



# Alcock Ram Pump (ARP) System Assembly Guide



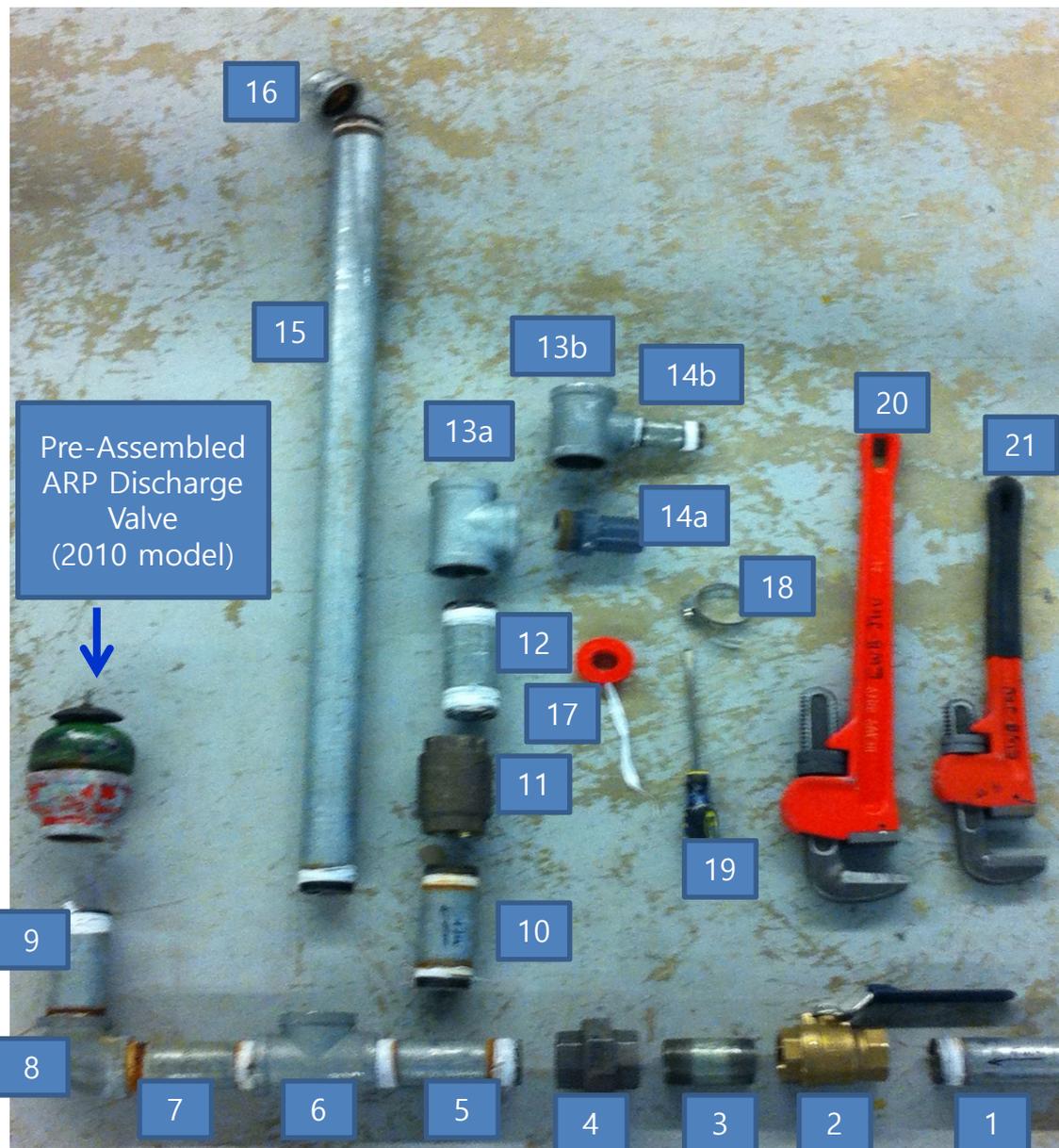
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CREDIT: This guide was prepared by members of the **Johns Hopkins University** student chapter of *Engineers Without Borders - USA* in Baltimore, Maryland, U.S.A. We hope you find it useful.

# Illustrated Parts List for Assembling the ARP System



1. Supply pipe (from weir)
2. ball valve (on-off valve)
3. barrel nipple 6 (optional)\*
4. socket union (optional)\*
5. barrel nipple 1
6. Tee 1
7. barrel nipple 2
8. 90-degree elbow
9. barrel nipple 3
10. barrel nipple 4
11. Non-return valve
12. barrel nipple 5
- 13a. Tee 2
- 13b. Reducing tee (This option is for smaller delivery pipe sizes.)
- 14a. Male pipe to hose barb
- 14b. Barrel nipple 6 (e.g., to connect with smaller delivery pipe size)
15. Air vessel
16. Air vessel cap
17. Pipe tape (Teflon™ tape)
18. Hose clamp
19. Screw driver
20. Pipe spanner 1
21. Pipe spanner 2

\*Note: The "socket union" (#4) and associated pipe nipple (#3) are optional and are not illustrated in the main instructions. See Appendix D for details..

# Things to Know before Reading the Manual

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- Always use pipe spanners to tighten every connection very tight – see **Appendix A**. (Loose fittings can let in air and can cause the pump not to function.)
- Use the white Teflon pipe tape to wrap the threads prior to making each connection – see **Appendix B**.
- See **Appendix C** for purpose and use of the ball valve.
- Use of a socket union can facilitate dis-assembly but is optional – see **Appendix D** for purpose and use of socket unions.
- Two options are illustrated for connecting to the delivery pipe – see parts #13 and #14 in the parts list.

# Connecting the Main Valves and Pipes



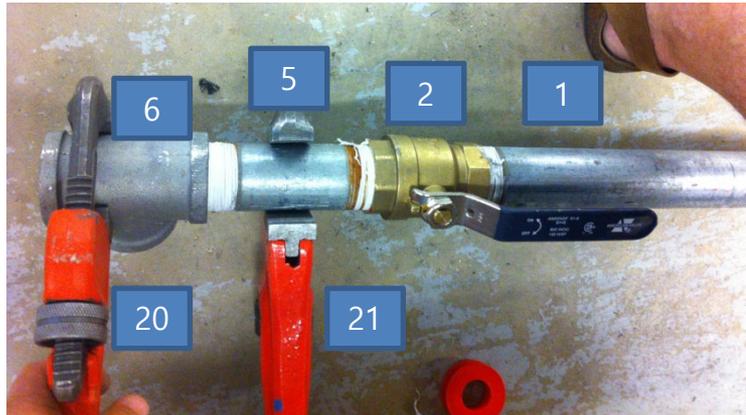
1. Connect the ball valve (#2) onto the supply pipe (#1). The direction of the ball valve does not matter. Just make sure that the handle has room to swing 90 degrees to close it.

2. Connect barrel nipple 1 (#5) onto the other side of the ball valve (#2). The picture below shows how to tighten using two spanners (#20 and #21).

Note that the left spanner (#20) is holding the ball valve (#2) stationary while the right spanner (#21) is doing the work of tightening by turning barrel nipple 1 (#5). The pipe is turned clockwise, as seen when looking at the connection from barrel nipple 1. See also Appendix A.



# Connecting the Main Valves and Pipes (continued)

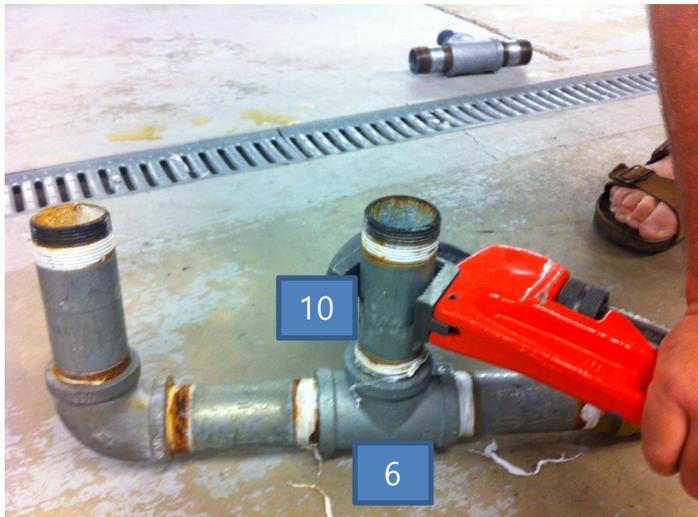


3. Connect tee 1 (#6) onto the other side of barrel nipple 1 (#5).

(Note: that the left spanner (#20) is doing the work and the right spanner (#21) is holding the other pipes stationary.)

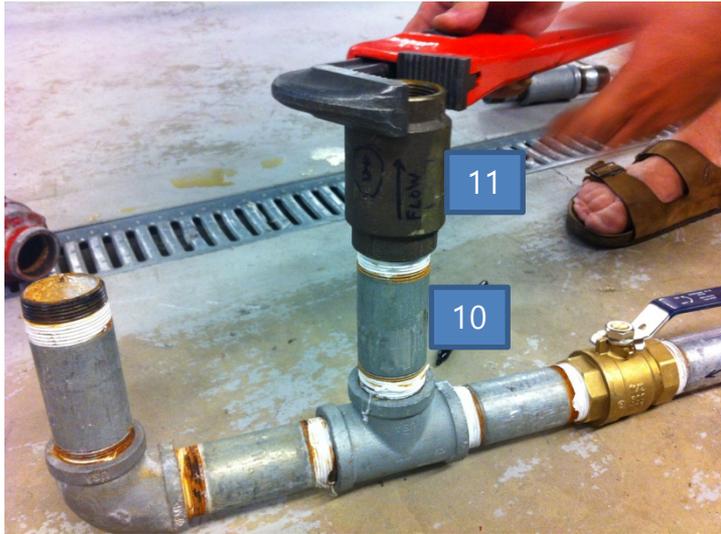


4. Continue connecting barrel nipple 2 (#7), 90° elbow (#8) and barrel nipple 3 (#9) to create the assembly shown above.



5. Connect barrel nipple 4 (#10) onto the top of tee 1 (#6).

# Connecting the Main Valves and Pipes *(continued)*



6. Connect the non-return valve (#11) onto barrel nipple 4 (#10). There is an arrow sign on the non-return valve. Find it and connect the non-return valve in a way that the direction of the arrow is **“up”**. This is the direction of water flow.

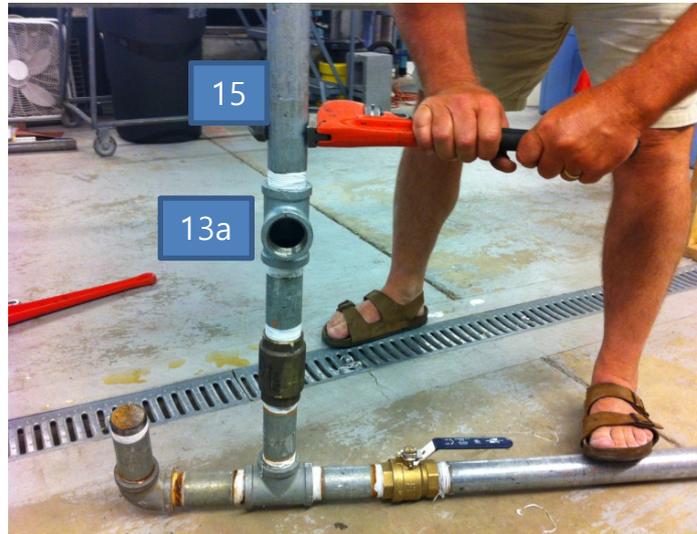
7. Connect barrel nipple 5 (#12) onto the other side of the non-return valve (#11). The product so far should look like the assembly shown above.

# Connecting the Main Valves and Pipes (continued)

8a.\* Connect tee 2 (#13a) onto barrel nipple 5 (#12).



9. Connect the air vessel (#15) onto the other side of tee 2 (#13a).

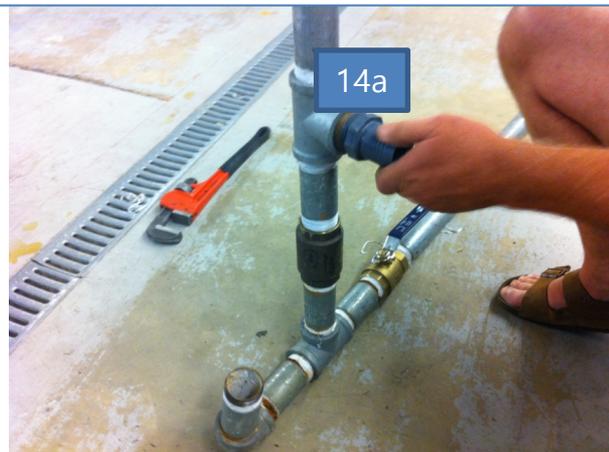
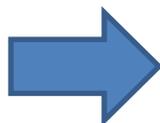


10. Connect the air vessel cap (#16) onto the air vessel (#15).

\* Note: See pg. 9 for an alternative to part #13 in step 8.

# Connecting to the discharge pipe: hose barb alternative

This illustrates the procedure of installing the delivery pipe (hose) onto the ram-pump assembly. Other parts can be installed instead of the hose. An alternative connection type is described on the next page.



11a. Connect the hose barb (#14a) onto tee 2 (#13a).



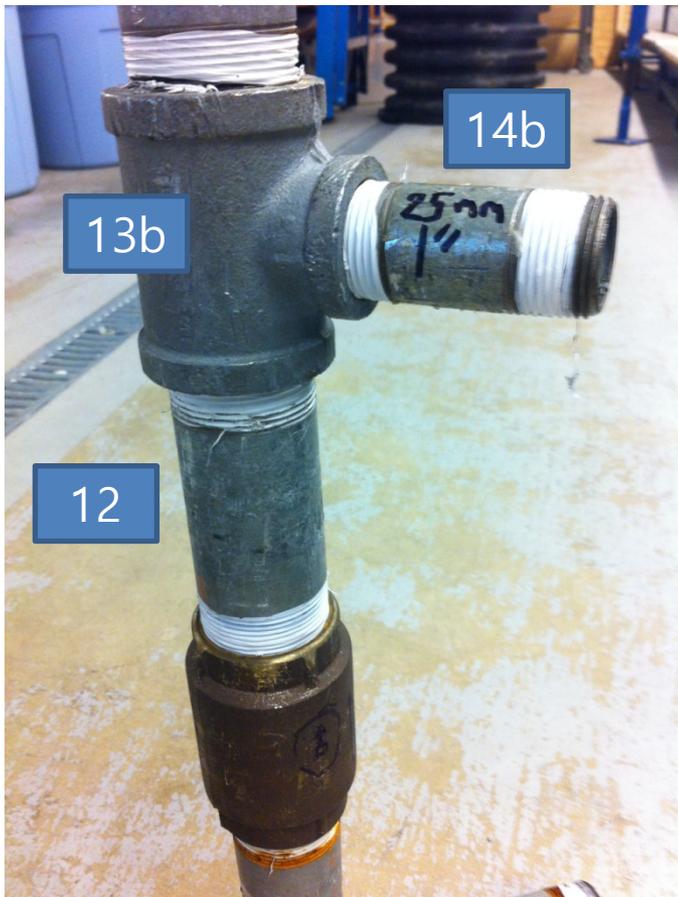
13a. Push the hose as far as possible onto the hose barb (#14a). Use the screw driver (#19) to tighten the hose clamp (#18), thus squeezing the hose tight onto the hose barb.



12a. Put a loose hose clamp (#18) around the hose and bring the hose up to the hose barb (#14a).

# Connecting to the discharge pipe: pipe nipple alternative

This illustrates the *alternative* procedure of installing a pipe nipple (#14b) on the ram pump. For example, we may want to use a 25-mm (1-inch) pipe nipple (#14b), which fits nicely inside of smooth 32-mm (1¼-inch) high-density polyethylene (HDPE) delivery piping. In this case, we need a 40-mm by 25-mm reducing tee (#13b) at step 8.



8b. Go back to page 7 of this manual. Instead of connecting tee 2 at step 8, install the reducing tee (#13b) onto barrel nipple 5 (#12).

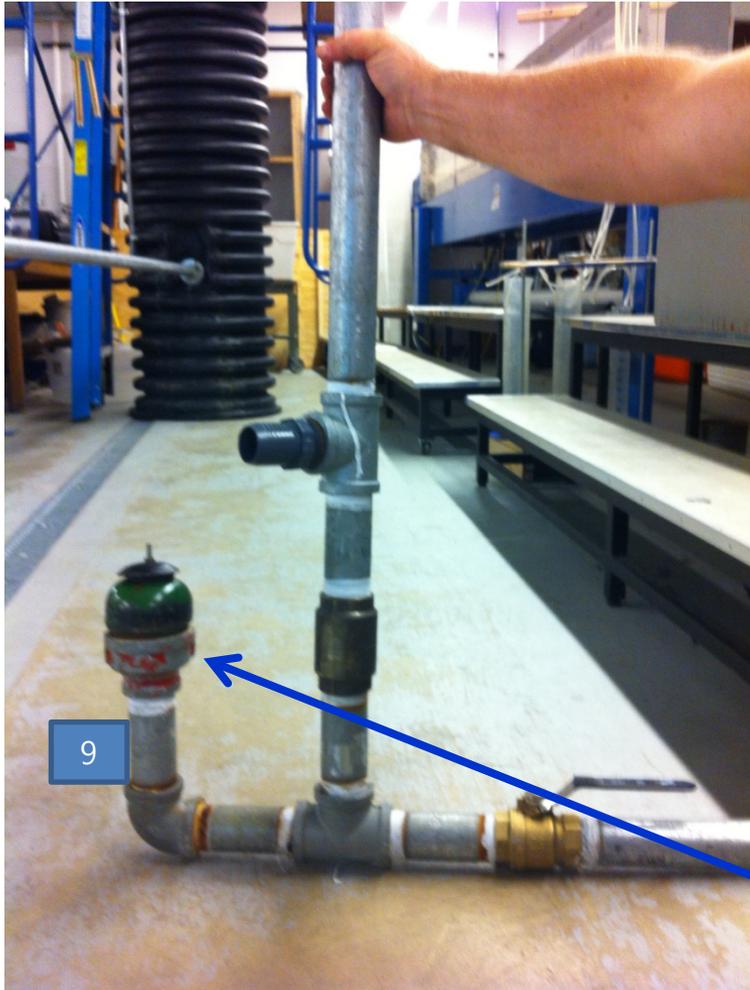


9. & 10. Steps 9 & 10 are the same as before. See page 7.



11b. Connect the barrel nipple 6 (#14b) onto the reducing tee (#13b).

# Assembling the Ram Pump: connecting the discharge valve



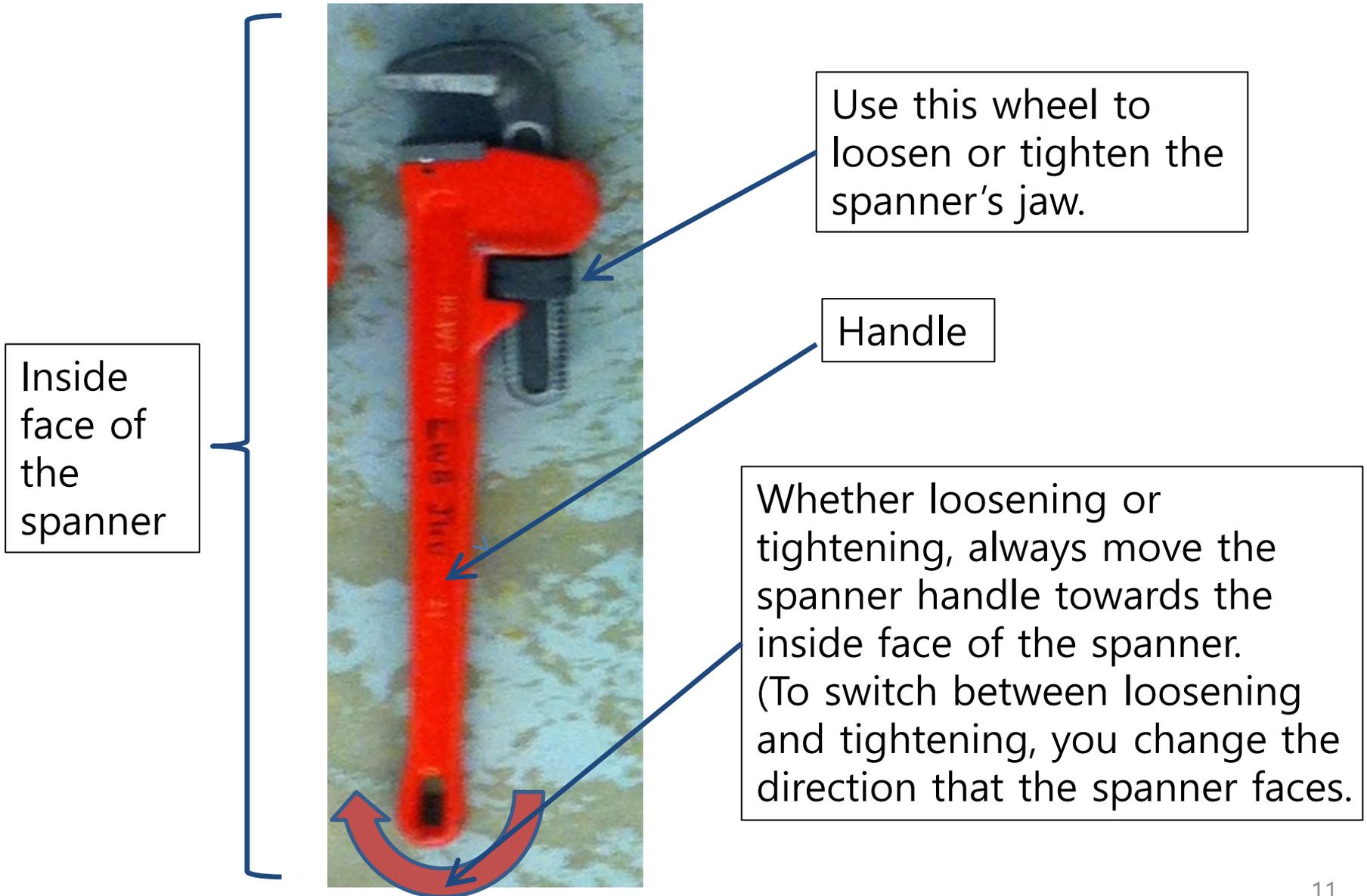
14. Connect the pre-assembled ARP discharge valve onto barrel nipple 3 (#9).

As with other parts, use the pipe spanners to ensure that the connection is very tight before testing and operating the ram pump.

Refer to the *ARP Discharge Valve Assembly Guide* for more information about the discharge valve. (Shown here is a 2010 model.)

Pre-Assembled  
ARP Discharge  
Valve  
(2010 model)

# Appendix A: How to Use a Pipe Spanner



# Appendix A: How to Use a Pipe Spanner (*continued*)

Example: Let us **loosen** the non-return valve to remove it from the rest of the assembly.



1. First, think which direction you wish to turn the parts. In order to **loosen** the non-return valve (#11), you have to turn the non-return valve (#11) **counter-clockwise** (when facing down from the part to the connection), while holding the lower pipe still. Align the spanners appropriately by remembering that you can only push the handles toward the spanner faces. **Note:** For loosening, one spanner handle pulls away from the other.



2. Turn the spanners. Sometimes, working together with others or using tools such as long pipes on the ends of handles can be very helpful.



3. The non-return valve is loosened from the rest of the pump.

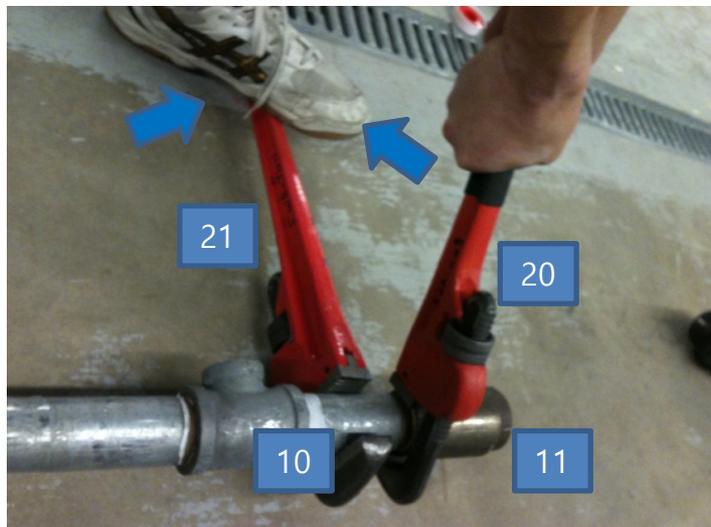
# Appendix A: How to Use a Pipe Spanner (*continued*)

**Loosen** **Note:** For loosening, one spanner handle pulls away from the other.



This picture shows loosening. Here we are loosening barrel nipple 5 (#12) from the non-return valve (#11). In order to **loosen** barrel nipple 5, we turn it **counter-clockwise when facing from the part toward the connection**. Also, we have to hold the non-return valve so that it does not turn along with pipe section. So, we align the spanners as shown, and both handles are pushed toward ground.

**Tighten** **Note:** For tightening, one spanner handle pushes toward the other.



This picture shows tightening. Here we are tightening the non-return valve (#11) onto barrel nipple 4 (#10). In order to **tighten** the non-return valve, we turn it **clockwise when facing from the part toward the connection**. We hold barrel nipple 4 in place, so that it does not turn. Align the spanners as shown in the picture and turn spanner (#20) in the direction of the arrow. **Note that the floor is used** to push up on the other spanner (#21) and prevent it from moving.

# Appendix B: How to Use Pipe Tape

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## Purpose

White Teflon™ pipe tape is used at every connection primarily in order to make disassembly easier. The tape prevents the corrosion (rusting) of the pipe from bonding the threads together. It also makes it easier to tighten the pipe and can perhaps help seal the joint and prevent air leaks.



1. Wrap the pipe tape around the pipe thread in a clockwise direction (clockwise facing the pipe)

2. Keep wrapping until all the threaded parts are covered, from the point of overlap to the end of the pipe.

# Appendix C: How to Use a Ball Valve

## Purpose

The ball valve is used to turn on/shut off water flow. One can shut off water flow by turning the handle of the valve 90 degrees. Unlike other valves, the ball valve is not good at partially shutting down flow.



open



closed

Note: Other types of valves (such as "gate valves" and "needle valves") usually have round handles (such as those on hose bibbs) that close clockwise and open counter-clockwise, with partially open positions between the full-shut and full-open positions, thus allowing restricted flow. For these other valve types, never open them 100% full. Instead, always turn back the handle  $\frac{1}{2}$  turn from "full" open. This way, if such a valve is ever "stuck" you can know that it is stuck shut and not stuck open!

