward the ground, from the face and torso.

3. Air in the system or low oil supply will cause the porto-power's force to be greatly diminished. Any leakage around the ram cylinder seals or pump packing will reduce the power also. To remedy this, bleed off the air in the system, as with hydraulic brakes in cars. Pump the ram to full extension without applied load, placing the pump and hydraulic fluid reservoir at a level above the cylinder. This allows the air bubbles in the system to rise toward the highest point (the reservoir). Leave the pressure release closed for 2 - 3 minutes. Then apply load to the ram and open the release the valve allowing the ram to rapidly retract, forcing the hydraulic fluid and air bubbles into the reservoir, if this is done two or three times, and the reservoir is full of fluid, as recommended, the ram should work properly.
4. Some porto-powers have provisions for the reservoir to be vented during pump operation that prevents a possible partial vacuum from being formed in the reservoir when the fluid is drawn through the pump.
5. It is important that as much of the "dead" empty space be filled in before force is exerted. The most efficient pushing force of a ram's travel is within the first half of its extended length, and if that travel is simply "taking out the slack" between two points in a wreckage, much more effort will be required. To let off the pressure - insert cribbing blocks to stabilize the load and slowly open the pressure release valve.
6. Wooden blocks (preferably oak 4" x 4" blocks) can be used to crib or cross-block and support the displaced or moved mass in case of system failure. In addition, as the amount of travel increases, the mass supported becomes more unstable, making secondary support necessary.

F. Displacing a Steering Column

1. Removal of the steering column should be accomplished by pushing the column rather than pulling due to the possibility of tilt steering columns or the steering columns on front-wheel drive vehicles coming back into the passenger compartment.
2. Attach flat base to bottom of ram cylinder.
3. Attach female to male adapter to plunger.
4. Measure distance between rocker panel or seat bracket to bottom of steering column and insert necessary extensions using lock-on connectors, as needed.
5. Put 90-degree V-wedge on extension to secure it to steering column.
6. Make sure ram is pushing at a right angle to the steering column to minimize ram slipping as pressure is applied.
7. Hold pump in hands with hose downward, close relief valve, and begin pumping slowly while watching column movement.
8. Cease pumping when sufficient space has been achieved for the rescue

G. Partial Roof Removal

1. Use cutting tools such as a hacksaw or a reciprocating saw to cut the posts
2. Cut a notch approximately three inches deep on each side of the roof near the beginning of the C-post.
3. Attach flat base to bottom of ram cylinder.
4. Attach female to male adapter to plunger.

5. Measure distance between rocker panel to bottom edge of the roof near the A-post and insert necessary extensions using lock-on connectors, as needed.
6. Put 90-degree V-wedge on extension to secure it to the roof edge.
9. Make sure that ram is pushing at a right angle to the roof to minimize ram slipping as pressure is applied.
10. Hold pump in hands with hose downward, close relief valve, and begin pumping slowly while watching roof movement.
11. Cease pumping when the roof is in a position where it can be pulled back with ropes attached to the A-post (may require adjustment and additional extensions before lift is completed)
12. Secure the roof to minimize any movement.

H. Forcing Door

1. Forcing a door is best accomplished with both wedgie and spreader and two pumps.
2. Due to strength of locking mechanism on most modern automobiles, forcing of door should be undertaken at hinges rather than lock.
3. Use a haligan bar and axe to make purchase point in opening between door and fender by forcing adz (wedge) end of the haligan bar in opening and prying up or down to widening the opening.
4. Use wedgie to further widen opening and expose hinges.
5. As opening is widened, spreader can be used to force door at hinged side.
6. Hold both pumps with the hose pointing downward and pumping the squeezing the handle against the pump (this reduces the chance for overpowering the pump).

7. Reposition either wedgie or spreader as needed. Forcing should be done as close to hinge as possible.
8. Be cautious not to overpower the wedgie or spreader. The porto-power may not have sufficient strength to force the door open.
9. If door latch and locking mechanism can be operated, porto-power can be operated at lock side to force door (porto-power not strong enough to overcome lock).

I. Displacing Front Seat

1. Attached serrated saddle to bottom of cylinder.
2. Attach female to male adapter to plunger.
3. Measure distance between bottom of A-column near rocker panel and seat bracket and insert necessary extensions using lock-on connectors, as needed.
4. Put 90-degree V-wedge on extension to secure to seat bracket; place wedge against upper portion of seat bracket.
5. Make sure ram is pushing at right angle to seat bracket to minimize ram slipping as pressure is applied.
6. Hold pump in hands with hose downward, close relief valve, and begin pumping slowly while watching seat movement.
7. Cease pumping when sufficient space has been achieved for the rescue.
8. Alternative method is to pull seat from behind using the pulling capability of ram.
9. Place the single chain plate on outside cylinder threading.
10. Place double chain plate on plunger.

11. Pass chain under seat and secure it to forward portion of both seat brackets using caution to make sure that chain is attached to portion of bracket attached to seat rather than portion attached to floor. This is best accomplished with two short pieces of chain.
12. Pass chain through the holes on double chain plate and attach in respective slots on single chain plate.
13. Using another piece of chain, wrap chain around a frame member under vehicle.
14. Pass chain back to ram and secure in respective slots in double chain plate.
15. Take up slack in chains and make necessary adjustments so that pulls evenly.
16. Hold pump in hands with hose downward, close relief valve, and begin pumping slowly while watching seat movement. Movement of plunger pulls chain rather than pushes.
17. Be aware that movement of seat will probably be sudden rather than gradual. Patient should have been boarded and collared prior to beginning operation.

J. Widening Door Opening

1. Operation involves pulling door away from opening to make opening for patient removal wider.
2. Place single chain plate on outside cylinder threading.
3. Place double chain plate on plunger.
4. Pass chain around door already been forced open and secure so that it will not slip as door is pulled. This is best accomplished with single piece of chain.
5. Pass chain through holes on double chain plate and attach in respective slots on single chain plate.

6. Using another piece of chain, wrap chain around frame member under vehicle.
7. Pass chain back to ram and secure in respective slots in double chain plate.
8. Take up slack in chains and make necessary adjustments so that chain pulls evenly.
9. Hold pump in hands with hose downward, close relief valve, and begin pumping slowly while watching seat movement. Movement of plunger pulls chain rather than pushes. Be aware that shock absorber bumpers or air bags may activate if pressure is applied to bumper.
10. Monitor door movement to observe that the chain is not slipping from the door.

The instructor should show any of those items in the terminology section that are available and how they are attached. The instructor should also demonstrate the various techniques and applications. The students should then be given an opportunity to demonstrate their understanding of the classroom material and demonstrations.

Depending upon the size of the group, more than one set of equipment and additional vehicles may be required. There should also be adequate instructional resources to maximize safety and minimize tool damage.

Summarize the material in the lesson and discuss the lessons learned from the practical session.

SUMMARY:

Review:

The safety precautions associated with the use of porto-powers should be stressed. The potential for a difference between the pump and attachments should also be stressed so that the student better understands the capabilities and limitations of the system.

Porto-Power Operation and Use

- Introduction to hydraulically powered tools
- Components of a porto-power
- Operation of the porto-power
- Practical applications

Remotivation:

Stress the importance of regular maintenance of equipment, practice, and a general understanding of the uses and limitations of the various components of the porto-power system.

Assignment:

EVALUATION: