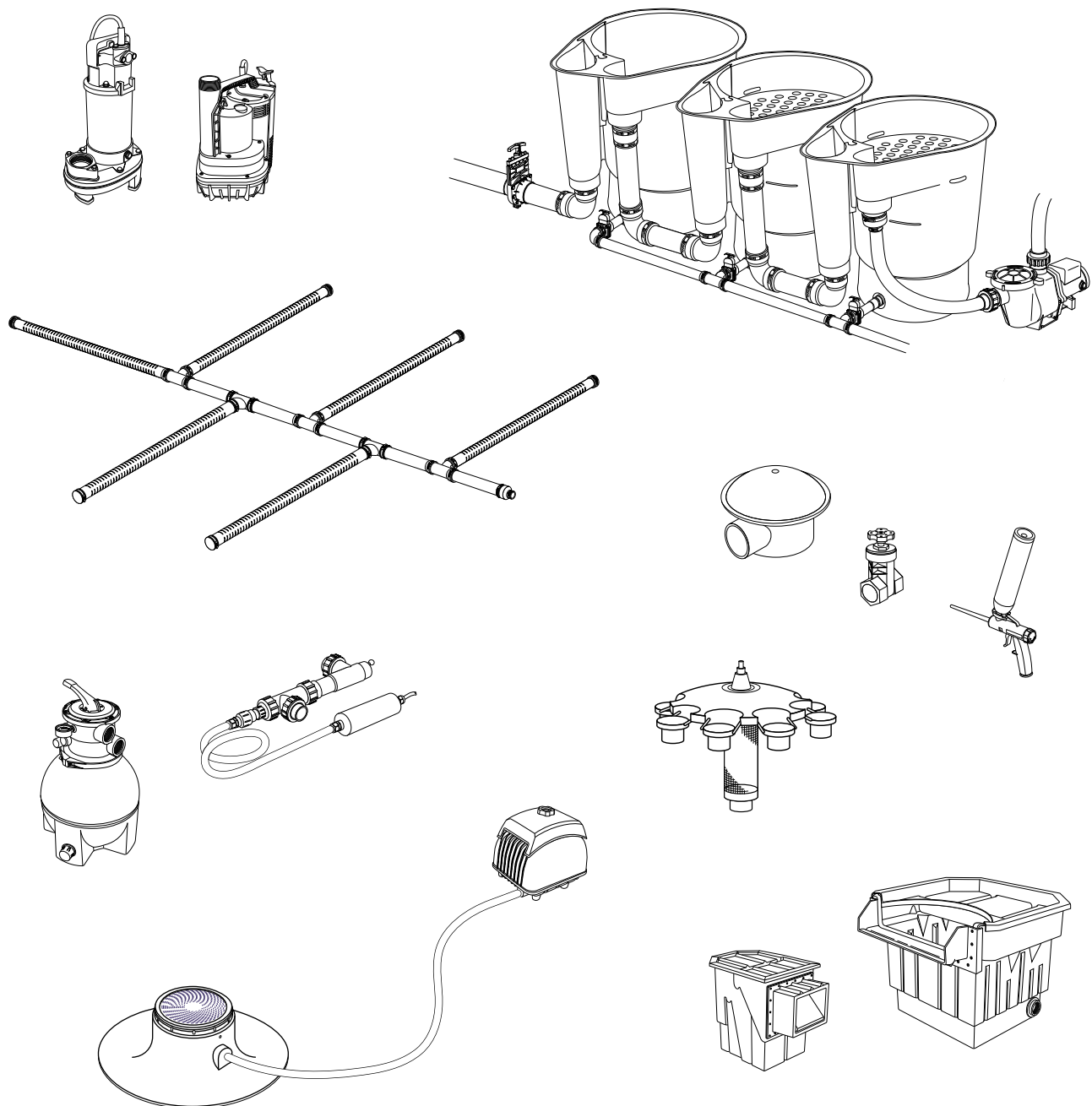


Pond Builder's Handbook



GENERAL INFORMATION

Conservation Technology has supplied state-of-the-art technology for garden ponds, green roofs, rainwater collection, rubber membrane waterproofing, and energy-efficient building since 1984: for more information, visit our corporate website www.conservationsotechnology.com. Through our PondTechnology division, we offer a unique selection of pond liners, protection fabrics, pumps, filters, aeration equipment, biological controls plumbing, and other professional-grade aquatic gardening products. We are experts in rubber technology, pump engineering, and filter design, so we can provide complete technical support and one-stop product sourcing for projects of any size, anywhere in the world.

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PRICING AND DISCOUNTS: Please see our website for current list pricing, or contact us for a price list. Landscape contractors with appropriate credentials, nurseries, garden centers, and pet stores are eligible for discounted pricing based on annual purchases. We also offer discounts for large projects. Please call for more information about discounted pricing.

TECHNICAL ASSISTANCE: We have tried to convey a great deal of information in this small handbook, some of which is fairly technical. If you find it overwhelming, just call for assistance, or fax a simple sketch of what you have in mind. We will need to know the length, width, depth, and shape of your pond as well as any water features such as a waterfall or fountain. You can also email questions and drawings to sales@pondtechnology.com.

PAYMENT: Our minimum order is \$25. We accept Mastercard, VISA, Discover, American Express, checks, bank drafts, money orders, or wire transfers. Some UPS shippable items can also be sent COD. If you wish to send payment by mail or wire, please call for a quote that includes shipping charges. Credit terms are available for dealers and active contractors.

HOURS OF OPERATION: We're open Monday through Friday from 8:30 AM until 5:30 PM Eastern time, often longer hours during our busy season. You can fax an order at any time to (410) 366-1202, but please remember to supply your telephone number and to indicate when you can be reached during business hours if we have questions.

PICKUPS: You are welcome to visit our Baltimore warehouse at 2233 Huntingdon Avenue to pick up merchandise, but please place your order by telephone before you visit and ask for directions. We do not currently have a showroom.

SHIPPING: Since we try to stock everything we sell, we usually ship very quickly. If your pond is less than 15 feet by 20 feet, your order is likely to ship by UPS. Larger ponds require heavy liners and bulky filters that usually must ship by truck, but our substantial truck discounts permit us to offer very reasonable rates to almost any point in North America. Please note, however, that truck shipments to residential addresses can be significantly more expensive than shipments to commercial addresses, and someone must be available to unload and inspect the merchandise. It's always best to arrange for a commercial delivery address or to request shipment to the closest truck terminal (we can locate a terminal in your area). We regret that we cannot ship orders via the US Postal Service.

INSPECTING TRUCK SHIPMENTS: Although we rarely have shipping damage, it is essential that you inspect all truck shipments thoroughly before signing the freight bill, note any damage on the freight bill, and call us within one business day to report the damage. If you follow this procedure, we will guarantee free repair materials in the event of minor damage, and free replacement in the event of major damage. If you fail to note damage before accepting a truck shipment, you may be denied this protection, so insist on taking the time for a thorough inspection.

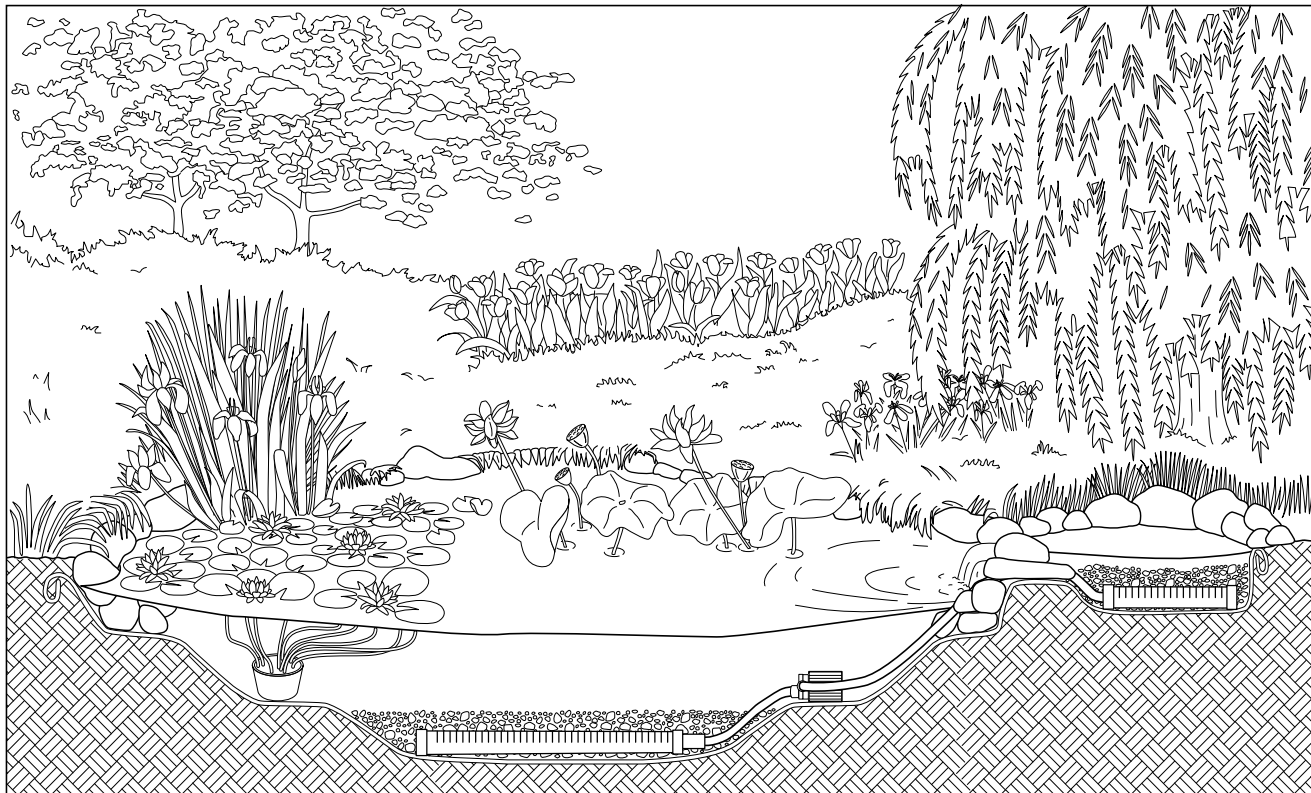
CONSERVATION TECHNOLOGY

tel: (800) 477-7724 fax: (410) 366-1202 email: sales@pondtechnology.com

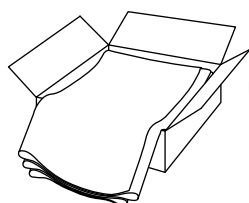
A LILY POND

A *lily pond* is a tranquil body of water covered with water lilies and other floating aquatic plants. For the most natural appearance, the pond should be located in a flat area at the lowest part of the site. A small waterfall can be used to create sound and visual interest, but excessive turbulence will limit the growth of large floating plants. For minimal maintenance, the fish population should not exceed one inch of fish per square foot of pond surface. A depth of 24" is sufficient, except in cold climates.

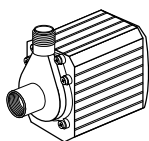
In the illustration, the pond is excavated as a series of terraces, the highest forming a small pool. Protection fabric is laid over the soil and covered with a rubber pond liner. Rounded rocks cover the terraces, so the pond liner is completely hidden in the shallow-water areas. An in-line submersible pump draws water through a slotted pipe buried in a bed of gravel at the bottom of the pond and conveys the water to a second slotted pipe buried in a bed of gravel in the upper pool. As the water in the upper pool rises, it spills over a few rocks to return to the pond. This system provides both mechanical and biological filtration, and with periodic addition of bacteria it can be virtually maintenance free.



LILY POND KITS: We can custom design a complete kit with everything required to build a lily pond of any size and shape. Typical components are shown below, along with page references for more information. After construction has been completed, we can also ship a package of appropriate plants.



rubber liners
(page 9)

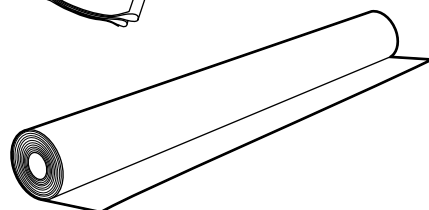


pumps (page 18)

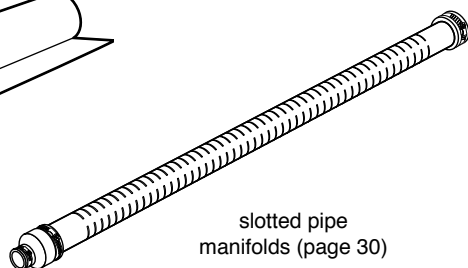
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pots (page 39)



biological clarifiers
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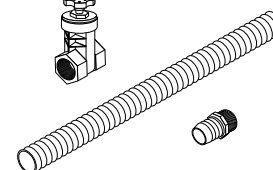
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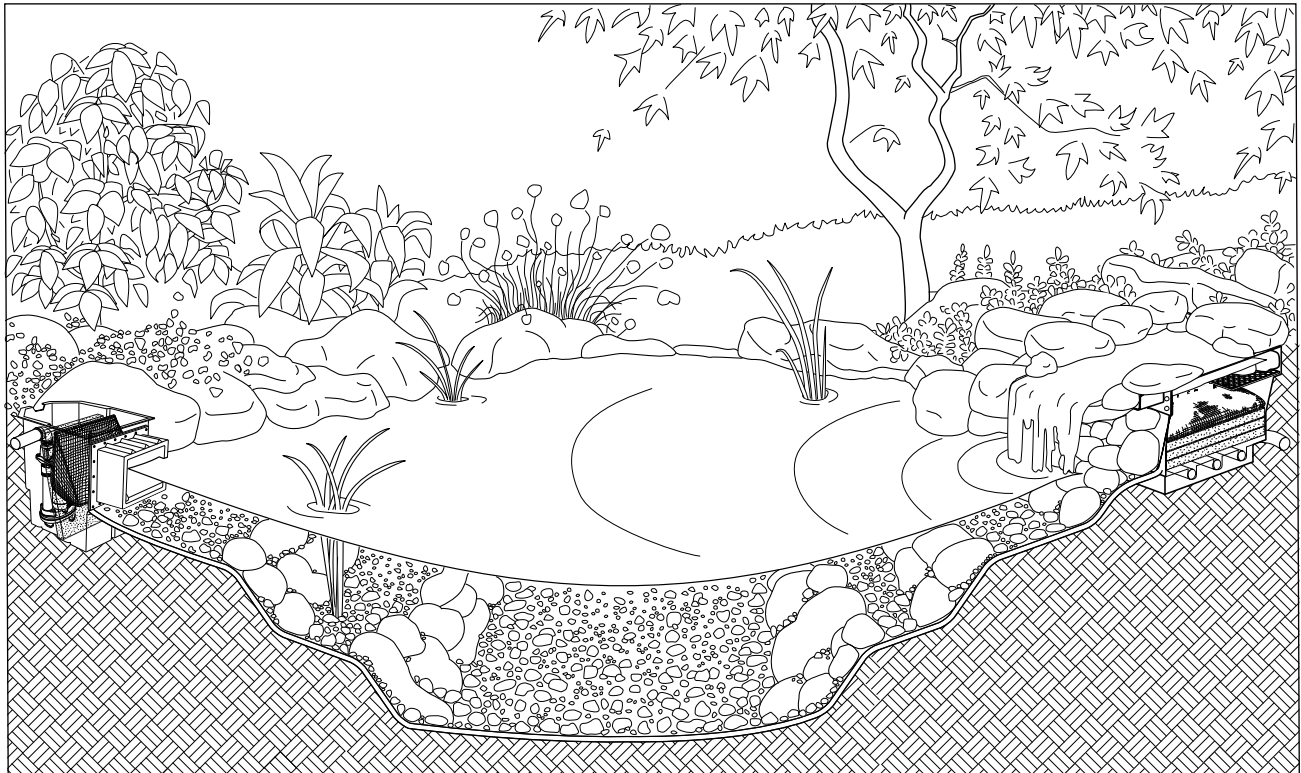


hose, valves, fittings
(page 40)

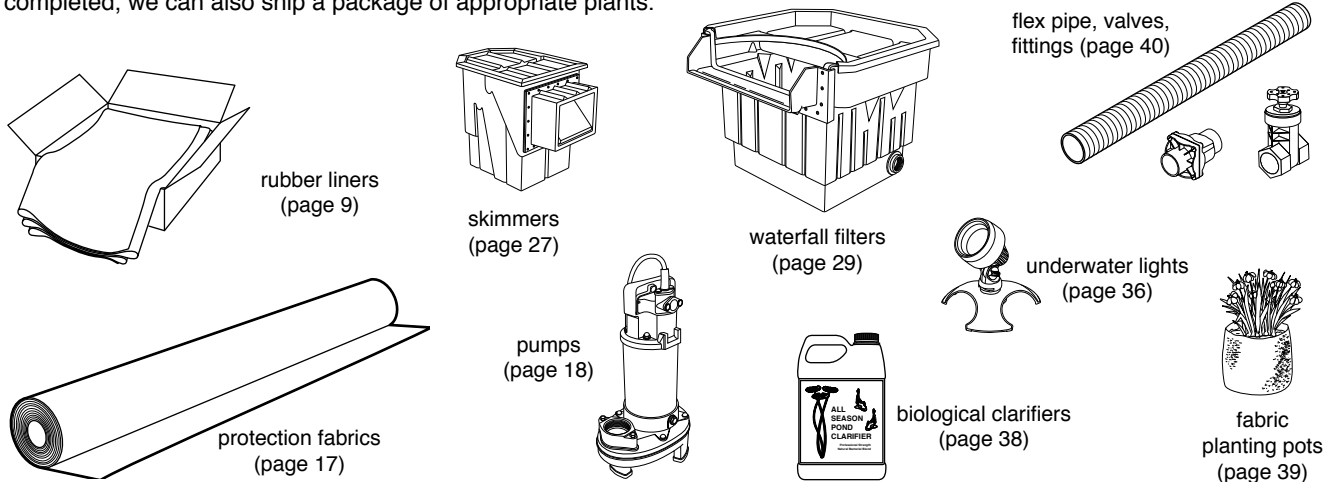
A ROCK POND

When water flows over the earth, it strips the soil, exposes the rocks and gravel below, and creates waterfalls. A *rock pond* attempts to recreate this natural landscape, although on a much smaller scale. For the most realistic appearance, the design should be integrated into an existing hillside, and the surrounding site should be covered with rocks similar to those used in the pond. Since the water should be fast-flowing, marginal plants are more appropriate than floating plants. The fish population should not exceed one inch of fish per square foot of pond surface. A depth of 18" to 24" is sufficient, except in cold climates.

In the illustration, the pond is excavated as a series of terraces. Protection fabric is laid over the soil and covered with a rubber pond liner. Rounded rocks form the edge of each terrace, while the horizontal surfaces are covered with coarse river gravel that completely conceals the rubber liner. Water is drawn into a skimmer (left) which extracts leaves and other floating debris. A submersible pump at the rear of the skimmer conveys the water underground into the bottom of a waterfall filter (right). As the water rises, it is mechanically and biologically filtered by various filter media. Reaching the top, the water spills over a flat rock set on the lip of the filter, beginning the waterfall.



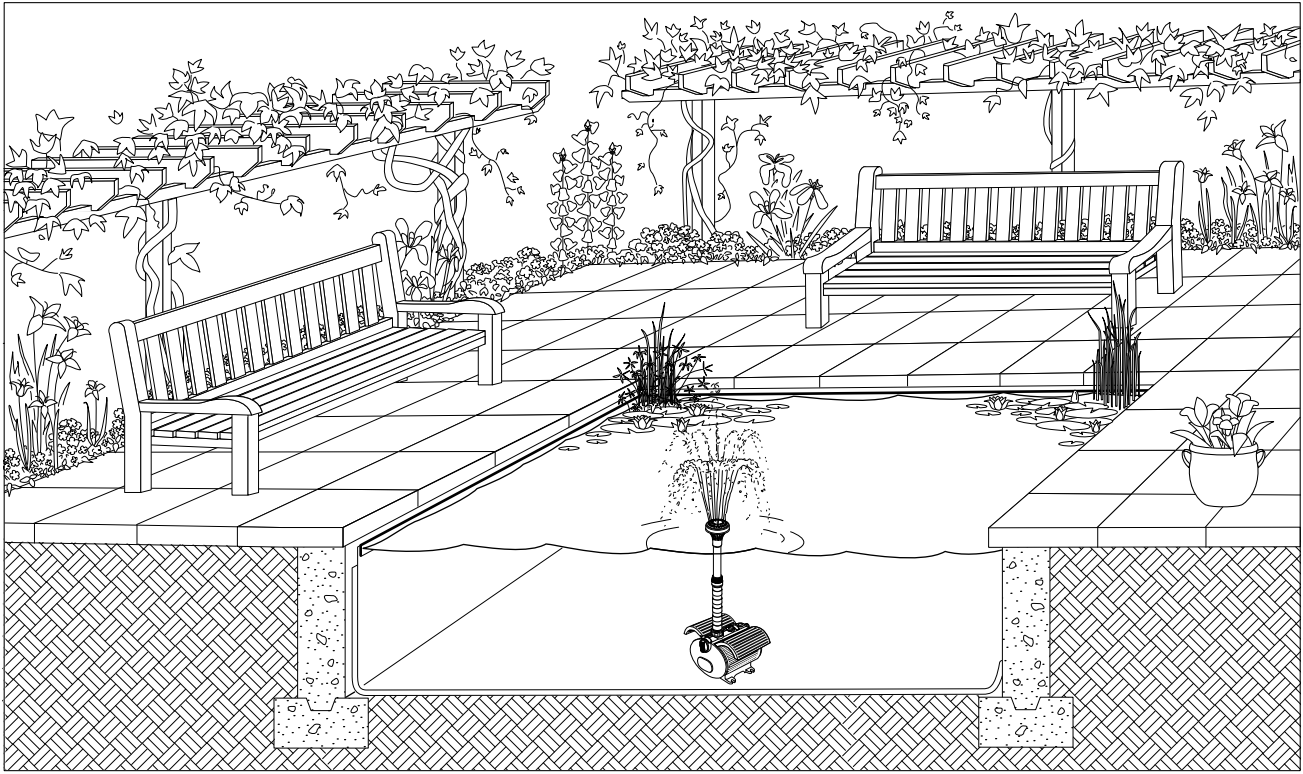
ROCK POND KITS: We can custom design a complete kit with everything required to build a rock pond of any size and shape. Typical components are shown below, along with page references for more information. After construction has been completed, we can also ship a package of appropriate plants.



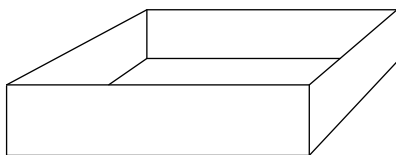
A FORMAL POND

For thousands of years, creative architects have employed *formal ponds* to provide focus, noise abatement, and evaporative cooling in both public and private gardens. Although formal ponds were traditionally built of stone, today they can also be built with brick, concrete block, poured concrete, or pressure-treated wood. A raised perimeter wall can highlight attractive structural materials and offer visitors a place to sit by the water; a flush edge is easier to build and will make the garden feel more spacious. Simple rectangular shapes with vertical side walls are recommended for ease of waterproofing, but other shapes are possible. Fish and plants are optional, but a fountain is a virtual necessity. A depth of 18" to 24" is sufficient, except in cold climates.

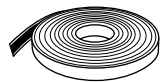
In the illustration, protection fabric is laid over the earth bottom and up the concrete-block side walls. A custom-fitted rubber liner covers the fabric and is secured to the walls just above the water line with black metal bars and a tacky rubber tape. Water is drawn through a slotted screen into an adjustable-flow pump which ejects it upward through a fountainhead.



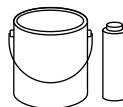
FORMAL POND KITS: We can custom design a complete kit with everything required to build a formal pond of any size and shape. Typical components are shown below, along with page references for more information. Waterproofing can be a flat sheet of rubber that is folded at the corners, a custom fabricated box liner that requires no folds, or a liquid-applied liner. After construction has been completed, we can also ship a package of appropriate plants.



custom-welded box
liners (page 10)



termination tape and
bars

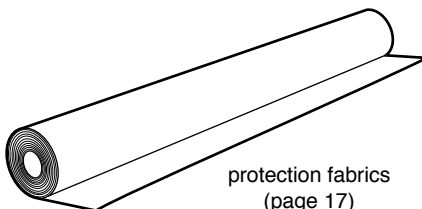
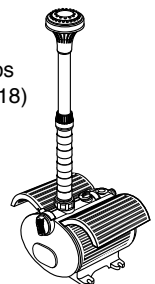


liquid-applied
liners (page 17)



biological clarifiers
(page 38)

pumps
(page 18)



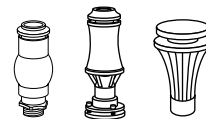
protection fabrics
(page 17)



fabric
planting pots
(page 39)



underwater lights
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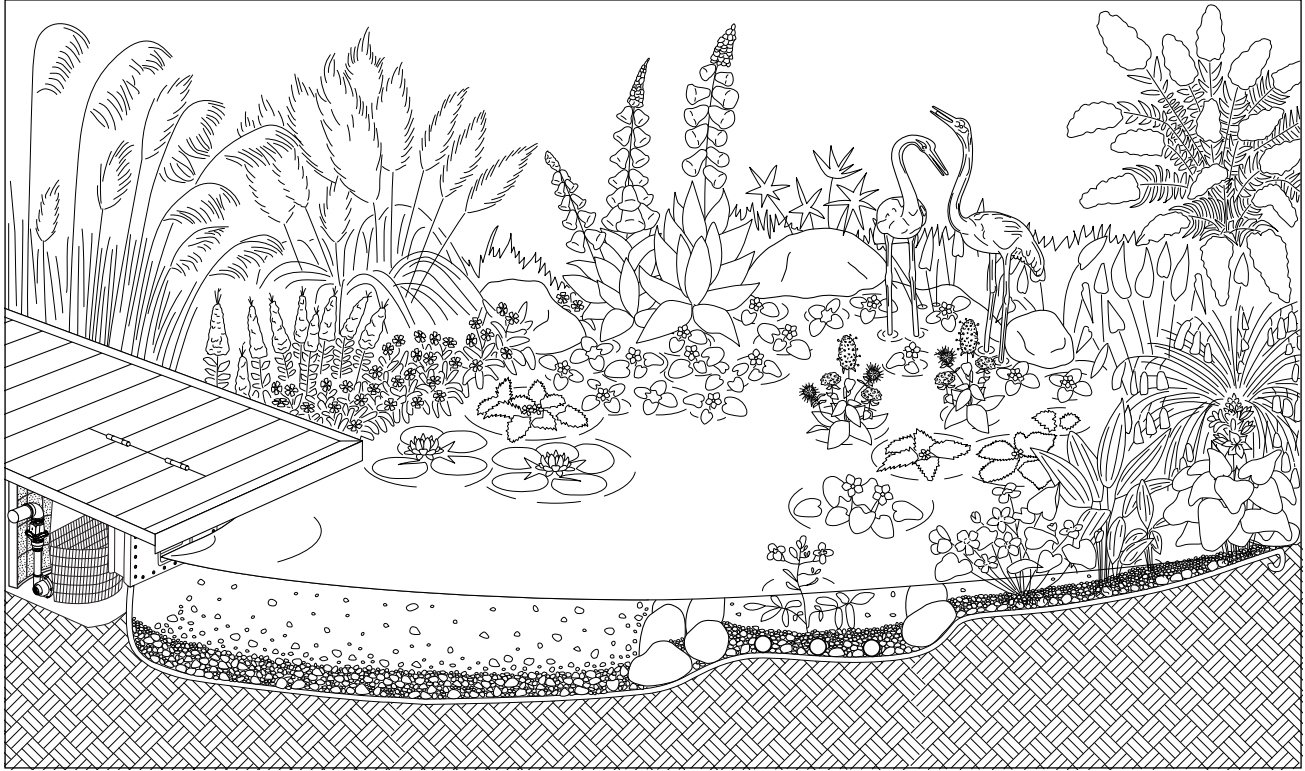


fountainheads
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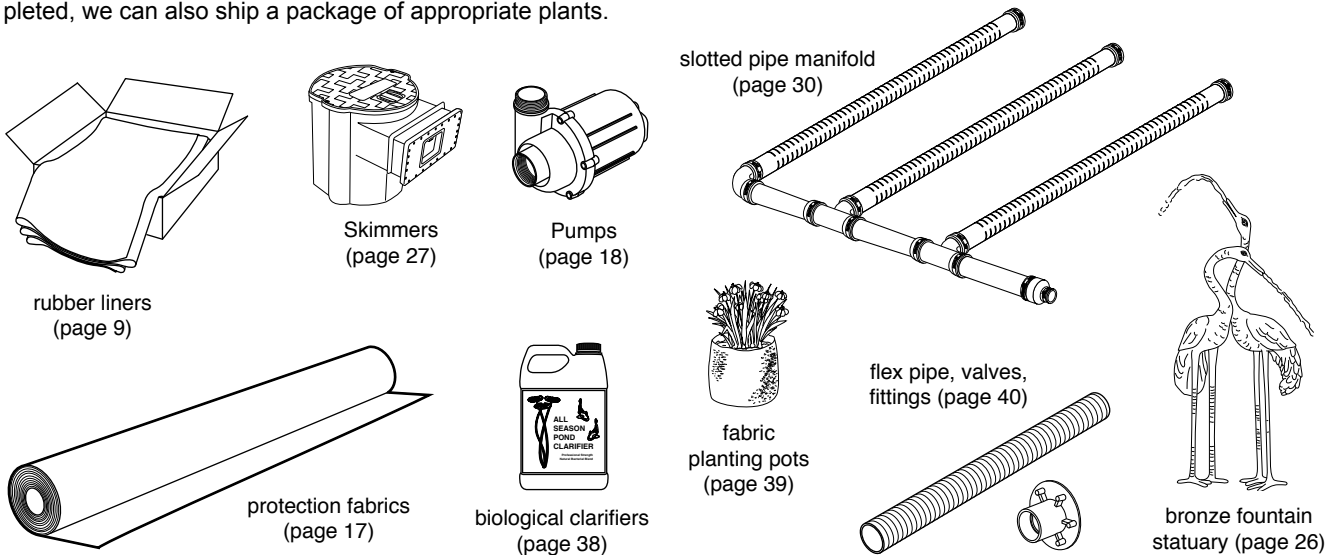
A MARSH POND

A *marsh pond* , replicates the transition between wet soil and open water that would typically be found at the edge of naturally occurring earth ponds. This environment supports a wide range of aquatic plants ranging from plants that live in damp soils, to plants that require several inches of water, to floating and submerged aquatic plants found in open water. This environmental diversity also attracts a wide range of animal life. Marsh ponds with no open water are also called *bog ponds*.

In the illustration, the pond is excavated as a gently sloping bowl. Protection fabric is laid over the soil and covered with a rubber pond liner. A small skimmer is installed at the deepest end, under a projecting pier with a trap door for access. A submersible pump draws water into the skimmer and conveys it to a slotted pipe buried in a bed of gravel in the shallowest part of the pond. This system provides both mechanical and biological filtration, and with periodic addition of bacteria, it can be virtually maintenance free.



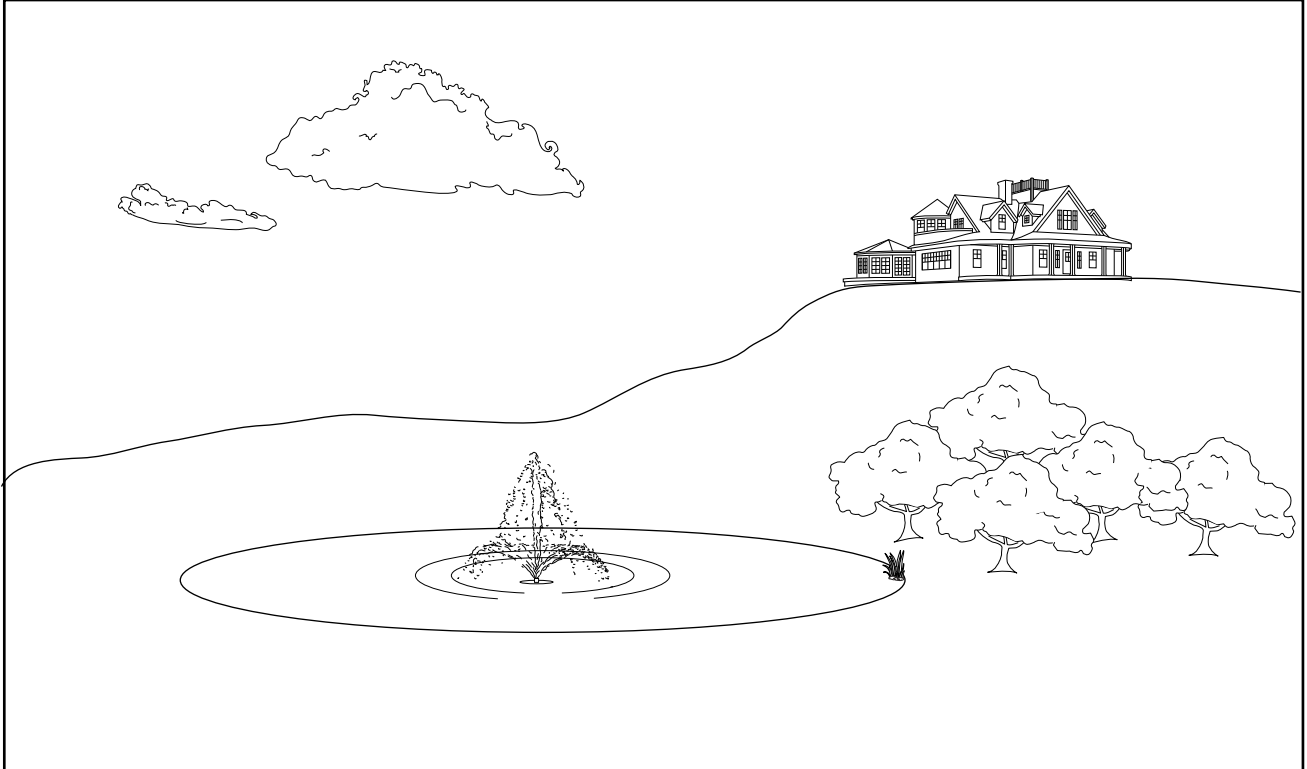
MARSH POND KITS: We can custom design a complete kit with everything required to build a marsh pond of any size and shape. Typical components are shown below, along with page references for more information. When construction is completed, we can also ship a package of appropriate plants.



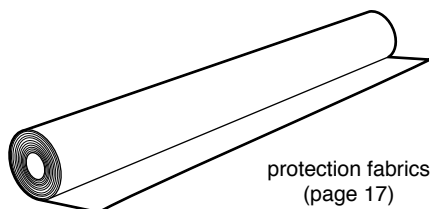
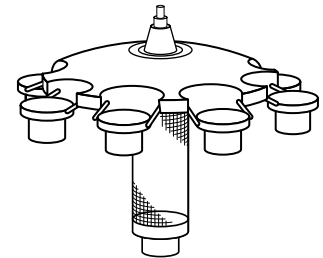
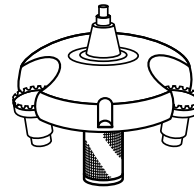
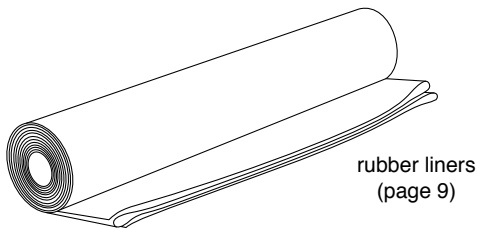
A FOUNTAIN POND

A *fountain pond* is a body of water with a fountain shooting water into the air. Since wind can blow fountain spray a considerable distance, fountain ponds are typically found on estates and commercial properties with considerable open space. For the most natural appearance, the pond should be located in a flat area at the lowest part of the site. The depth should be at least 48" and the width should be at least four times the fountain height.

In the illustration, the pond is excavated in a bowl shape, protection fabric is laid over the soil, and the fabric is covered with a rubber pond liner. For larger ponds, several pond liners are seamed to obtain sufficient size. A floating fountain draws cool water from several feet below the surface and projects it upward and outward. In contact with air, the water releases gases and absorbs oxygen. When the water falls on the pond surface it is still cooler than the surface water, so it sinks, carrying oxygen to the bottom and completing the loop.



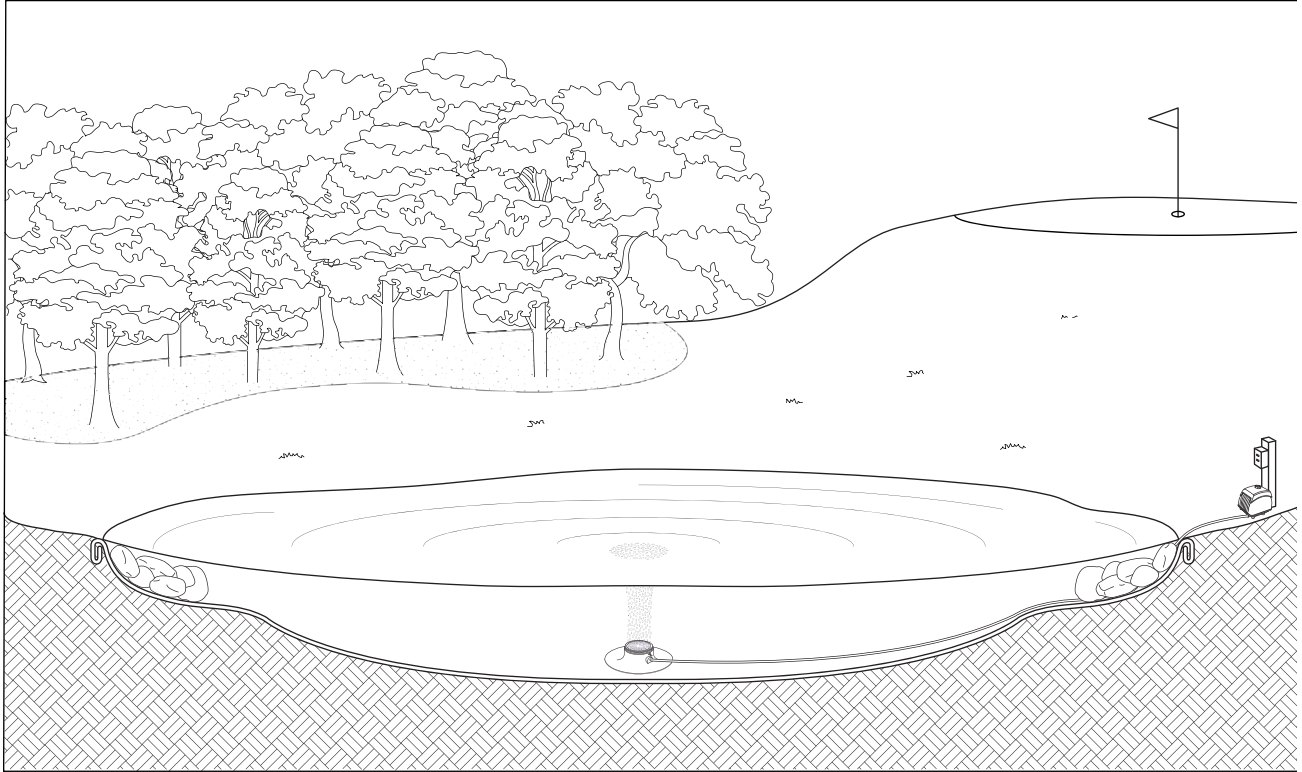
FOUNTAIN POND KITS: We can custom design a complete kit with everything required to build a fountain pond of any size and shape. Typical components are shown below, along with page references for more information. When construction is completed, we can also ship a package of appropriate plants.



A STILL POND

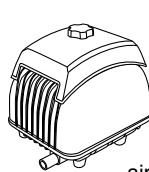
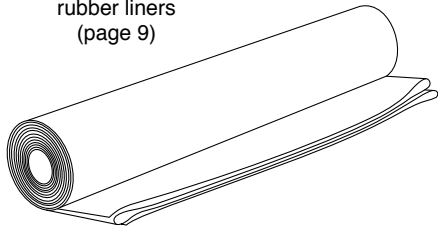
A *still pond* is a pond without any pumping system, either because it is too large to pump and filter economically or because a waterfall or fountain is not desired. For a natural appearance, the pond should be located in a flat area at the lowest part of the site. For effective circulation, a depth of 48" at the center is recommended.

In the illustration, the pond is excavated as a series of terraces. Protection fabric is laid over the soil and covered with a rubber pond liner. For larger ponds, several pond liners are seamed to obtain sufficient size. A compressor pumps air to a weighted diffuser positioned at the bottom center of the pond. The diffuser generates millions of air bubbles that float to the surface, in the process lifting the cool water from the bottom of the pond. At the surface this water spreads outward, releasing waste gases into the atmosphere and absorbing oxygen. Since this water is cooler than the surface water, it sinks to the bottom and completes the water circulation loop.

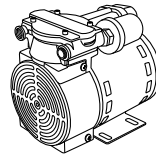


STILL POND KITS: We can custom design a complete kit with everything required to build a still pond of any size and shape. Typical components are shown below, along with page references for more information. When construction is completed, we can also ship a package of appropriate plants.

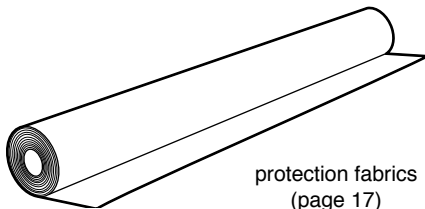
rubber liners
(page 9)



air compressors
(page 35)



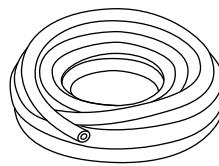
biological clarifiers
(page 38)



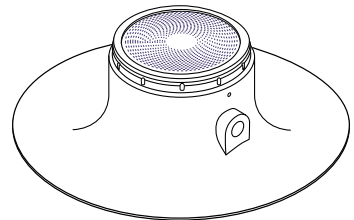
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(page 17)



fabric
planting pots
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self-sinking tubing
(page 36)

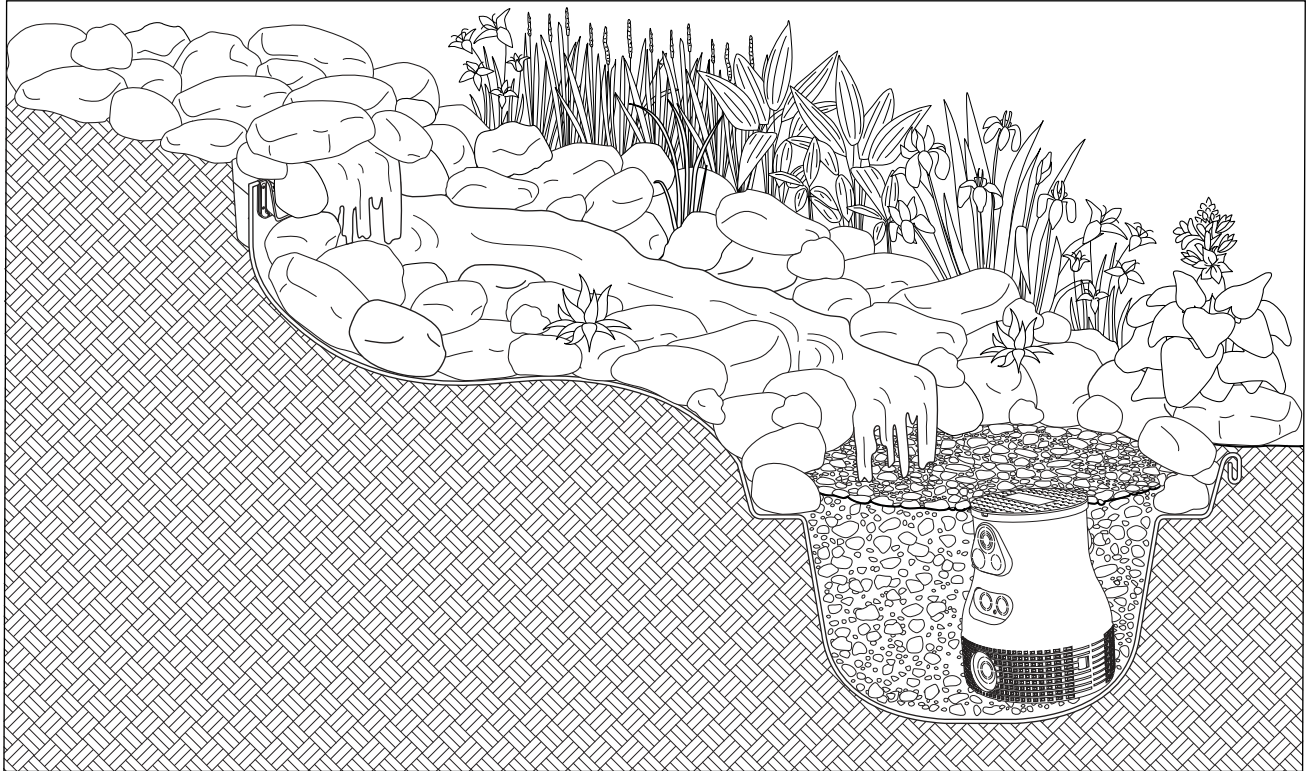


diffuser assemblies (page 35)

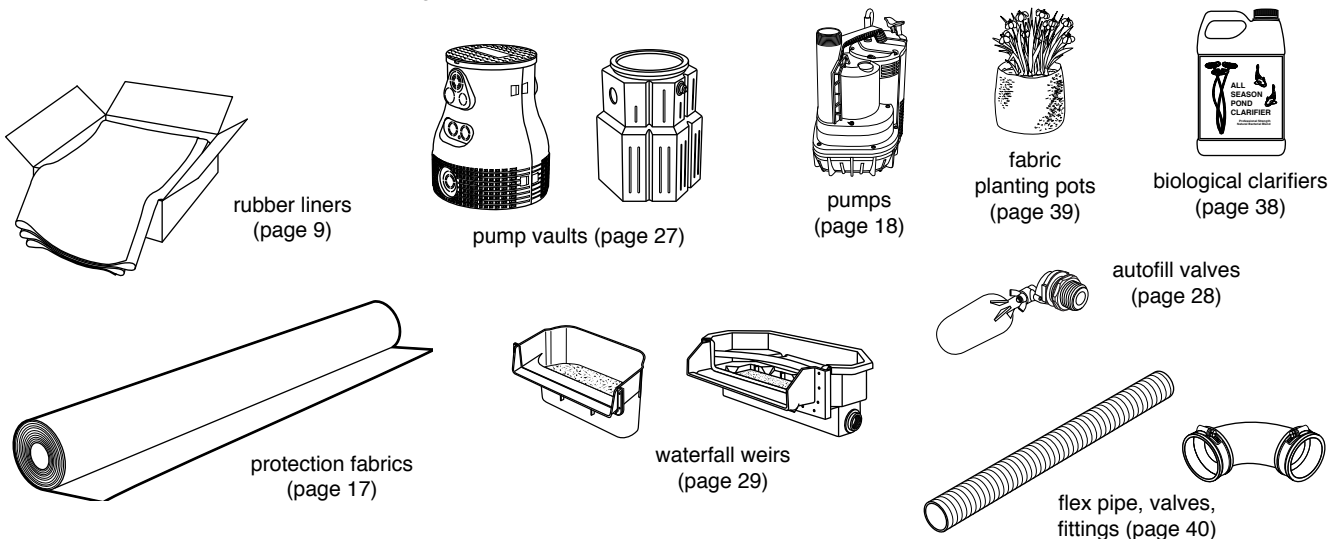
A PONDLESS WATERCOURSE

It's not necessary to have a pond to enjoy water movement in a waterfall or stream. A *pondless watercourse* substitutes a gravel bed for the pond and filter. For the most realistic appearance, the design should be integrated into an existing hillside, and the surrounding site should be covered with rocks similar to those used in the watercourse.

In the illustration, the watercourse is excavated as a series of terraces. Liner Protection Fabric is laid over the soil and covered with a rubber pond liner. Rounded rocks form the edge of each terrace, while the horizontal surfaces are covered with coarse river gravel that completely conceals the rubber liner. Water is drawn through the gravel into a pump vault. A submersible pump conveys the water underground into the bottom of a waterfall weir. Reaching the top, the water spills over a flat rock set on the lip of the filter, beginning the waterfall.



PONDLESS WATERCOURSE KITS: We can custom design a complete kit with everything required to build a lily pond of any size and shape. Typical components are shown below, along with page references for more information. When construction is completed, we can also ship a package of appropriate plants.



RUBBER POND LINERS

Pond liners made from synthetic rubbers are significantly more flexible and durable than liners made from plastics such as polyvinyl chloride (PVC), high-density polyethylene (HDPE), Polypropylene (PP), or thermoplastic polyolefin (TPO). Understanding the important differences between pond-grade rubbers and roofing rubbers and deciding what type of pond-grade rubber is best for each project requires a rudimentary understanding of how synthetic rubbers are made and how they differ.

SYNTHETIC RUBBER: A synthetic rubber is made by mixing one or more rubber polymers—the chemical backbones of rubbers responsible for their distinctive elastic properties—together with oils, carbon-black, sulfur, and other substances that provide the desired color, flexibility, strength, and hardness. This mixture passes between massive steel rollers which squeeze it into a thin sheet of uncured rubber. Since uncured rubber is very sticky, it must either be dusted with mineral talc (talc-process) or layered between sheets of fabric (talc-free process) so that it can be rolled up without sticking to itself and fusing into one solid mass. The roll is then baked in an oven until it chemically cures into the elastic substance we normally think of as rubber.

EPDM RUBBER: EPDM is the name given to the class of synthetic rubbers made primarily from EPDM polymer, shorthand for Ethylene Propylene Diene Monomer. Although there are hundreds of ways to formulate EPDM rubber from EPDM polymer, all share a chemical structure that gives them extraordinary resistance to heat, cold, sunlight, and air pollution. EPDM has been primarily used for waterproofing in exposed environments where long-term weatherability is essential, such as for waterproofing large flat roofs on commercial buildings. Since an EPDM rubber sheet can be formulated by combining as little as 30% of EPDM polymer with 70% of oils and fillers, it is relatively inexpensive to manufacture. As a consequence, EPDM rubbers are among the lowest priced of all synthetic rubbers.

EPDM RUBBER POND LINERS: The characteristics of an EPDM rubber sheet is determined both by the particular EPDM compound (mixture of ingredients) selected. Since any rubber made primarily of EPDM polymer can be called EPDM rubber, there are many types of EPDM and simply purchasing an EPDM sheet for use as a pond liner can be risky in the absence of information about the other ingredients which make up the majority of the formula. For example, certain curing compounds, fire-retardants, and fillers commonly used in EPDM roofing sheets rubber can be toxic to aquatic life. Pond-grade EPDM rubbers must be specially formulated and tested to be safe for plants, fish, and other aquatic life. We offer two pond-grade EPDM sheets: Pondguard EPDM and Pondtechnology EPDM, both of which have a long track record of safe use for pond lining.

POND LINER THICKNESS: Thickness of synthetic rubbers is expressed in mils: one mil equals one-thousandth of an inch or one-fortieth of a millimeter. In general, the thickness of rubber has little effect on environmental aging characteristics of a liner, but can have a significant effect on the ease of installation and resistance to mechanical abuse. Irregular free-form garden ponds, especially those smaller than 500 square feet, should be lined with 30 mil (0.75mm) rubber for the neatest results with the fewest folds. Larger free-form ponds, or small ponds with simple rectangular or elliptical shapes, can be successfully lined with 40 mil (1.0mm) rubber. Recreational ponds, stormwater ponds, irrigation reservoirs, canals, artificial wetlands, and other large projects are usually lined with 60 mil (1.5mm) rubber since it is easier to seam and is considerably stronger than thinner sheets. 60 mil sheet is also preferred for waterfalls and streams.

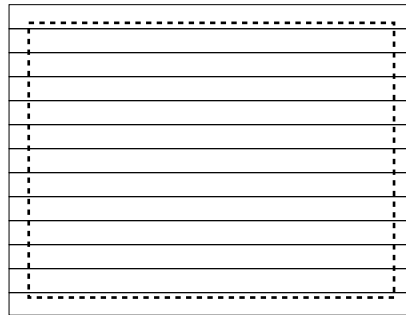
PONDGARD EPDM: *Pondgard* EPDM is our most popular and affordable EPDM rubber pond liner. It is manufactured with the talc process (see above) which leaves a mineral talc residue that gives it a slightly shiny surface: sheet color can vary from dark black to charcoal gray, depending on the amount of talc present. White streaks of talc may be present, but will usually disappear with time. Standard sizes in 40 mil thickness follow. Sizes shown in plain type are stock sizes that generally ship within 24 hours. Sizes in italics are not stock sizes and may involve shipping delays.

5 x 5								
5 x 10	10 x 10							
5 x 15	10 x 15	15 x 15						
5 x 20	10 x 20	15 x 20	20 x 20					
5 x 25	10 x 25	15 x 25	20 x 25	25 x 25				
5 x 30	10 x 30	15 x 30	20 x 30	25 x 30	30 x 30			
5 x 35	10 x 35	15 x 35	20 x 35	25 x 35	30 x 35			
5 x 40	10 x 40	15 x 40	20 x 40	25 x 40	30 x 40			
5 x 50	10 x 50	15 x 50	20 x 50	25 x 50	30 x 50	35 x 50	40 x 50	50 x 50
5 x 100	10 x 100	15 x 100	20 x 100	25 x 100	30 x 100	35 x 100	40 x 100	50 x 100
5 x 150	10 x 150	15 x 150	20 x 150	25 x 150	30 x 150	35 x 150	40 x 150	50 x 150
5 x 200	10 x 200	15 x 200	20 x 200	25 x 200	30 x 200	35 x 200	40 x 200	50 x 200

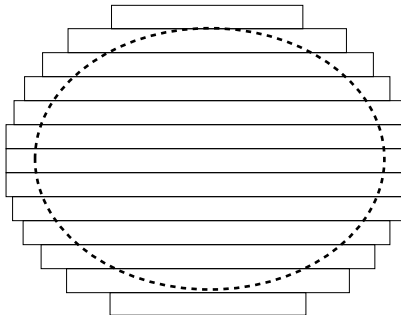
For large water features and lakes can generally supply the following non-stock roll sizes in 60 mil thickness.

10 x 100	20 x 100	30 x 100	40 x 100	50 x 100
10 x 200	20 x 200	30 x 200	40 x 200	50 x 200

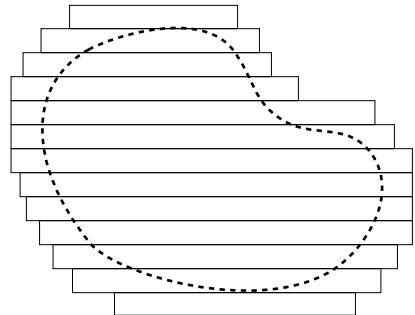
PONDTECHNOLOGY EPDM: PondTechnology EPDM Rubber is our highest quality EPDM pond liner. Its superior performance makes it the liner of choice for projects that demand the very best liner available. It is manufactured with the talc-free process (see above) that yields a clean, slightly textured black surface. We custom-fabricate 30 mil, 40 mil, and 60 mil sheets to order, so there are no standard sizes. In addition to simple rectangles, we can make almost any shape that can be drawn as a series of 5/6" strips of rubber (with certain length limitations), such as the following



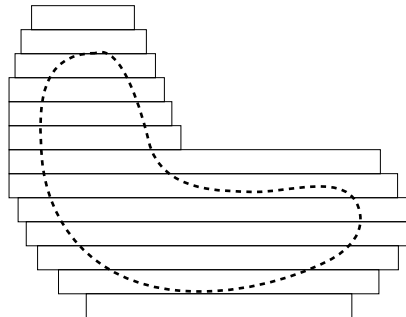
rectangle



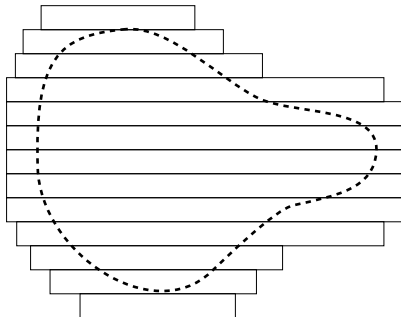
ellipse



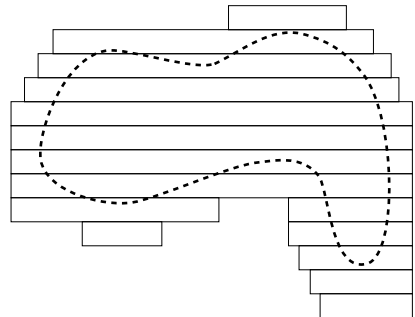
kidney



crescent



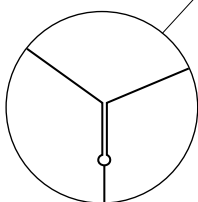
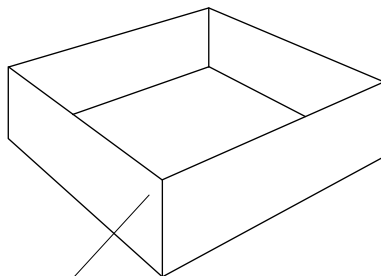
pear



freeform

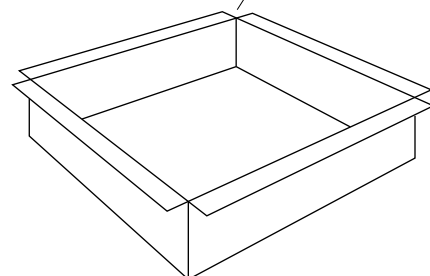
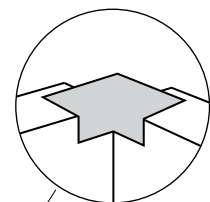
CUSTOM THREE-DIMENSIONAL PONDTECHNOLOGY LINERS: Where folds are not acceptable, such as for formal reflecting ponds, we can fabricate three-dimensional rectangular liners with vulcanized corners. We can also fabricate three-dimensional L-shapes and cylinders, but these can be very expensive and may require long lead times. The walls of the pond must be accurately formed of wood, masonry, or concrete: three-dimensional liners cannot be used with soil or rustic stone walls. The liner can be fastened to the walls with our black metal termination bars and termination bar tapes, or it can be wrapped over the top as shown.

If the liner is to be wrapped over the top of the pond walls, size the liner at least four inches taller than the pond.



Position the liner in place, and fill it partially with water. Cut a small round hole at each corner of the pond walls and slit the corners to make four side flaps.

The open corners of the flaps can be sealed with a small square of uncured repair tape. After the rubber is cleaned, the tape is positioned so that it hangs over the pond approximately two inches. Since the tape is stretchable, it can be formed into the corner.



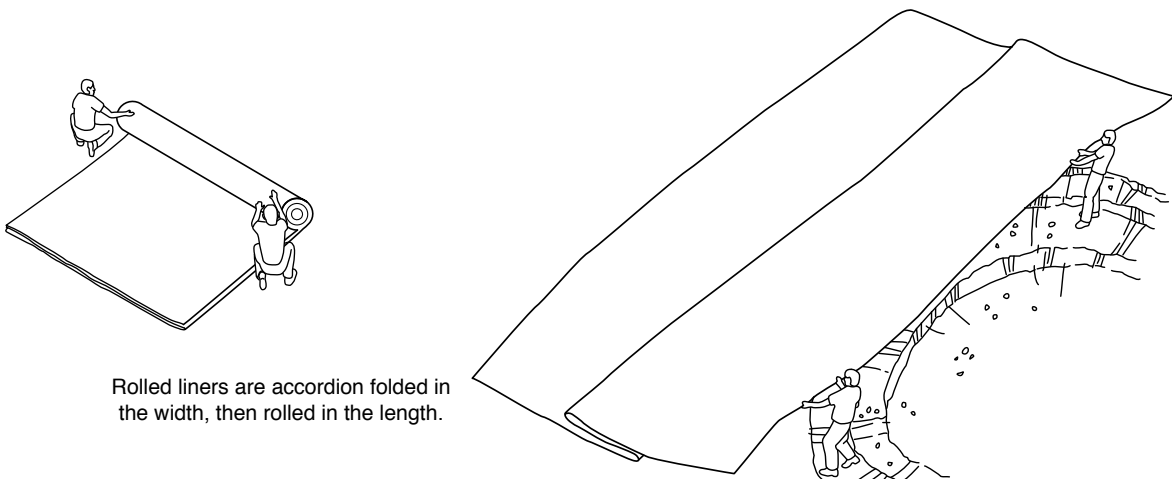
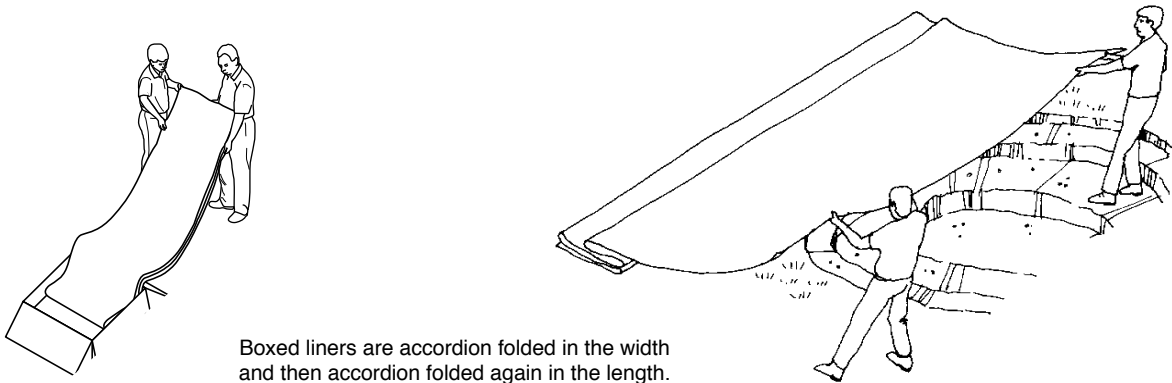
FIELD SEAMS AND REPAIRS: Whenever possible, a pond should always be lined with a single sheet of rubber. Since sizes up to 50 ft x 200 ft are standard in *Pondgard* EPDM and even larger sizes are possible in *PondTechnology* EPDM, field seaming in residential-scale work is usually limited to joining a stream or waterfall to a pond. Larger projects such as recreational ponds and reservoirs will require field seaming several large sheets with a two-step process utilizing our self-adhesive seam tapes and laminates that are cold-applied without specialized equipment. Holes can be permanently patched with our self-adhesive repair laminates; stream and waterfall liners can be easily joined to pond liners with our self-adhesive seam tapes.

Field seams and repairs in EPDM can be very reliable provided the rubber is cleaned with recommended solvents or with special cleaner/primers, the tapes are applied carefully and with adequate pressure, and the liner is positioned in a manner that prevents long-term seam stress. When we supply liners for a project requiring field seaming, our technical staff reviews all the details to make certain that the project can be successfully completed. Note that we do not recommend the use of contact adhesives commonly used for rubber roofing, since these adhesives are too weak and have insufficient resistance to ponded water to be reliable for seaming pond liners.

LIFETIME: *Pondgard* and *PondTechnology* EPDM liners are warranted for twenty years, subject to certain limitations (request written warranty for details). Extensive field experience suggests that they will last longer than twenty years in severe above-ground environments and perhaps longer than fifty years in protected underwater or underground environments.

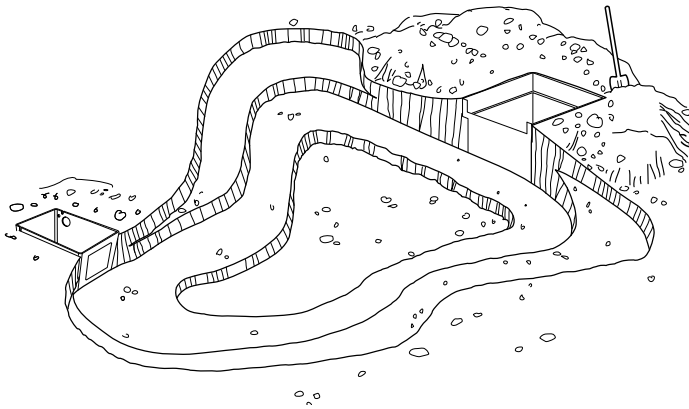
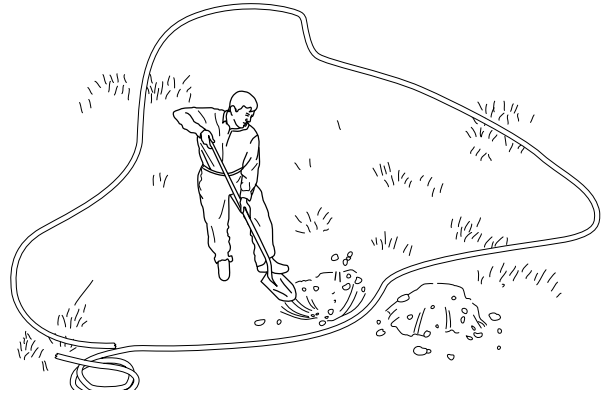
PACKING AND HANDLING: *Pondgard* EPDM liners 50 feet and longer are supplied accordion-folded and rolled; shorter liners are supplied accordion-folded and boxed. Stock 40 mil rolls are shipped on 7 foot cardboard cores; non-stock 40 mil rolls and 60 mil rolls are shipped on 11 ft long cardboard cores. All *PondTechnology* EPDM liners are supplied boxed, accordion-folded in both directions. Both types of EPDM rubber weigh approximately 0.2 pounds per square foot in 30 mil thickness, 0.3 pounds per square foot in 40 mil thickness, and 0.4 pounds per square foot in 60 mil thickness.

When ordering a large liner, be prepared to get the roll or box off the delivery truck and get it to the site since the delivery company will not do this for you. Position the roll or box at one corner of the pond, either on the surrounding land or within the pond. Carefully remove the roll wrapper or open the box to see how the rubber is folded and then orient the roll or box in the proper direction. After checking the site to make certain there are no sharp objects that could snag the liner, unroll or unfold the liner into a long strip beside or into the pond and then pull the liner across the pond, flipping it slightly to force air under the liner to help it float into place.



INSTALLING A RUBBER POND LINER

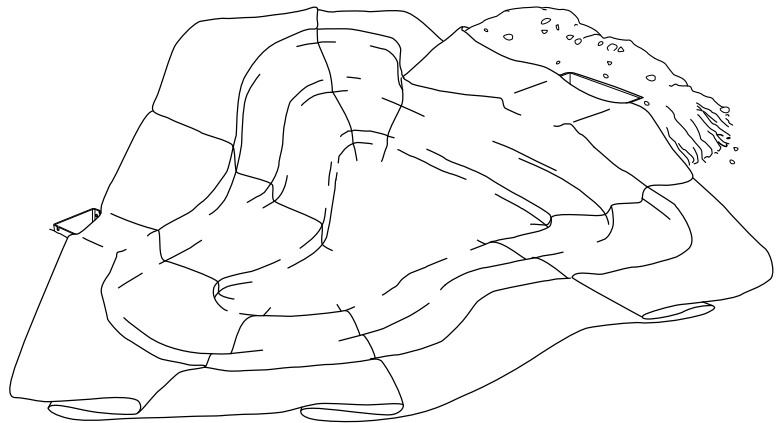
Outline the perimeter of the pond with a rope, garden hose, wood stakes, or spray paint. Measure the width W at the widest point, the length L at the longest point, and the maximum depth D . Order a pond liner with at least $W+2D+2$ feet wide by $L+2D+2$ feet long. If the pond is very irregular, increase these measurements by a few feet.

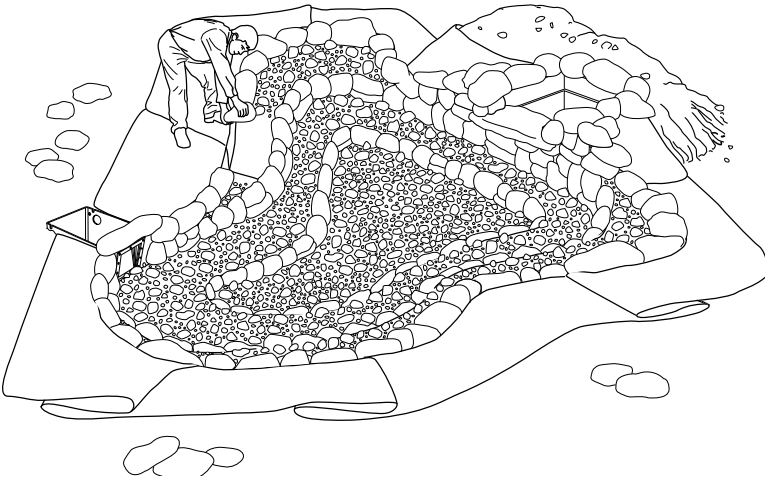


Excavate the pond and install in-ground components such as skimmers, waterfall filters, and bottom drains. Most garden ponds are designed as a series of terraces with a maximum depth of 24" to 30" deep, but we suggest you consult your plant and fish suppliers for specific recommendations for your climate. If the site is flat, the soil removed can be used to create a hill for a waterfall.

To protect the liner from stones and other soil debris, we recommend a base of sand or fine soil covered with *PondTechnology* Liner Protection Fabric. The fabric should be overlapped and folded as required to completely cover the bottom and sides of the excavation and should extend onto the ground surface.

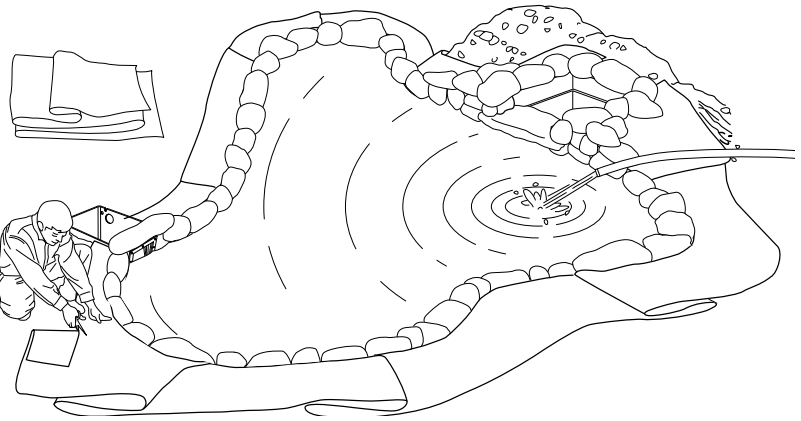
When preparation is complete, carefully unfold and position the rubber liner. Don't stretch the rubber: just let it wrinkle and pleat naturally to fit the contours of the pond.





Begin to lay rounded river rocks and gravel. Since stretching will shorten the life of a rubber liner, always start at the bottom and work upward, allowing the liner to slip freely into the pond. Before placing rocks at a transition point such as the edge of a terrace, always make sure to leave sufficient rubber to fill the contours of the pond under the weight of water.

Fill the pond with water. Then trim both the liner and protection fabric with a sharp scissors. Prevent runs in the rubber by cutting gentle curves. Leave a 12" margin of rubber, fold it several times, and bury it at the pond edge so there will be extra material available should the perimeter settle.



For a natural look, apply topsoil and mulch around the pond so that the perimeter rocks just barely protrude from the ground surface and then plant heavily at the pond edge to further conceal the rocks. For optimal durability, the liner should be totally protected by rocks and water, and the water level must be maintained in hot dry weather.

Rubber liners normally require no maintenance and are unaffected by weather. We recommend that ponds not be drained in the winter since ice will not damage the liner.

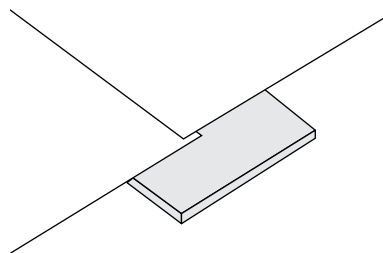
SEAMS

Two sheets rubber can be permanently joined by applying Seam Tape between the sheets and Cured Repair Tape over the resulting seam as a secondary seal. For non-critical seams, such as seams between a stream and a pond, either the Seam Tape or the Cured Repair Tape can be omitted since a single tape will suffice.

It is essential to clean the rubber with a solvent before applying tapes. For best results, use toluene. If this is not available, use white gas (Coleman fuel) or naphtha. Do not use any other solvents since they may prevent proper adhesion!

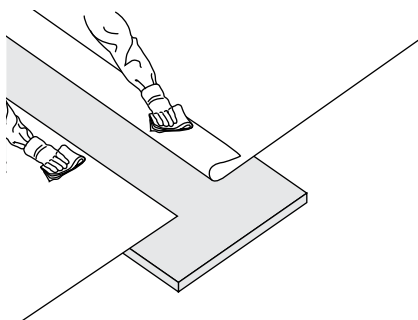
Since this procedure requires that backup boards be placed under the entire seam area, it is only practical for seams less than fifteen feet long where the wood can be easily extracted. Contact us for information about making longer seams.

①



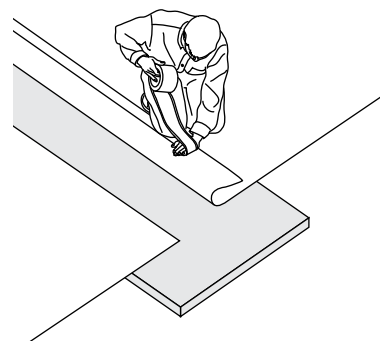
Begin by laying a plywood board (corners should be rounded or taped) under the area to be seamed. Overlap the two rubber sheets at least 3".

②



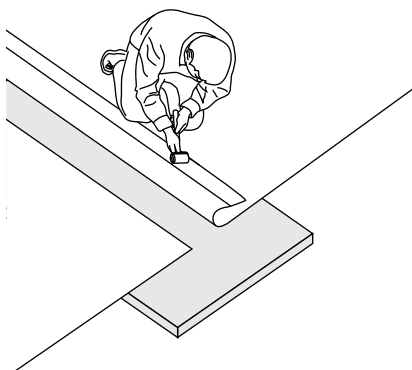
Fold back the top sheet. Wearing protective gloves, apply solvent to one of the surfaces, scrubbing vigorously with a plastic scouring pad. Wipe the solvent off with a lint-free cloth and repeat the process until the rubber is dark black. Then repeat the process on the other surface.

③



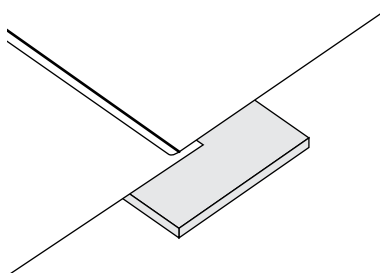
After the solvent has evaporated, apply Seam Tape to the edge of the folded sheet. The black tape should extend slightly past the edge of the rubber. Do not remove the paper backing from the tape! If the tape starts to run off-track, cut it and make a splice by overlapping at least one inch.

④

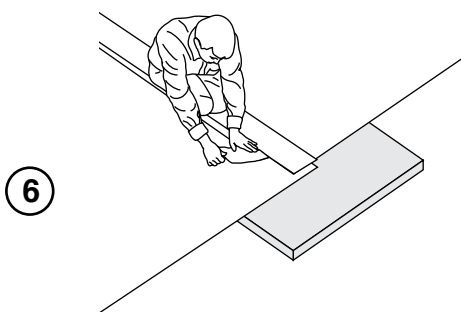


Press the paper backing with your hands in a sweeping motion to force out air trapped beneath. Then roll with a 2" to 3" wide roller angled 45° to the tape edge.

⑤

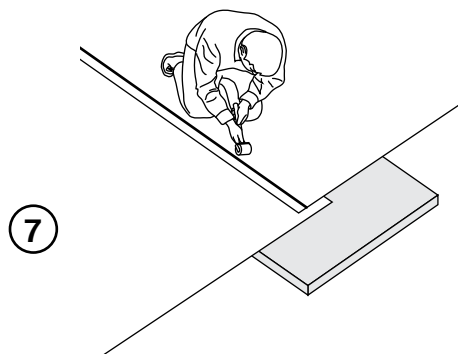


After checking to see that the bottom sheet is still clean, flip the taped sheet back over the other sheet. Note that the paper backing is still in place.



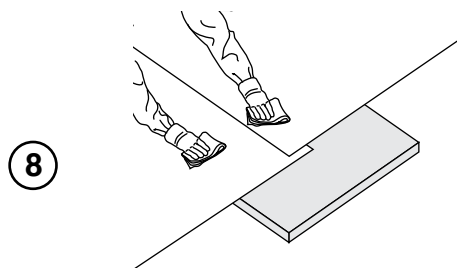
6

Reach under the top sheet and grab the end of the paper backing. Pull it out slowly with one hand, pressing the rubber with the other hand in a sweeping motion to force out air trapped beneath the tape.



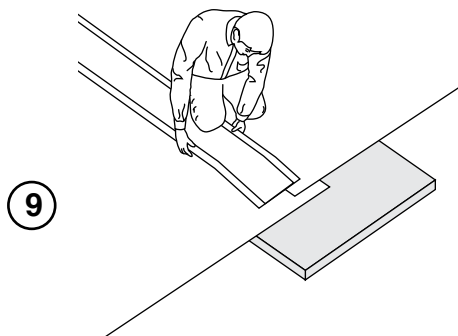
7

Roll the seam with the roller angled to the seam edge. Then roll several times along the length of the seam, leaning onto the roller to apply maximum pressure.



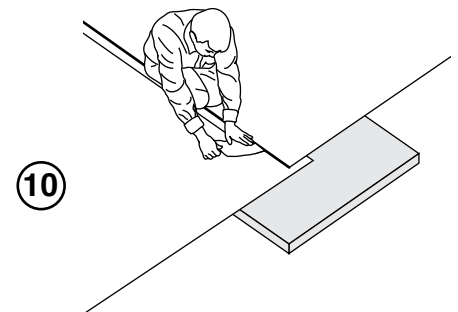
8

Clean at least 6" on both sides of the seam with solvent exactly as before. Don't flood solvent near the seam because too much can separate the tape just applied.



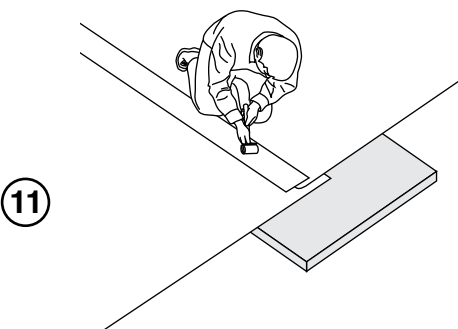
9

Center a 6" wide strip of Repair Tape over the seam so that there is a 3" overlap on either side. Then peel back the paper backing at one end and carefully make contact with the liner.



10

Reach under the repair tape and grab the end of the paper backing. Pull it out slowly with one hand, pressing the rubber with the other hand in a sweeping motion to force out air trapped beneath the tape.



11

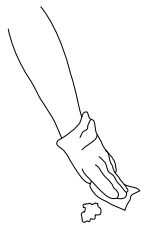
Roll the seam with the roller angled to the seam edge. Then roll several times along the length of the seam, leaning onto the roller to apply maximum pressure. Wait 24 hours before filling the pond.

REPAIRS

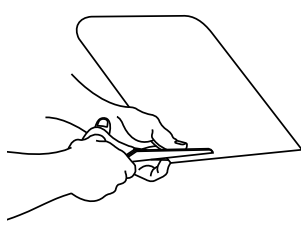
Permanent repairs in EPDM rubber are easily made with our cured and uncured repair tapes which are self-adhesive laminates of EPDM rubber with a tacky butyl compound. Of the two, cured repair tape is the most durable and is recommended for all routine repairs. However, cured repair tape cannot be stretched, so it is necessary to use uncured repair tape on irregular surfaces such as folds. Cured repair tape is available in 6" or 12" widths; uncured repair tape is only available in 6" widths.

To make a repair, first drain the pond well below the damaged area, scrub the area to be repaired to remove any mud and algae, and let the rubber dry in the sun. If possible, slide a board under the damaged area. Then clean the rubber with a solvent before applying tapes. For best results use toluene, but if this is not available, use white gas (Coleman fuel) or naphtha. Wearing protective gloves, apply the solvent to the rubber with a plastic cleaning pad. Scrub the rubber vigorously to abrade the surface and quickly wipe the dirty solvent with a lint-free cloth. Repeat this procedure until the rubber is dark black, and then wipe once more with a clean solvent-saturated cloth. Important: do not skip the solvent cleaning process and do not use any other solvents since they may prevent proper adhesion!

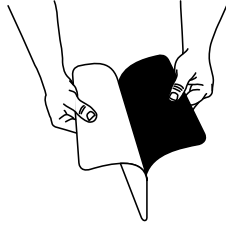
Cut a patch of Repair Tape several inches larger than the damaged area and round the corners of the patch. Remove and discard the paper backing, trying not to touch the sticky surface! Carefully position the patch so that it extends two-inches past all sides of the damage. Rub the patch from the center outward to remove trapped air, and roll with a 2" to 3" wide roller. If you don't have a roller, press firmly with the heels of your palms. Wait until the next day to refill the pond.



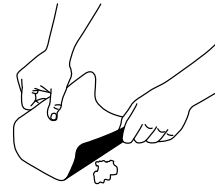
clean the pond liner with solvent



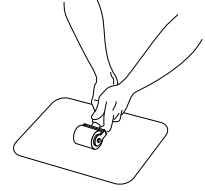
round the corners of the patch with a scissors



peel off the backing paper



place the patch with a 2" overlap all sides



apply firm pressure with roller or hands

LIQUID RUBBER LINER

CIM is a tough, abrasion-resistant coating that forms a seamless, thick rubber skin over concrete, masonry, metal, or wood surfaces. Although considerably more expensive than EPDM rubber, it can be used to waterproof old concrete ponds and other projects that are virtually impossible to seal with sheet liners. CIM is based on a two-component urethane chemistry that will far outlast single-component liquid rubber coatings and will comply with the toughest environmental air quality regulations. It is safe for use with fish and aquatic plants and is approved for use in drinking-water storage tanks and cisterns.

PREPARATION: Proper preparation is essential to achieve satisfactory results. Surfaces to be coated must be clean and dry. Old surfaces should be wire-brushed or sandblasted and then vacuumed. New concrete should first be cured 28 days and should be free of release agents and curing compounds. Holes should be filled with epoxy putty or other durable patching compounds.

APPLICATION: Surfaces to be coated must be warmer than 50° F. To avoid bubbling, CIM should not be applied in direct sunlight and should not be applied when the air temperature is rising. Consequently, the ideal time to apply it is late afternoon or early evening on a warm, dry day.

After mixing is completed, CIM must be applied within twenty minutes, so we recommend using one-gallon units to assure sufficient time for application. Stir the contents of the can with a spiral mixer mounted in an electric drill and then slowly add the bottle of activator. Continue mixing for a full three minutes, taking care not to draw air into the mixture. Follow this procedure exactly: do not mix by hand; do not mix only part of the components; and do not mix for less than three minutes! To achieve the recommended thickness of 60 mils (approximately one-sixteenth inch), apply at least one gallon for every fifteen to twenty square feet using a paint roller or squeegee. Several coats will be required to achieve this thickness on vertical walls. CIM can be recoated after one hour, but after four hours it must first be thoroughly wire-brushed, so work quickly to avoid extra preparation. After waiting two weeks for the coating to fully cure, clean the pond with a mild detergent, rinse the detergent thoroughly, fill the pond, and add dechlorinator if needed.



mix 3 minutes with spiral mixer in electric drill



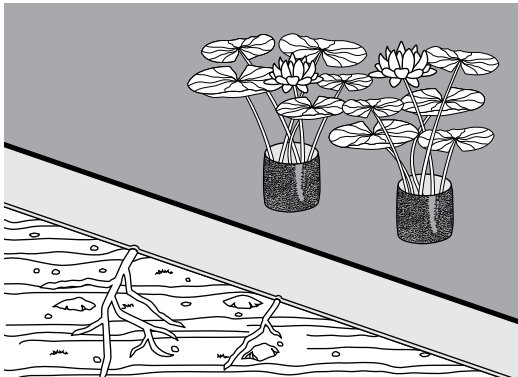
apply with roller within 20 minutes

PROTECTION FABRICS

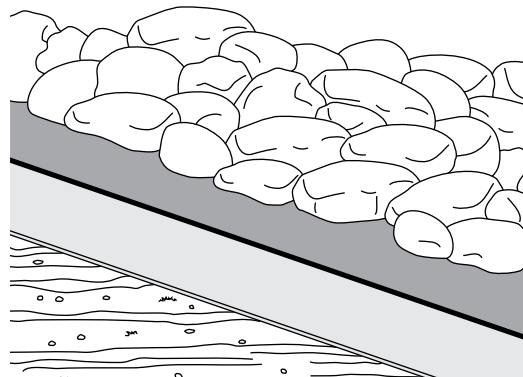
PondTechnology protection fabrics are custom-made tough synthetic non-woven fabrics used above or below pond liners to prevent puncture from rocks, roots, and soil debris. *Liner Protection Fabric* is recommended for use under any rubber liner: unlike sand bedding, carpet padding (never use old carpet!), and other fabrics, it can protect against puncture from above the liner by limiting how much the liner can stretch under pressure. When pond liners are to be completely covered with soil, gravel, rocks, or concrete, *Liner Protection Fabric* should be used both above and below the liner. *Boulder Padding* is a super-thick protection fabric recommended for use under large boulders and other concentrated loads.

LINER PROTECTION FABRIC: *PondTechnology* Liner Protection Fabric is a light gray, non-woven polyester fabric designed with optimal characteristics for preventing liner damage. It also is designed to allow lateral gas transmission to reduce the likelihood of liner bubbles due to deterioration of organic debris. At nearly one-eighth inch thick, it is substantially thicker than fabrics commonly used for landscaping and soil filtration, yet is extremely flexible. Unlike less-expensive fabrics, it is scanned for metal debris from manufacturing that could damage soft rubber liners. Since it does not deteriorate under a wide range of soil pH and is essentially non-biodegradable, it should last indefinitely. We offer two standard rolls – 5 ft x 100 ft and 7.5 ft x 100 ft – and will cut either to any length. For large projects, we can supply 15 ft x 300 ft and 15 x 1200 ft rolls.

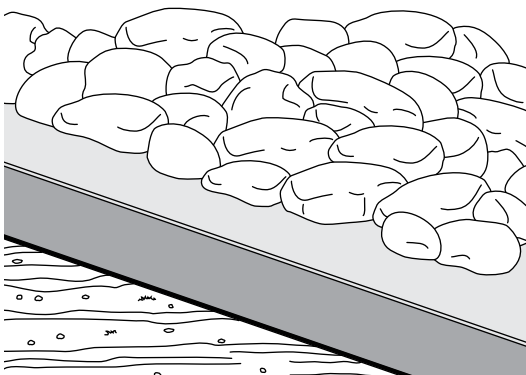
INSTALLATION OF LINER PROTECTION FABRIC: Simply spread the fabric over the excavation, folding and pleating as necessary to obtain a good fit. Overlap adjacent sheets of fabric six to twelve inches and spread sand over the joints so the fabric will stay in place when the liner is dragged over it. When installing large liners it is often better to lay the rubber in place first and then fold back sections of the rubber to install the fabric.



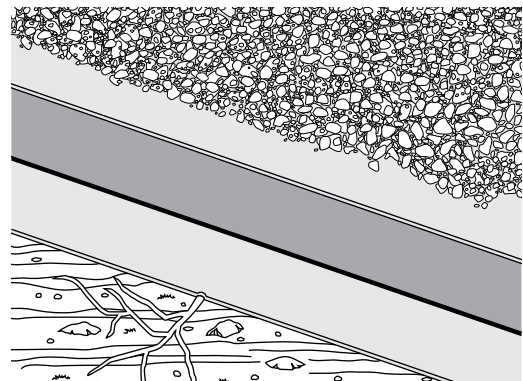
Liner Protection Fabric used below a pond liner protects against damage from roots and rocks. Fabric is more effective than sand and more durable than old carpets.



Liner Protection Fabric used below a pond liner also protects against damage from rocks and animals above by preventing the liner from stretching enough to tear.



Where pond liners are to be covered with rocks, sand, earth, or other fill, Liner Protection Fabric used above the liner creates a barrier that's almost impossible to breach.



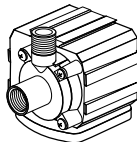
For recreational ponds and other abusive environments, it may be appropriate to use Liner Protection Fabric both above and below a liner for the ultimate protection.

BOULDER PADDING: *PondTechnology* Boulder Fabric is a dark gray, non-woven polypropylene fabric measuring approximately three-eighths of an inch thick, designed to reduce the chance of liner damage from very heavy objects. Since it does not deteriorate under a wide range of soil pH and is essentially non-biodegradable, it should last indefinitely. We stock rolls measuring 6.5 ft x 49 ft and will cut any length.

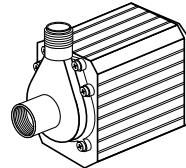
ENERGY-EFFICIENT PUMPS

Since the yearly electricity cost to run a typical pond pump often exceeds the cost of the pump, it always makes economic sense to buy the most energy-efficient pump possible. We stock more than thirty different energy-efficient pumps that can be divided into two categories: submersible pumps that are designed to be fully submerged in water and external pumps that are designed to operate in air. Submersible pumps are further divided into three basic types: in-line pumps that draw water through an inlet fitting that can be connected to a hose to draw water from a remote location; utility pumps that draw water through slots or holes that screen out debris; and solids pumps that draw water directly through large unscreened openings because they can pump debris without clogging. These pumps are described below, and complete specifications can be found in the tables that follow. (Note: GPH = gallons per hour)

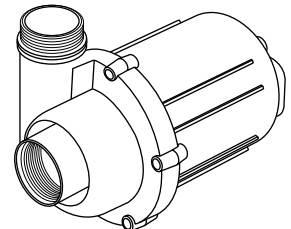
DANNER IN-LINE PUMPS: These compact, standard-duty submersible pumps utilize energy-efficient, reliable, magnetic-drive and hybrid magnetic-drive technology. We stock nine pumps with peak flow rates from 250 to 3600 GPH (PM2, PM5, PM9, PM12, PM24, PM36, HY1600, HY2100, HY2600). All pumps have threaded inlets and outlets which make them ideal for use with slotted pipe intake and discharge manifolds to create gravel filter systems.



PM2, PM5

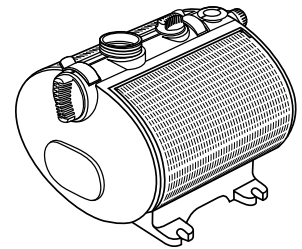


PM9, PM12, PM24, PM36



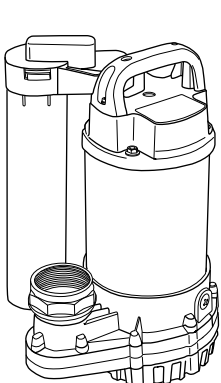
HY1600, HY2100, HY2600

OASE UTILITY PUMPS: Oase submersible pumps are world famous for their energy-efficiency and reliability. We stock three pumps with peak flow rates from 500 to 2600 GPH (N500, N1600, N2600). Their low electricity consumption yields substantial savings when compared to pumps with similar flow characteristics, and their superior-quality construction assures a very long life. These pumps offer several features that make them ideal for fountains. A slotted housing completely surrounds the pump and serves as an oversized inlet screen to prevent fountainhead clogging. Side wings on the housing can be extended to increase the surface area further, or can be detached to provide a remote intake. Other standard features include a flow-control built in to the end of the inlet screen, a diverter outlet, and a telescopic fountain extension. A Vulcan fountainhead is included, but this can be replaced with any of Oase's extensive line of one-inch professional-quality plastic, stainless-steel, and brass fountainheads.

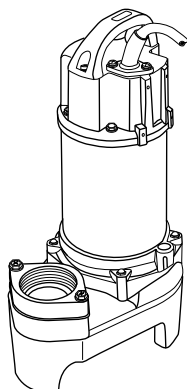


N500, N1600, N2600

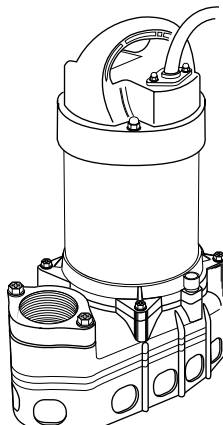
TSURUMI UTILITY AND SOLIDS PUMPS: Tsurumi pumps are known for their energy-efficiency and superior-quality construction, features that have made them popular among pond professionals. The smallest two in the series (OM2, 2-PU) have a peak flow rates of 3330 GPH and 3420 GPH and are available with or without an automatic low-water shutoff feature. For larger ponds, we offer Tsurumi's most advanced pond pump series with peak flow rates from 4250 to 6250 GPH (3-PN, 4-PN, 8-PN). For ponds requiring very high flow rates at very low head pressure, we offer Tsurumi's remarkable heavy-duty super-efficient axial-flow utility pump (AB2/4) that delivers more than 15,000 GPH yet requires only 750 watts of power! We also offer a Tsurumi trash pump (HS2) designed to suspend and pump pond sediment and muck, making it ideal for pond cleanouts. All seven pumps feature ceramic shaft seals and stainless-steel motor housings. Note that Tsurumi pumps contain a small amount of oil shaft lubricant that should be easily changed to assure the longest possible pump life (use readily available mineral oil or canola oil).



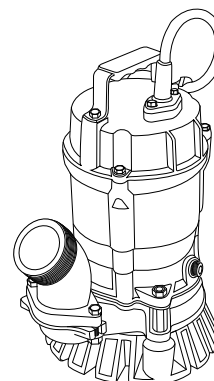
OM2 automatic



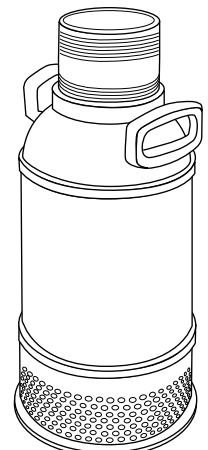
2PU



3PN, 4PN, 8PN



HS2



AB2/4

PONDTECHNOLOGY UTILITY AND SOLIDS PUMPS: We offer our own line of economically-priced, superior-quality pumps designed for mid-size and large water features. Two are plastic utility pumps with peak flow rates of 2200 GPH and 3400 GPH (C33, C50). These pumps feature a unique built-in automatic shutoff that protects the pump from running dry, making them ideal for use in confined spaces such as pond skimmers and pondless watercourse pump vaults. Lifting a knob on the top of the pump disables the shutoff float, allowing the pump to draw water down to 1-1/2" to drain the enclosure. Pressing the knob opens the float chamber for cleaning.

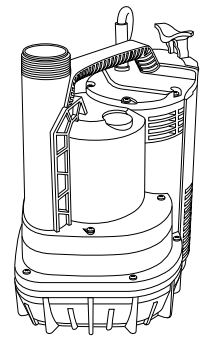
We also offer four heavy-duty solids pumps with flow rates of 3510, 5460, 7120, and 8040 GPH (S25, S33, S50, S100). These feature ceramic shaft seals, stainless-steel motor housings, and 1-3/8" solids-handling capacity. Unlike many other solids pumps, they have been designed not to overheat in low-head systems typical of pond construction.

LEADER EXTERNAL PUMPS: The Leader Ecopool 6 is our smallest external pump, delivering 1500 GPH. It features a totally enclosed capacitor motor with a built-in switch. The inlet and outlet have 1" threads. The low cost, compact size, and high-head characteristics of this pump make it ideal for interior fountains and water walls.

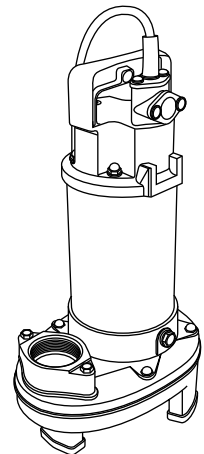
PONDTECHNOLOGY EXTERNAL PUMPS: Unlike similar-looking pumps designed for high-pressure swimming pool filtration systems, these heavy-duty pumps have been optimized for low-pressure aquatic gardening applications. Built with energy-efficient industrial-duty motors and carefully matched impellers, they can save hundreds or even thousands of dollars per year when compared with conventional pumps with similar flow rates. They are also much quieter.

All pumps in this series are self-priming so they can be installed above the pond water level with little risk of dry running or overheating. We offer six low-head models with peak flow rates of 3530, 4900, 5650, 9240, 11160, and 13020 GPH (EP12, EP25, EP33, EP50, EP75, EP100) and three medium-head models with peak flow rates of 14460, 17640, and 20400 GPH (EP150, EP300, EP500). We pre-wire all low-head pumps with an 8-foot, 115 volt power cord. The three smallest low-head pump have 2" threaded inlets and outlets; the larger low-head pumps and the medium-head pumps have built-in unions with 3" socket fittings. All of the pumps have large built-in strainer baskets.

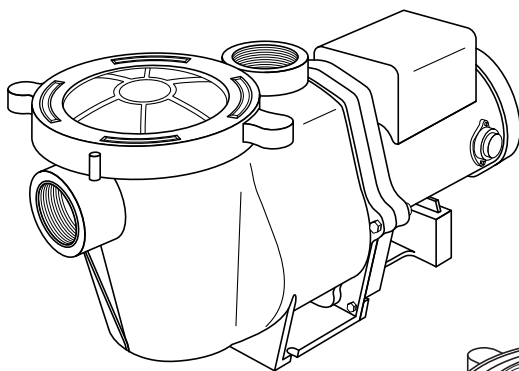
CARRY UTILITY PUMPS: These all-stainless-steel, super-heavy-duty axial-flow utility pumps are the largest submersible pumps we offer, with peak flow rates up to 100,000 GPH. We custom-engineer each pump and can accommodate both vertical and horizontal installations.



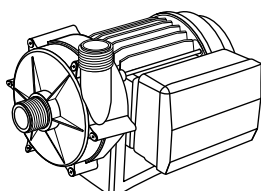
C33, C50



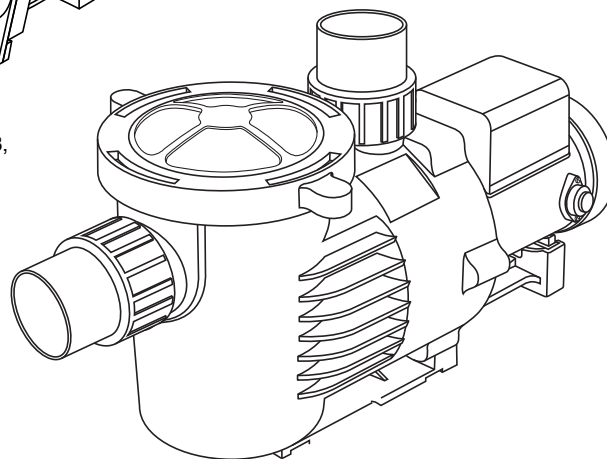
S25, S33, S50, S100



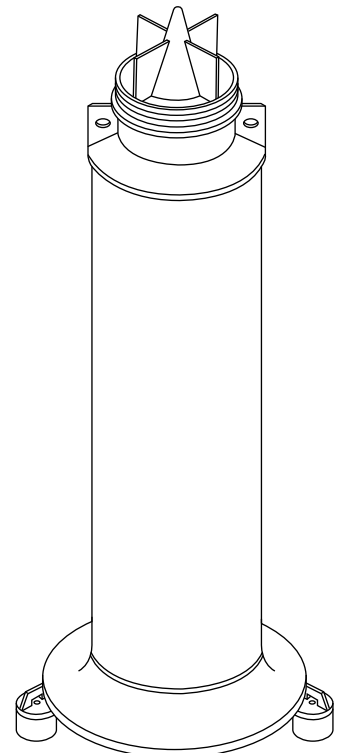
EP12, EP25, EP33,



Leader EP 6



EP50, EP75, EP100, EP150, EP300, EP500



Carry

SELECTING A PUMP: To determine the best pump for a pond, first calculate the pump flow rate from the following formulas (choose the waterfall flow rate to yield the desired effect, or use 0 for the waterfall flow rate if there is no waterfall):

pond volume (gal) = 5 x widest width (ft) x longest length (ft) x deepest depth (ft)

filtration flow rate (GPH) = 0.5 x pond volume (gal)

waterfall flow rate (GPH), gentle flow = 50 GPH x waterfall width (in)

waterfall flow rate (GPH), average flow = 100 GPH x waterfall width (in)

waterfall flow rate (GPH), strong flow = 200 GPH x waterfall width (in)

pump flow rate (GPH) = greater of filtration flow rate and waterfall flow rate

Next, calculate the system head (try to choose a hose size that will keep the friction head less than two feet):

lift head (feet) = height of waterfall, measured from pond surface

friction head (ft) = length of pipe or hose (ft) x friction head per foot of pipe or hose (from chart below)

system head (ft) = lift height (ft) + friction head (ft)

The pump flow rate and the system head just calculated determine which pumps are suitable. Using the charts on the following pages, find the row corresponding to the system head and read across to find all pumps that deliver at least the required pump flow rate. If the pump is to be inside the pond, choose an in-line pump and use a pre-filter, or choose a solids pump. If the pump is to be inside a skimmer, any submersible pump will work. Bead filters and vortex filters usually require external pumps.

