



RK2

SYSTEMS
SAN DIEGO, CA

RK2000PE-PF

PROTEIN FRACTIONATOR

Operations Manual

RK2 1000 PE and 2000 PE Protein Fractionators

I. Introduction

II. Tools, parts and hardware

III. Unpacking procedures

IV. Assembly procedures

Appendix A: Components (includes hardware packages)

Appendix B: Views of fully assembled RK2 1000 PE (separate documents)

I. Introduction

Congratulations on your purchase of the RK2 1000 PE or 2000 PE Protein Fractionator. The 1000 PE processes 750-1250 gallons per minute, and the 2000 PE, nearly identical but with a taller reaction chamber, processes 1250-2200 gallons per minute. When assembled, operated and maintained correctly, they will provide many years of service, clean water, and health for aquatic life systems. For ease of use, the model referenced throughout the manual is the 1000 PE, but if you have purchased the 2000 PE, the procedures are identical.

Should any technical issues arise during assembly or operation of this unit, please contact your RK2 Systems Distributor.



HINT: It requires at least two people to assemble the RK2 1000 PE. It is recommended to have three or four people on hand, as well as tall, stable ladders and a forklift.

II. Tools, Parts and Hardware



Tools needed:

- Flat-head screwdriver
- Two 3/4" open-end wrenches
- One or two 1 1/8" socket wrenches
- Box-cutter or similar blade
- One tube of Dow Corning Compound 111 Silicone or similar Teflon Grease product, available at swimming pool or industrial plastics supply *
- Hand-clamp



- * For the silicone or Teflon grease, any of the products pictured at left will suffice.



WARNING: Do not use pipe wrenches for assembly of the filter. Doing so will result in expensive damage to the unit.

Hardware is included in various bags, pictured in Appendix A.

III. Unpacking Procedures

- A. To uncover the Top/ Cone Assembly, remove staples on box, remove the box, and remove the bubble wrap surrounding the Top/Cone.
- B. Most of the parts are stored within the Reaction Chamber (large grey tank). One person must climb inside the Reaction Chamber and hand out the parts to the other assemblers. See Figs. B1 and B2.



Each filters is pre-assembled at the factory, and then dismantled for shipping. The components packaged with each filter are specific to that unit. When installing several units, it is important not to mix the components, but rather to keep each unit's components separate, even if they appear identical.



Fig. B1



Fig. B2



BE CAREFUL. A few components of the 1000 PE are very heavy (approximately 100 lbs./50 kgs.) and may require two or more people to lift. It may be necessary to remove heavier components by using ropes. (See Fig. B3.)






Fig. B3

3. Matching the components to descriptions in this manual (See Appendix A), set aside all parts where they can be identified and retrieved conveniently.
4. Prior to attaching pipes, remove any tape from threadings. (This tape is used to keep washers and O-rings from falling off.)

IV. Assembly Procedures

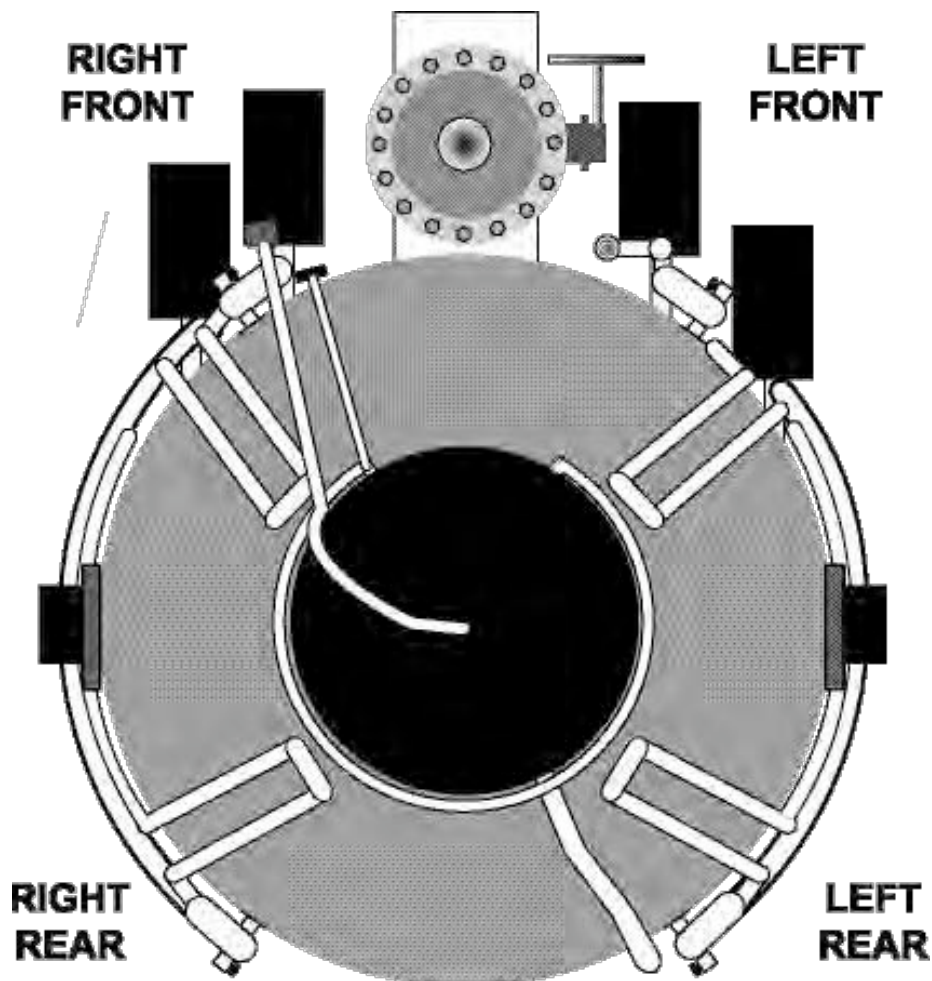
As mentioned before, it is important to have two people involved in the assembly of the 1000 PE, with three to four people recommended when lifting the Top Assembly into place.

Follow the instructions below very carefully, taking special note of the Helpful

Hints , Notes  and Warnings . This will help prevent breakage of any difficult-to-replace components. Appendices A and B, at the end of this document, identify the fixtures and assemblies you will be installing.

Throughout the following procedure, references may be made to Top Right, Back Right, Top Left and Back Left. The diagram below provides orientation regarding these four portions of the 1000 PE.

Assembling the unit also requires the assembler to tighten bolts on several flanges. The torque values for these flanges is lighter than what would be expected for similar flanges, and we recommend using a torque wrench, utilizing the torque table found in Appendix C.



Installing the Foam Baffles

1. Insert the bottom half of the foam baffle assembly using the notches found along the inner rim of the Reaction Chamber, as shown in Fig. 1, below.



Fig. 1

2. Insert the top half of the foam baffle assembly using the notches found along the inner rim of the Reaction Chamber, and nesting the notches cut in the middle of each baffle, as shown in Fig. 2, below.



Fig. 2

Mounting the Top/Cone Assembly

3. Remove the six bolts that hold the Top/Cone Assembly together.
4. Apply a 1/4" bead (approximate) of grease to the inside edge of orange gasket found on top of the Reaction Chamber, as shown in Fig. 4, below. Spread evenly over the gasket.



Fig. 4



HINTS: Do not get this grease on your clothes! It does not dry, which is one of the reasons it's perfect for this job. A small amount of grease goes a long way. As long as you've got the grease on your finger, you can also apply it to the Waste Drain port as shown in Fig. 11 and the Discharge Gasket shown in Fig. 13. However, if you do that you'll be skipping around so be sure to return back to Step 5, below, after you're finished greasing!

5. Place the entire Top/Cone Assembly on top of the Reaction Chamber, taking care to align the notches indicating the front of the unit as shown in Fig. 5A.



Fig. 5A



HINT: A forklift is a great way to elevate the Top/Cone Assembly to position it for easy mounting! Otherwise, four people are required to position the Top/Cone Assembly. See Fig. 5B.



Fig. 5B

6. Use a screwdriver or similar object to line up the holes found along the outside ring of the Top/Cone Assembly with the holes in the gasket and Reaction Chamber, as shown in Fig. 6.



Fig. 6

- Using the 36 bolts and washers found in the white bag placed in with the Top/Cone Assembly, secure the Top/Cone Assembly to the Reaction Chamber.



HINTS: Initial bolt insertions may be more challenging than subsequent ones. It is preferable to thread all bolts through the holes rather than using a hammer or other implement to pound them through.



The Top is very fragile. DO NOT tighten the bolts in a circle around the Reaction Chamber, or you risk fracturing the acrylic top. When tightening the bolts, follow a pattern of tightening opposite sides of the bolts in sequence, as shown in Fig 7A, below.

Also, there is a small ozone vent on the top of the unit. **DO NOT plug this vent.**

It may also be necessary to use a **hand-clamp** (Fig. 7B), to give the bolts enough threading room.

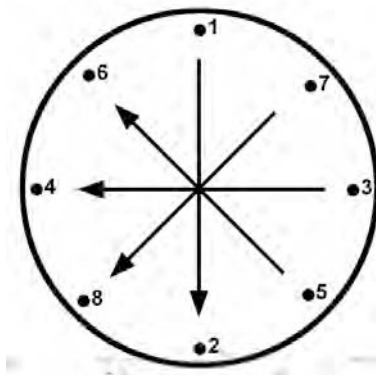


Fig. 7A



Fig. 7B

- Tighten the bolts until snug. The PSI of the water running through this part of the 1000 PE is LOW. Because of that, and because of all the grease you have applied, you do not need to tighten the bolts beyond snug. See Fig. 9 as an indication of what “snug” looks like in this case.

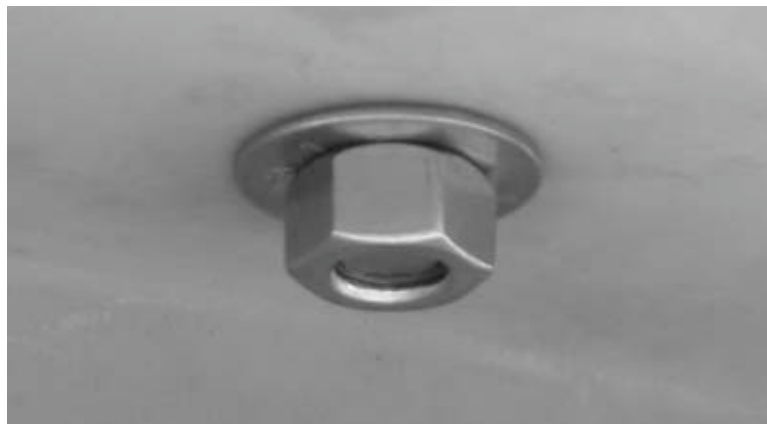


Fig. 8

9. Apply grease to the Waste Drain Port at the bottom of the Top (lid) assembly, per Fig. 9, below.



Fig. 9

Mounting the Discharge Flange

10. Place a block of wood or similar object directly beneath where you will position the very large Discharge Flange, such that you can elevate this heavy component to its proper position, as shown in Fig. 10, below.



Fig. 10

11. Apply a bead of silicon grease to the Discharge Gasket, positioning it within the inner perimeter of the holes, as shown in Fig. 11. Spread evenly over **both sides** of the gasket.

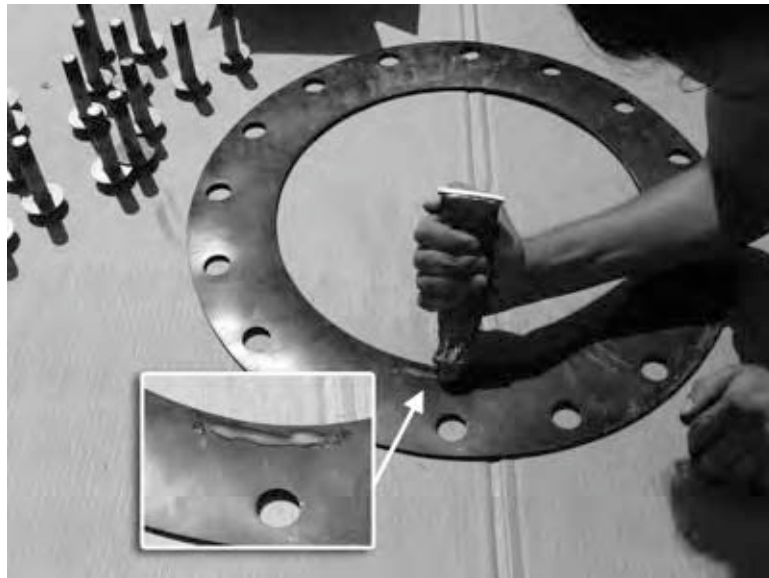


Fig. 11

12. Remove a first bolt from the box labeled “Bolts for 16” flange and gasket. Position it at the top (12 O’Clock) position, inserting it through both the flange and gasket, as shown in Fig. 12.

Note the bolt located at the 12-O’Clock position.



Fig. 12

13. Thread and tighten the remaining bolts in a similar fashion to Fig. 7A, above. After bolts are snug, tighten them firmly.



NOTE: Be sure that the top of the Discharge Flange is level. This will require a level. (Fig. 13.)



Fig. 13

Mounting the Butterfly Valve

14. Disassemble the hinged metal bracket, and adjust position to perpendicular, as shown in Fig. 14.

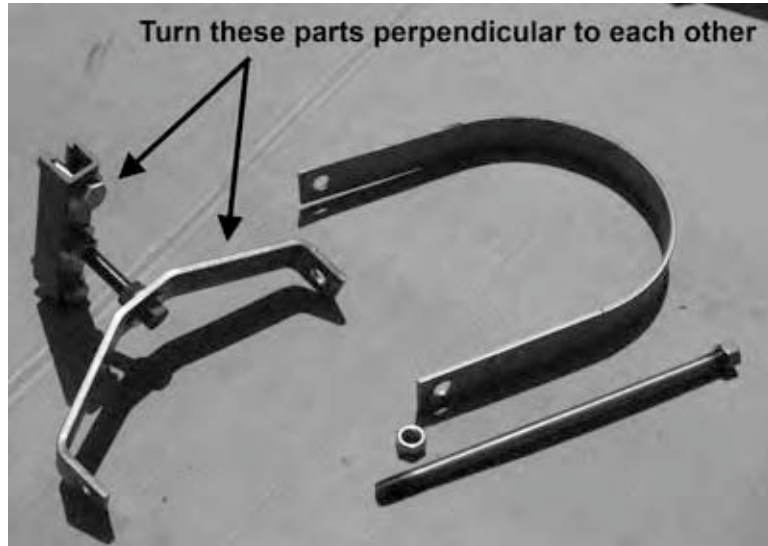


Fig. 14

15. Attach the base of the bracket to the Reaction Chamber, as shown in Fig. 15.



Fig. 15

16. Place the Butterfly Valve directly on top of the Discharge Flange, lining up the holes as shown in Fig. 16.



Fig. 16

17. Place the large bottom component of the Air Vent Assembly on top of the Butterfly Valve, as shown in Fig. 17. This component can be positioned in any orientation to suit your needs.



Fig. 17

- Using the 12 long bolts (inset) found in the box labeled, “Bolts for the Butterfly,” attach Discharge, Butterfly Valve and Air Vent, and tighten the bolts in the order indicated by the numbers on the top of the Butterfly, a similar pattern to Fig. 7A. (See Fig. 18)



Fig. 18

- Re-attach the remaining portion of the hinged metal bracket described in step 14 to support the Air Vent Assembly, as shown in Fig. 19.



Fig. 19

20. Position the top portion of the Air Vent Assembly and thread it in. Use Teflon tape (Fig. 20A) and hand-tighten (Fig. 20B).



Fig. 20A



Fig. 20B

Mounting the Pumps



NOTE: Four Pump Intake Valves (for attaching the pumps to the Reaction Chamber) are included. Three of these are identical, and the fourth, which has a longer length of piping coming off the mounting bracket, fits at the far right side of the Reaction Chamber if one is facing the front of the 1000 PE.

21. Position the two pump platforms as shown in Fig. 21.



Fig. 21

22. Using the bolts found in the Zip-Loc bags, attach the Pump Intake Valves to the bottom of the Reaction Chamber in the four positions, as shown in Figs. 22A and 22B. Remember to use the longer Pump Ball Valve in the far right position.

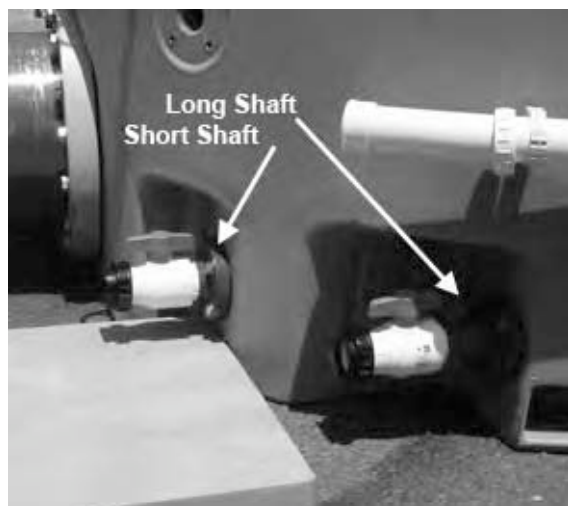


Fig. 22A

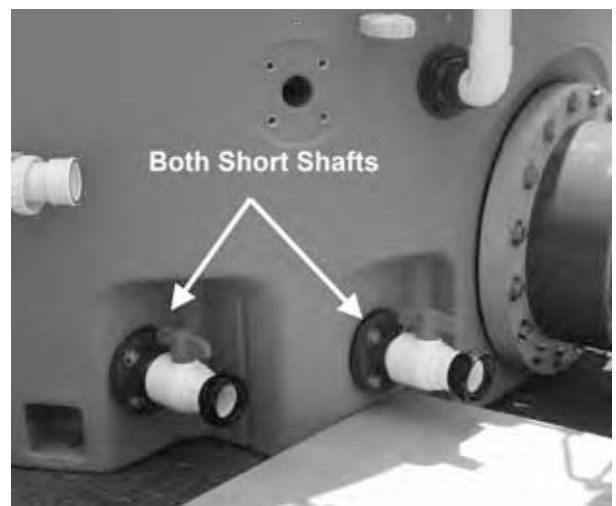


Fig. 22B

23. Position the rubber pump bases on the pump platforms, as shown in Fig. 23.

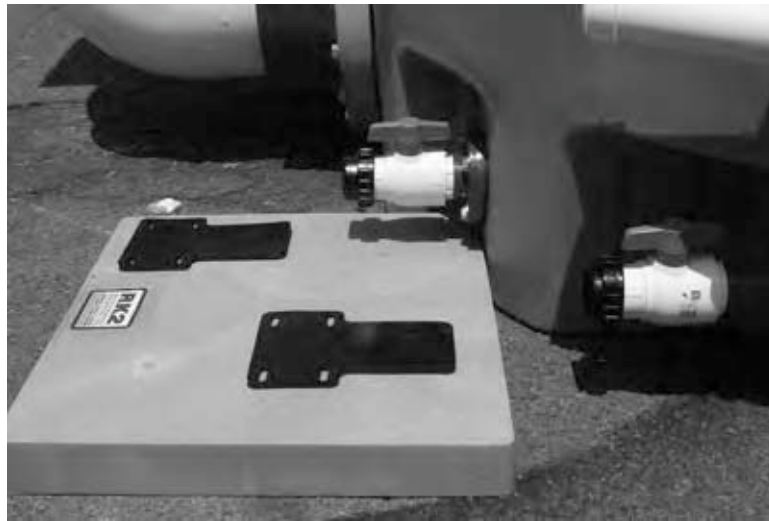


Fig. 23

24. Using the 11/16" wrench, remove all four pumps from their plywood bases.
25. Position the pumps near the Pump Intake Valves, and for each one, hand-tighten the pump onto the Pump Ball Valve union, making sure that the surface of the unions is flush, as shown in Fig. 25.

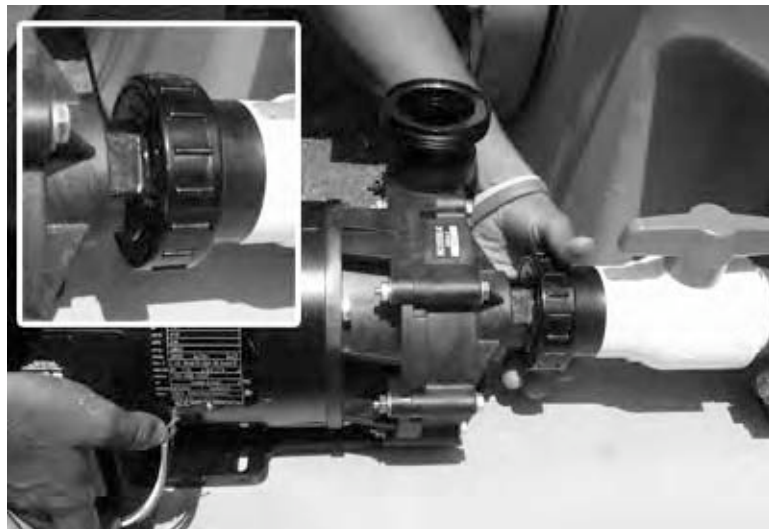


Fig. 25



Hint: Keep the pumps loose until you attach them to their proper fittings, in order to keep some play for necessary movement, then tighten them accordingly.

26. (Optional) AFTER assembly of the 1000 PE is complete, you may permanently bolt or screw the pumps to the platforms if you choose, using 3/16" fasteners. We recommend high-quality stainless steel bolts for this purpose, because they resist corrosion.

Mounting Venturi Plumbing

27. Identify the four Venturi Intake Plumbing assemblies. Note that the ball valves on each point in different directions. For ease of use, the two valves on each side should point straight in the same direction, as shown in Fig. 29.

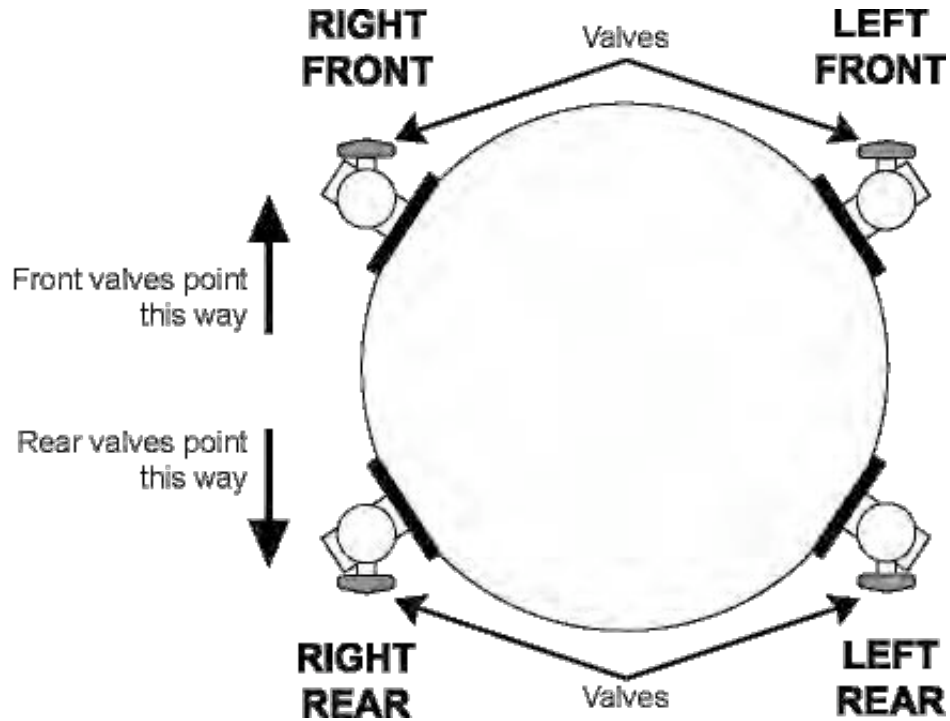


Fig. 27

28. Using the gasket and bolts found in the Ziploc bag, mount the four Venturi Intake Plumbing assemblies as shown in Fig. 28. Spread a thin layer of silicone grease on each gasket before attaching it.



Fig. 28

29. Identify the four identical Venturi Plumbing assemblies.
30. Fasten the Venturi Plumbing Assemblies to the Venturi Intake Plumbing as shown in Fig 30A and to the pump as shown in Fig. 30B.



Fig. 30A



Fig. 30B

31. Attach the Saltwater Rinse Assembly to the Venturi Plumbing as shown in Fig. 31, below.



Fig. 31

32. Attach the Saltwater Rinse Plumbing union to the Saltwater Rinse Assembly as shown in Fig. 32A, and to the union at the top of the unit, as shown in Fig. 32B.



Fig. 32A



Fig. 32B

33. Attach the Pump Discharge Plumbing union (Outside Left) to the top of the pump and to the circular pipe at the bottom of the Reaction Chamber, as shown below in Fig. 33.



Fig. 33

34. Join the Venturi Air Intake Plumbing (Right Front) to the Venturi Plumbing Assembly and to the pipe clicks, as shown in Fig. 34.



HINT: A simple way to engage the pipe click clamps is to set the pipe into the cradle of the clamp and press firmly.



Fig. 34

35. Attach one of the four identical Air Gauges to the bottom of the Venturi Air Intake Plumbing, as shown in Figure 35.



NOTE: The air gauges are not cemented so that they can be easily removed for regular maintenance.



Fig. 35

36. Attach another Air Gauge to the circular pipe surrounding the top middle third of the Reaction Chamber, as shown in Fig. 36.



Fig. 36

37. Along the RIGHT REAR side of the 1000 PE, attach the Venturi Plumbing Assembly to the Venturi Intake Plumbing, as shown in Fig. 37.



Fig. 37

38. Attach the Right Rear Venturi Air Intake Plumbing to the Venturi Plumbing Assembly.



Fig. 38

39. Attach the Freshwater Rinse Assembly to the Rinse Manifold (circular pipe surrounding the Top Unit, and to the City water supply. (Fig. 39)



Fig. 39

40. Attach bottom half of the Sight Gauge to the 2" Ball Valve located at the LEFT FRONT of the reaction chamber as well as to the pipe click located above it, as shown in Fig. 40.



41. Join the top half of the Sight Gauge to the bottom half of the Sight Gauge, as shown in Fig. 41.



Fig. 41

42. Attach the LEFT FRONT Venturi Plumbing Assembly to the Venturi Intake Plumbing and the inside LEFT FRONT pump, as shown in Fig. 42.



Fig. 42

43. Attach the LEFT FRONT Venturi Air Intake to the Venturi Plumbing Assembly, as shown in Fig. 43.



Fig. 43

44. Attach the air gauges to the Venturi Air Intake Assembly and the circular pipe that will join the other Venturi Air Intake Assembly at the LEFT REAR of the 1000 PE, as shown in Fig. 44.



Fig. 44

45. Attach the Left Rear Pump Discharge to the pump and to the circular pipe, which will join the Venturi Plumbing Assembly at the REAR LEFT of the 1000 PE (Fig. 45).



Fig. 45

46. Attach the LEFT REAR Venturi Plumbing Assembly to the Left Rear Venturi Intake Plumbing and to the circular pipe that joins to Pump Discharge, as shown in Fig. 46.



Fig. 46

47. Attach the LEFT REAR Venturi Air Intake to the Venturi Plumbing Assembly and to the circular piping that connects to an Air Gauge, as shown in Fig. 47.



Fig. 47

48. Insert the top of the Waste Drain to the port at the rear of the Top/Cone Assembly and to the adjacent pipe click. Use silicon grease to lubricate and seal this union, as shown in Fig. 48.



Fig. 48

Congratulations! You have successfully assembled the RK 1000/2000 PE! Now it's time to plumb the filter to the outside world.

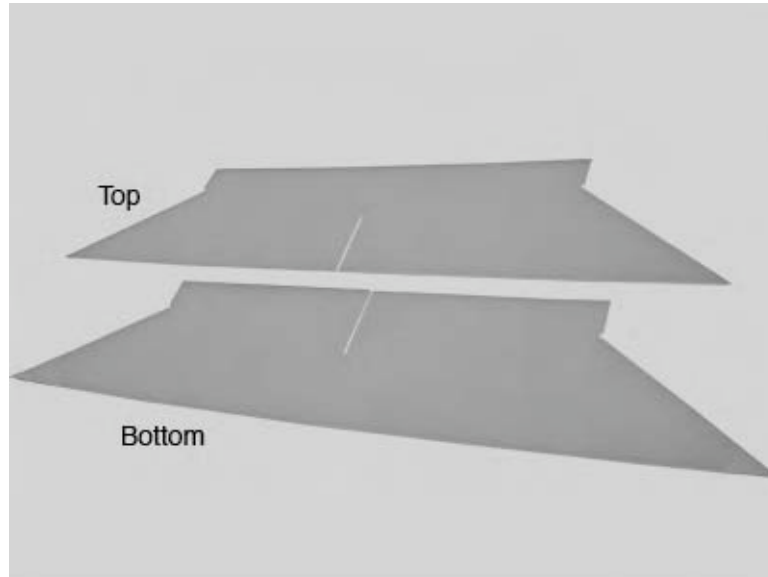
50. Plumb the flanged intakes at the top of the filter to exhibit 's water that must be filtered.

WARNING: Immediately after the 3" Discharge, you must provide a minimum of 12" vertical drop. Do not install horizontal piping until you have provided 12" of vertical drop.

51. After you have completely connected the RK 1000 PE, fire it up! Then inspect for any unions or nuts/bolts that leak, and hand tighten.

Appendix A: Components

Included within the Reaction Chamber (main structural component of the RK 1000 PE) and accompanying boxes there are some components wrapped in bubble-wrap that you will need to install. They are shown below for your reference (not to scale):



Foam Baffles, top and bottom

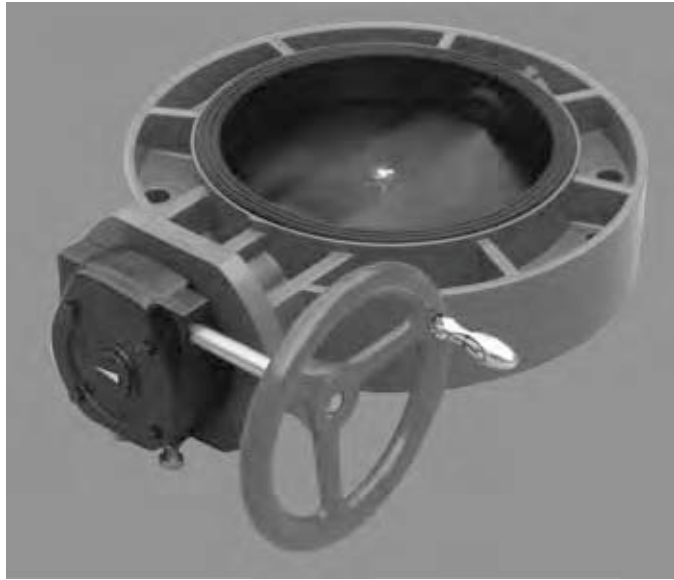


Discharge Plumbing (Bottom Half)