# Appendix D: Installing a socket union

## Purpose

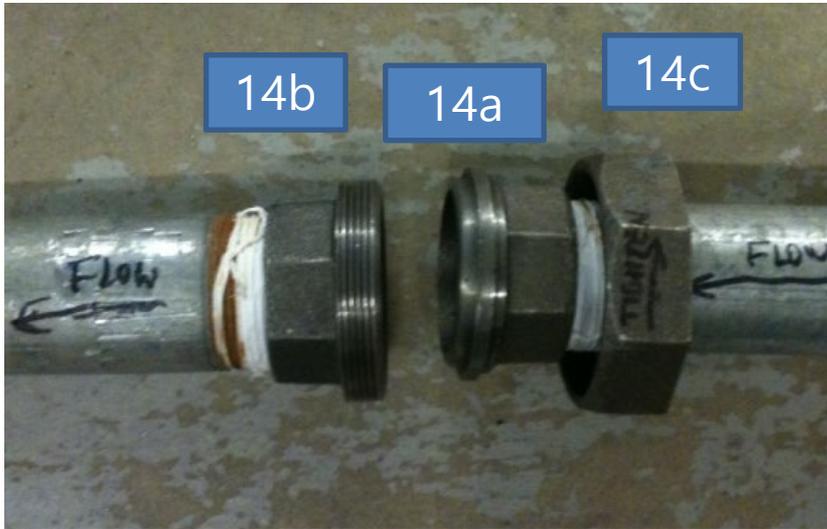
We can use a socket union to facilitate easy assembly/disassembly. For example, if you install a socket union in the middle of the pump system, it is easier to separate the left part of the pump assembly from the supply pipe without having to disassemble step-by-step from the last part added. See photo in step 2.



1. Loosen the socket union by turning the center "closure nut", without turning either pipe. Note: It can be "tricky" to know which smaller nut to hold and which direction to turn the larger center nut – see suggestion on next page for an installation trick that solves this problem.
2. Once you loosen the socket union, you can separate the pump from the rest of the pipes.

## Appendix D: Installing a socket union (cont'd)

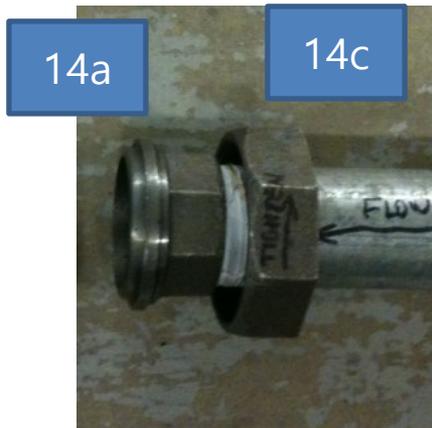
### A. Structure of a socket union



- 14a: Male compression fit piece (with female NPT threads on left, threaded onto a pipe section)
- 14b: Female compression fit piece (with female NPT threads on right, threaded onto a pipe section)
- 14c: Closure nut. This will move left to thread onto part 14a and pull the compression fittings together,

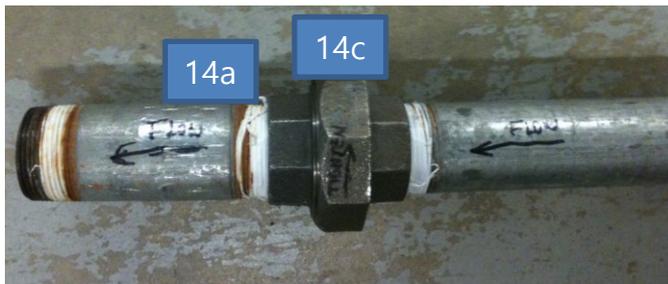
\*Note: Unless one knows how the coupling was installed, it is difficult to know which way to turn the closure nut in order to open an in-place closed coupling. To avoid this problem, we suggest that you **always install the coupling so that the male compression face of #14a faces downstream**—that is, in the direction of flow as shown above. With this convention, one **loosens** the closure nut (#14c) by turning it **counter-clockwise when facing downstream**, while holding the downstream female piece (#14b) against turning by using the the other spanner.

## Appendix D: Installing a socket union (cont'd)



1. Slide the closure nut (#14c) up onto the *upstream* section of pipe, and then screw the male compression-fit piece (#14a) onto this pipe section and tighten fully with pipe spanners.

2. Screw the female compression-fit piece (#14b) onto the *downstream* section of pipe and tighten fully with pipe spanners.



4. **Tighten** the closure nut (#14c) onto the downstream compression-fit piece (#14a) by turning **clockwise when facing from the part downstream to the connection**.

3. Bring the compression-fit pieces (#14a and #14b) together. Note that they must be very straight and well aligned as you bring the closure nut (#14c) toward the connection and onto its threads.