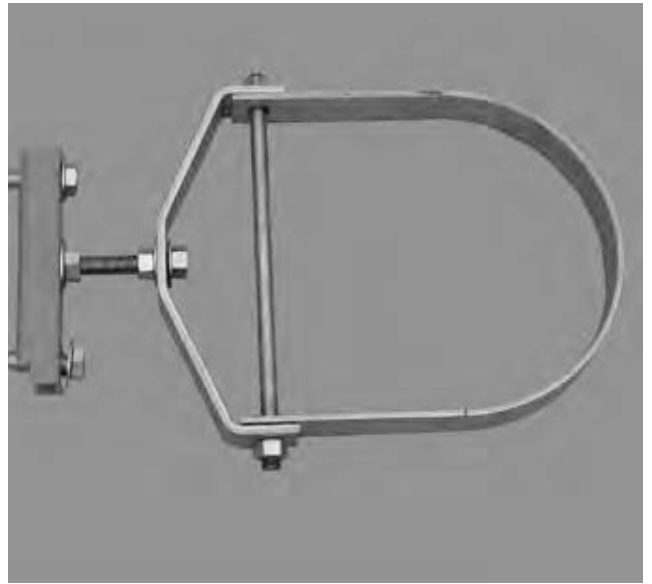


Discharge Plumbing (Top Half)

Appendix A (continued)



Butterfly Valve



12" Pipe Hanger

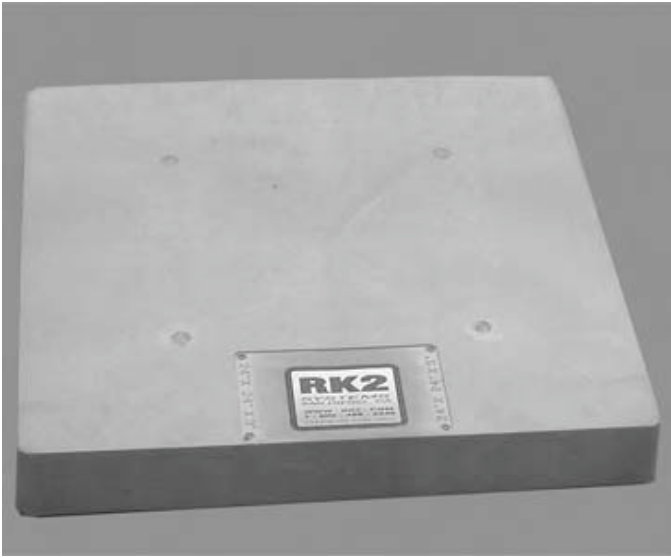


Pump Intake (Far Right, long shaft)

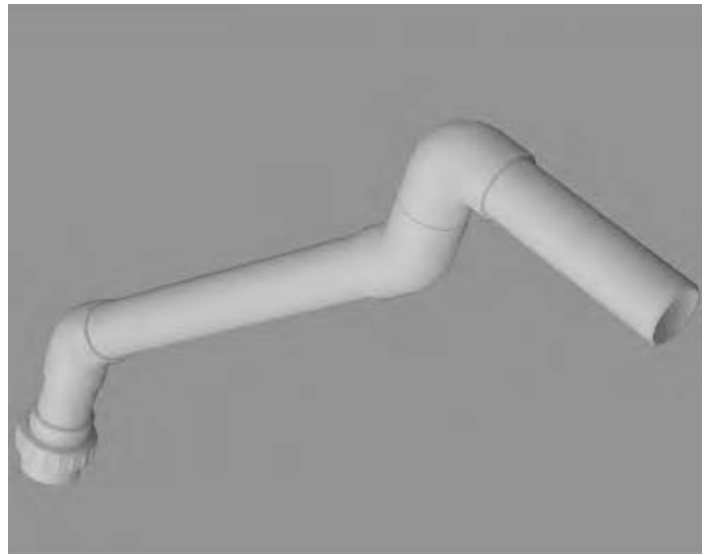


Pump Intake (all other positions)

Appendix A (continued)



Pump Platform



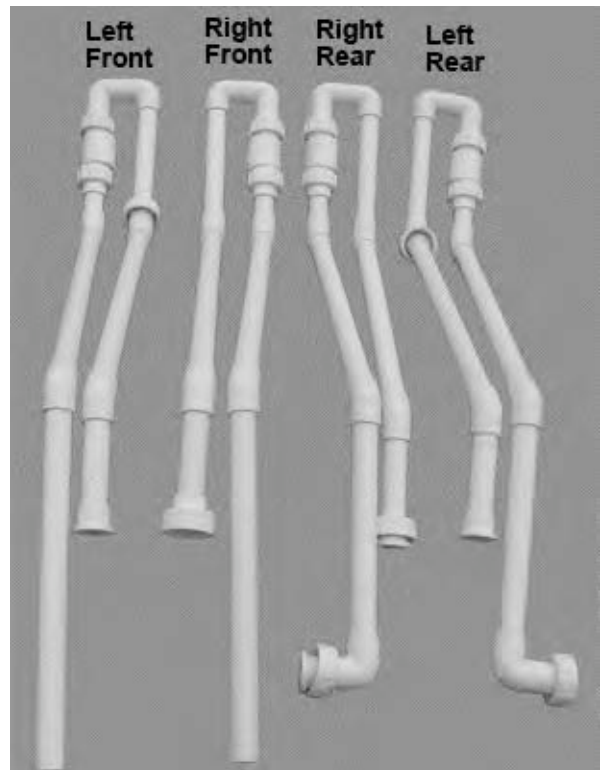
Waste Drain



Venturi Intake Plumbing



Venturi Plumbing Assembly



Venturi Air Intake (all)

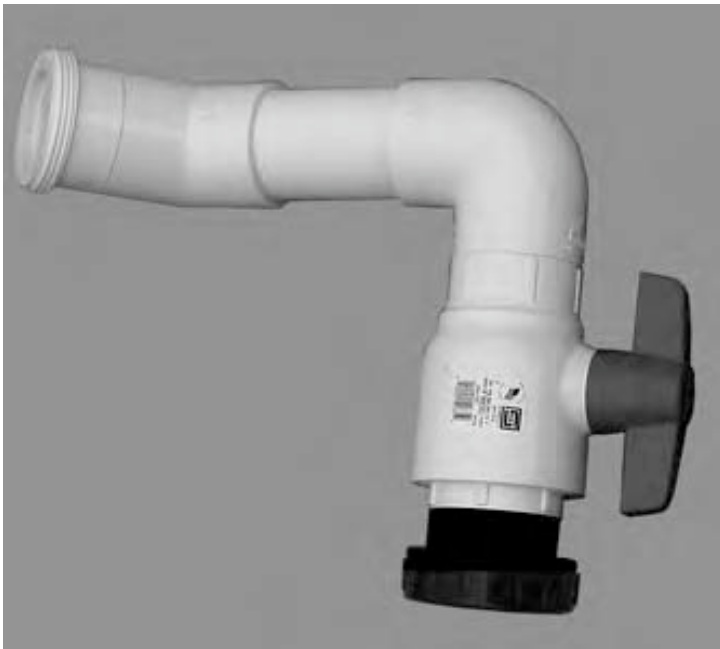
Appendix A (continued)



Saltwater Rinse Assy. (Lower Half)
(Valve type may vary)



Saltwater Rinse Assy. (Upper Half)



Pump Discharge (Outside Lt. Position)



Pump Discharge (Outside Rt. Position)

Appendix A (continued)



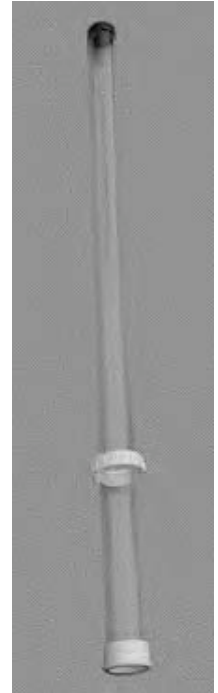
FW Rinse Assembly
(Valve type may vary)



Air Gauge



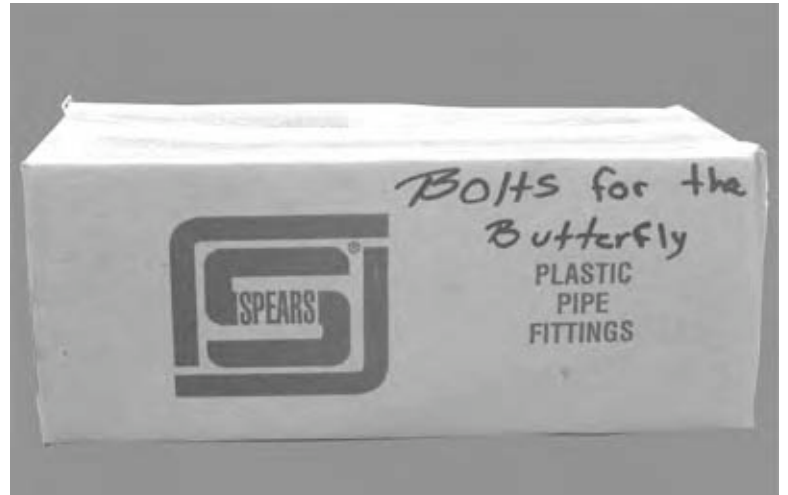
Sight Gauge
(Bottom)



Sight Gauge
(Top)



Box of bolts: 16" Flange and Gasket



Box of bolts: Butterfly Valve

Appendix A (continued)



Hardware for Top/Cone Assembly



Hardware for Venturi Intake Plumbing

RK2 PROTEIN FRACTIONATOR FLOW CONTROL SETTINGS

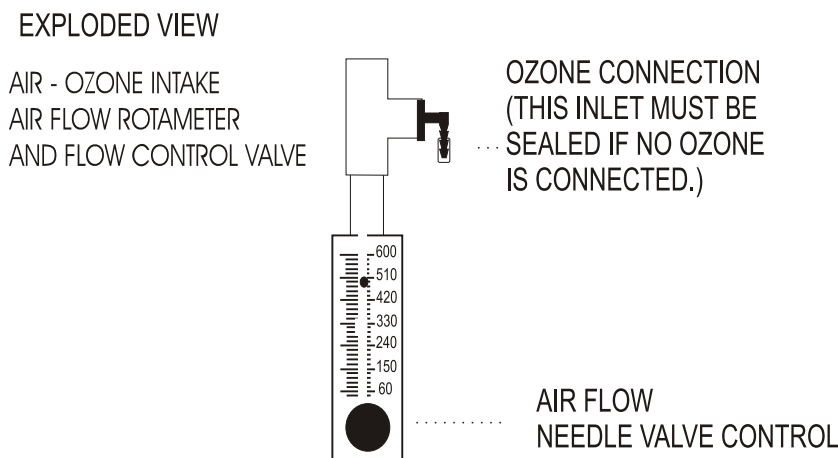
INITIAL START-UP

1.) WITH THE VENTURI PUMP(S) OFF, OPEN ALL WATER VALVES FULLY EXCLUDING INLET SUPPLY. OPEN THE FRACTIONATOR INLET VALVES, THE VALVES SHOULD BE ADJUSTED TO ALLOW A MAXIMUM FLOW RATE AT WHICH THE FILTER IS RATED.

CHECK FOR LEAKS. IF ANY UNIONS HAVE LEAKS HAND -TIGHTEN ONLY. IF THE UNION CONTINUES TO LEAK THE FITTING NEEDS TO EXAMINED FOR CRACKS AND CORRECT "O" RING SEATING.

LEAKS AT THE FLANGE AREA SHOULD BE ADDRESSED BY TIGHTENING THE FLANGE BOLTS IN A CRISS-CROSS PATTERN. THE SCH80 FLANGES WITH INSERTS IN THE TANK WALL SHOULD TORQUED TO A MAXIMUM OF 25LBS. THE FLANGE CONNECTING THE CLEAR CHAMBER TO THE TANK SHOULD TIGHTENED IN A CRISS-CROSS PATTERN ½ TURN PAST HAND TIGHT. INCORRECT TIGHTENING OF THIS FLANGE WILL FRACTURE THE UPPER CHAMBER.

2.) TURN ON THE VENTURI PUMP(S). ADJUST THE AIR/OZONE FLOW INTO THE FRACTIONATOR WITH THE NEEDLE CONTROL VALVE . DIFFERENT MODEL VENTURIS HAVE DIFFERENT FLOW RATES. CHECK THE GAUGE WITH THE NEEDLE VALVE SET TO FULL FLOW. THE TOTAL FLOW SHOULD THEN BE REDUCED BY 20%. THIS FLOW REDUCTION WILL CREATE A VACUUM OF 1" TO 2" IN THE VENTURI GAS INTAKE LINE. THIS IS THE CORRECT SETTING. IF OZONE IS APPLIED, THE AIR FLOW SHOULD BE REDUCED BY THE AMOUNT OF OZONE BEING INTRODUCED SO THAT THE TOTAL COMBINED FLOW REMAINS THE SAME.



3.) FINAL FOAM LEVEL ADJUSTMENT IS CONTROLLED WITH THE FILTER DISCHARGE VALVE. ALL OTHER VALVES SHOULD REMAIN IN THERE SET POSITIONS AND THE DISCHARGE VALVE ADJUSTED AS NECESSARY FOR CHANGING CONDITIONS AND TO ACHIEVE THE CORRECT FOAM CONSISTENCY.
(SEE "PROPER PROTEIN ADJUSTMENT")

Proper Protein Fractionator Adjustment

A protein skimmer (actually a protein fractionator) is not a 'plug and play' piece of equipment. It requires close attention to achieve proper adjustment. This proper adjustment is critical to achieving the maximum performance from the unit.

The fractionator is adjusted by creating back pressure at the discharge by throttling the discharge valve. The gas intake and water inlet need to be set to their recommended flow rates. Throttling back the discharge valve increases the back pressure and raises the foam level in the upper chamber. This is basically a hydraulic balancing procedure. (Do not throttle water or air flow to and from the venturis to control foam height. Venturi water valves should run in the open position. Venturi air intakes should be adjusted to a 1" to 2" vacuum.)

The fractionator needs to be adjusted to a level that consistently produces an effluent the color of weak tea or ginger ale. Lowering the foam level to the point where it only produces dry foam and a dark effluent inhibits the removal of waste products. A new installation that has not had any fractionation for more than a few days will require 2 to 7 days for the system to achieve a level of stable organic removal.

Protein fractionators remove compounds from the water by injecting fine bubbles into the water. Organic compounds 'stick' to the surface tension of the water which includes the surface of the bubbles. As the organic laden foam rises into the upper chamber it overflows into the collection area.

The discharge valve adjustment combined with the Bio-load (and certain additives) will affect the foam level. If the foam level is set too low the protein fractionator will only remove a small amount of waste even from very dirty water. Waste levels which are below this threshold remain in the water since the protein fractionator is not adjusted to remove them. The result of this level of adjustment is a very dark, concentrated waste extract from the protein fractionator. When this is occurring the aquarist has no way of determining how efficient the protein fractionator is working other than by observing the color of the water in the aquarium.

Adjusting the level too high creates a situation where the fractionator is removing a large amount of water that has very little dissolved organics.

To properly adjust a protein fractionator takes at least several days of observation and adjustments. You should allow a minimum of a half an hour between adjustments to allow the hydraulics to settle into balance. There are a couple things to remember to achieve proper adjustment. The first is the protein fractionator only removes waste to the threshold you have set. As it approaches this threshold it removes less and less resulting in a concentrated extract. The other is that the extract should be roughly the color of ginger ale or weak tea. If it is darker, the threshold is set too low.

To adjust the fractionator properly the following must be done:

1. Make sure the venturi and inlet flows are set to the recommended rates.
2. Adjust the protein fractionator by throttling the discharge valve so that the extract is about the color of ginger ale or weak tea. Ideally you will produce a sudsy foam that is between the consistency of water and shaving cream.
3. Let it run, even though it may run wet for a while. As it approaches the new threshold level for waste extraction it will begin to slow down and the extract will become darker and more concentrated. When this happens repeat step 1 and step 2.
3. When the point is reached that the protein fractionator does not slow down after a few days then it can be assumed that the protein skimmer is properly adjusted. In the case of very dirty water this process may take quite a number of adjustments and may take longer to slow down the first time. Keep the protein fractionator adjusted so that the extract does not become dark.

Adding feed, organic matter or animals to the water will cause the foam level to rise, sometimes substantially. Certain oils and other compounds will inhibit foam production. If the skimmer level “bounces” or changes radically over a short period, there may be hydraulic issues with the way the filter is plumbed and/or vented.

NEVER BLOCK THE DISCHARGE VENT UNION AT THE TOP OF THE FRACTIONATOR. This will pressurize the unit, and void all warranties. If you connect any filters or ozone destruct equipment to the top vent, the vent must remain free-flowing or at a slightly negative pressure.

To maintain an efficient fractionator the upper chamber must remain clean and the rinse system in the upper chamber needs to be working properly. The chamber should be accessed through the top cover and cleaned manually every 90 days or if the rinse system has been out of operation for more than 3 hours. With a properly adjusted protein fractionator the water will be noticeably cleaner. Ideally aquarium water should be clear and colorless. The closer to this goal the better.

RK2

SYSTEMS

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PRODUCT WARRANTY TERMS

RK2 Systems, Inc. (The Seller) warrants to the original purchaser, that products of its own manufacture will be free from defects in materials or workmanship, under normal use and service, for a period of one year from the date of purchase (with the exception of a vessel, which is warranted for three years). The Seller's obligations under this Warranty are limited to replacing or repairing or giving credit for, at its option, any of its said products which shall, within one year after purchase, be returned to the Seller's place of origin, transportation charges prepaid, and which are, after products examined, disclosed to the Seller's satisfaction to be thus defective. This Warranty does not apply to defects caused by shipping damages, or to any products manufactured by Seller which have been subject to improper installation, misuse, neglect, accident, ordinary wear and tear, or Buyer's attempts to use any products beyond its mechanical, thermal, or electrical capacity. Notice of a defective product must be given to Seller in writing within 48 hours of discovery and be free, without limitation of labor charges, lost profits, expenses of repair or other costs incidental to replacement. All transportation costs incurred in shipping product to or from Seller's plant shall be at the Buyer's expense. The aforementioned provisions do not extend the original Warranty period of any product which has either been partially repaired or replaced by the Seller.

FOR FURTHER TECHNICAL ASSISTANCE

Contact your RK2 distributor or call:

**RK2 Systems, Inc.
(303) 772-6500**