Example: Select a pump for a pond 8 ft x 12 ft x 2 ft deep with a 2 ft high x 10 inch wide waterfall and 20 ft of hose.

pond volume = 5 x 8 ft x 12 ft x 2 ft = 960 gallons

filtration flow rate = 0.5 x 960 gallons = 480 GPH

waterfall flow rate = 100 GPH x 10" wide = 1000 GPH (assuming an average flow)

pump flow rate = 1000 GPH (select the waterfall flow rate because it is greater than filtration flow rate)

lift head = 2 ft

friction head = 20 ft x 0.16 = 3 ft with 1" hose, but only 20 ft x 0.04 = 1 ft with 1-1/4" hose, so use 1-1/4" hose

system head = 2 ft lift head + 1 ft friction head = 3 ft

From the pump specification charts we see that the Supreme PM12 in-line submersible and the Oase Nautilus 1600 fountain pump would both produce at least 1000 GPH at 3 ft system head.

Friction Head Per Foot of Pipe or Hose, 200 - 5000 GPH						
Flow (GPH)	Pipe Size (inside diameter)					
	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
200	0.08	0.02	0.01	0.00	0.00	0.00
400	0.40	0.10	0.03	0.01	0.00	0.00
600		0.20	0.06	0.02	0.01	0.00
800		0.35	0.11	0.03	0.01	0.00
1000		0.53	0.16	0.04	0.02	0.00
1200			0.22	0.06	0.03	0.01
1400			0.29	0.08	0.04	0.01
1600			0.37	0.10	0.05	0.01
1800			0.46	0.12	0.06	0.02
2000			0.56	0.14	0.07	0.02
2200				0.17	0.08	0.02
2400				0.20	0.09	0.03
2600				0.23	0.11	0.03
2800				0.27	0.13	0.04
3000				0.31	0.13	0.04
3200				0.34	0.16	0.05
3400				0.38	0.18	0.05
3600				0.42	0.20	0.06
3800				0.46	0.22	0.06
4000				0.50	0.24	0.07
4200					0.26	0.08
4400					0.28	0.08
4600					0.34	0.10
4800					0.37	0.10
5000					0.50	0.11

Friction Head Per Foot of Pipe, 5000 - 60000 GPH					
Flow (GPH)	Pipe Size (inside diameter)				
	2"	3"	4"	6"	8"
5000	0.11	0.02	0.01	0.00	0.00
5500	0.13	0.02	0.01	0.00	0.00
6000	0.15	0.02	0.01	0.00	0.00
6500	0.18	0.03	0.01	0.00	0.00
7000	0.21	0.03	0.01	0.00	0.00
7500	0.24	0.03	0.01	0.00	0.00
8000	0.27	0.04	0.01	0.00	0.00
8500	0.30	0.04	0.01	0.00	0.00
9000	0.33	0.05	0.01	0.00	0.00
9500	0.37	0.05	0.01	0.00	0.00
10000	0.41	0.06	0.02	0.00	0.00
11000	0.50	0.07	0.02	0.00	0.00
12000		0.08	0.02	0.00	0.00
13000		0.09	0.02	0.00	0.00
14000		0.11	0.03	0.00	0.00
15000		0.12	0.03	0.00	0.00
20000		0.21	0.05	0.01	0.00
25000		0.30	0.07	0.01	0.00
30000		0.41	0.08	0.01	0.00
35000		0.51	0.08	0.02	0.01
40000			0.09	0.03	0.01
45000			0.10	0.03	0.01
50000			0.11	0.04	0.01
55000			0.13	0.05	0.01
60000			0.14	0.06	0.01

SPECIFICATIONS FOR SUBMERSIBLE PUMPS

Brand		Danner							Oase		
Model		PM2	PM5	PM9	PM12	HY1600	HY2100	HY2600	N500	N1600	N2600
Type		in-line	in-line	in-line	in-line	in-line	in-line	in-line	utility	utility	utility
Flow Rates (gallons per hour) as Determined by System Head	0 ft	280	500	950	1200	1800	2130	2700	500	1600	2600
	1 ft	250	450	950	1200	1750	2080	2640	470	1600	2600
	2 ft	210	420	900	1180	1690	1990	2580	420	1490	2500
	3 ft	170	380	850	1150	1630	1900	2520	370	1380	2390
	4 ft	130	310	800	1130	1540	1830	2450	320	1280	2290
	5 ft	80	250	750	1120	1450	1760	2380	270	1170	2180
	6 ft	20	180	720	950	1380	1680	2300	210	1060	2070
	7 ft	0	130	660	810	1300	1600	2230	140	960	1960
	8 ft	0	80	600	710	1220	1500	2150	70	850	1850
	9 ft	0	50	500	650	1130	1400	2080	0	750	1730
	10 ft	0	20	400	600	1050	1300	2000	0	650	1610
	11 ft	0	0	300	500	930	1210	1930	0	540	1490
	12 ft	0	0	220	450	800	1120	1850	0	440	1370
	13 ft	0	0	100	300	680	1030	1780	0	330	1250
	14 ft	0	0	0	130	550	940	1700	0	220	1120
	15 ft	0	0	0	0	430	850	1630	0	110	990
	16 ft	0	0	0	0	210	740	1490	0	0	860
	17 ft	0	0	0	0	0	630	1360	0	0	730
	18 ft	0	0	0	0	0	520	1230	0	0	580
	19 ft	0	0	0	0	0	410	1080	0	0	440
	20 ft	0	0	0	0	0	300	960	0	0	290
	21 ft	0	0	0	0	0	150	830	0	0	150
	22 ft	0	0	0	0	0	0	700	0	0	0
	23 ft	0	0	0	0	0	0	570	0	0	0
	24 ft	0	0	0	0	0	0	430	0	0	0
	25 ft	0	0	0	0	0	0	300	0	0	0
	26 ft	0	0	0	0	0	0	0	0	0	0
	27 ft	0	0	0	0	0	0	0	0	0	0
	28 ft	0	0	0	0	0	0	0	0	0	0
	29 ft	0	0	0	0	0	0	0	0	0	0
	30 ft	0	0	0	0	0	0	0	0	0	0
Watts		45	45	95	110	120	190	270	30	100	220
Volts		115	115	115	115	115	115	115	115	115	115
Inlet ID		1/2"	1/2"	3/4"	3/4"	1"	1"	1"	-	-	-
Outlet ID		1/2"	1/2"	3/4"	3/4"	1"	1"	1"	1/2"	1"	1"
Minimum Pipe		3/4"	3/4"	1"	1"	1-1/4"	1-1/4"	1-1/2"	-	-	-
Cord Length		18 ft	18 ft	18 ft	18 ft	20 ft	20 ft	20 ft	15 ft	20 ft	20 ft
Size (LxWxH)		5x4x4	5x4x4	6x3x5	6x3x5	6x6x9	6x6x9	6x6x9	8x5x5	11x9x9	11x9x9
Weight		4	4	7	10	10	10	11	5	8	12
Warranty		1 year	1 year	1 year	1 year	1 year	1 year	1 year	3 years	3 years	3 years

SPECIFICATIONS FOR SUBMERSIBLE PUMPS											
Brand		PondTechnology						Tsurumi			
Model		C33	C50	S25	S33	S50	S100	3-PN	4-PN	8-PN	AB2/4
Type		utility	utility	solids	solids	solids	solids	solids	solids	solids	utility
Flow Rates (gallons per hour) as Determined by System Head	0 ft	2200	3400	3510	5460	7110	8040	4250	5400	6250	15600
	1 ft	2130	3360	3400	5270	6920	7880	4200	5340	6210	15000
	2 ft	2060	3320	3290	5080	6740	7730	4100	5220	6170	14100
	3 ft	1990	3270	3190	4880	6550	7570	4020	5100	6110	12900
	4 ft	1920	3210	3080	4690	6360	7420	3900	4980	6060	12000
	5 ft	1860	3140	2970	4500	6180	7260	3840	4920	6000	11100
	6 ft	1800	3120	2820	4310	6010	7110	3720	4830	5910	9750
	7 ft	1730	3090	2670	4120	5840	6960	3570	4740	5850	7950
	8 ft	1670	3050	2520	3920	5680	6810	3480	4620	5790	6000
	9 ft	1600	3000	2370	3730	5510	6660	3360	4500	5760	4400
	10 ft	1520	2950	2220	3540	5340	6510	3240	4380	5640	3000
	11 ft	1450	2880	2040	3330	5160	6340	3120	4260	5550	0
	12 ft	1380	2800	1860	3120	4980	6180	3000	4140	5490	0
	13 ft	1300	2710	1680	2910	4800	6010	2880	4020	5430	0
	14 ft	1220	2610	1500	2700	4620	5840	2700	3900	5340	0
	15 ft	1130	2500	1280	2490	4440	5670	2580	3780	5250	0
	16 ft	1030	2390	1070	2290	4260	5510	2460	3660	5160	0
	17 ft	910	2280	860	2080	4080	5340	2220	3540	5070	0
	18 ft	780	2170	640	1870	3900	5170	2100	3420	4950	0
	19 ft	620	2060	430	1660	3720	5010	1920	3240	4890	0
	20 ft	440	1950	210	1450	3540	4840	1740	3120	4800	0
	21 ft	230	1810	0	1250	3360	4670	1550	2940	4680	0
	22 ft	0	1630	0	1040	3180	4500	1380	2820	4590	0
	23 ft	0	1440	0	830	3000	4340	1200	2700	4470	0
	24 ft	0	1260	0	620	2800	4170	1020	2520	4350	0
	25 ft	0	1070	0	420	2600	4010	840	2400	4260	0
	26 ft	0	870	0	210	2380	3840	660	2280	4110	0
	27 ft	0	680	0	0	2180	3670	480	2100	3990	0
	28 ft	0	480	0	0	1980	3500	330	1950	3870	0
	29 ft	0	240	0	0	1780	3330	150	1740	3720	0
	30 ft	0	0	0	0	1570	3170	0	1620	3600	0
Watts		300	600	350	550	840	1160	550	710	980	750
Volts		115	115	115	115	115	115	115	115	115	115
Inlet ID		-	-	-	-	-	-	-	-	-	-
Outlet ID		1-1/4"	1-1/4"	2"	2"	2"	2"	2"	2"	2"	4"
Minimum Pipe		1-1/2"	2"	2"	2"	2"	2"	2"	2"	2"	4"
Cord Length		16 ft	16 ft	20 ft	20 ft	20 ft	20 ft	32 ft	32 ft	32 ft	32 ft
Size (LxWxH)		7x8x11	7x8x12	7x9x16	7x9x16	7x9x16	7x9x16	7x10x15	7x10x15	7x10x16	10x10x19
Weight		11	15	18	20	23	27	19	23	29	70
Warranty		2 years	2 years	2 years	2 years	2 years	2 years	2 years	2 years	2 years	2 years

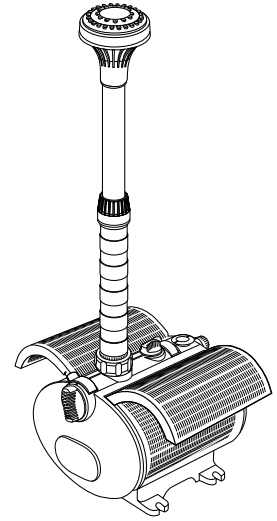
SPECIFICATIONS FOR EXTERNAL PUMPS

SPECIFICATIONS FOR EXTERNAL PUMPS											
Brand		Leader	PondTechnology								
Model		EP6	EP12	EP25	EP33	EP50	EP75	EP100	EP150	EP300	EP500
Type		external	external	external	external	external	external	external	external	external	external
Flow Rates (gallons per hour) as Determined by System Head	0 ft	1500	3530	4900	5650	9240	11160	13020	14460	17640	20400
	1 ft	1480	3530	4900	5650	9240	11160	13020	14460	17640	20400
	2 ft	1450	3530	4900	5650	9240	11160	13020	14460	17640	20400
	3 ft	1430	3530	4900	5650	9240	11160	13020	14460	17640	20400
	4 ft	1400	3530	4900	5650	9240	11160	13020	14460	17640	20400
	5 ft	1380	3530	4900	5650	8940	11160	13020	14460	17640	20400
	6 ft	1330	3530	4900	5650	8680	10930	13020	14460	17640	20400
	7 ft	1280	3390	4900	5650	8410	10640	13020	14460	17640	20400
	8 ft	1240	3210	4900	5650	8150	10360	12760	14460	17640	20400
	9 ft	1190	3030	4900	5650	7880	10070	12500	14460	17640	20400
	10 ft	1140	2820	4770	5650	7620	9780	12240	14250	17640	20400
	11 ft	1080	2640	4620	5650	7280	9440	11940	14040	17640	20400
	12 ft	1020	2430	4380	5650	6950	9110	11640	13830	17640	20400
	13 ft	960	2220	4140	5650	6610	8770	11340	13620	17480	20400
	14 ft	900	1980	3960	5340	6280	8440	11010	13410	17320	20400
	15 ft	840	1800	3690	5070	5940	8100	10680	13200	17160	20400
	16 ft	740	1440	3450	4800	5500	7680	10300	13020	16970	20400
	17 ft	650	1020	3180	4560	5060	7260	9920	12840	16780	20240
	18 ft	550	0	2880	4230	4620	6840	9540	12660	16580	20070
	19 ft	460	0	2400	3960	4050	6420	9090	12480	16390	19910
	20 ft	360	0	1830	3660	3480	6000	8640	12300	16200	19740
	21 ft	240	0	0	3360	2640	5610	8190	12100	15980	19550
	22 ft	120	0	0	2800	1800	4640	7740	11890	15770	19360
	23 ft	0	0	0	2550	900	3680	7130	11690	15550	19160
	24 ft	0	0	0	2130	0	2710	6510	11480	15340	18970
	25 ft	0	0	0	1560	0	1740	5520	11280	15120	18780
	26 ft	0	0	0	0	0	0	4440	11060	14890	18590
	27 ft	0	0	0	0	0	0	2700	10850	14660	18400
	28 ft	0	0	0	0	0	0	0	10630	14440	18200
	29 ft	0	0	0	0	0	0	0	10420	14210	18010
	30 ft	0	0	0	0	0	0	0	10200	13980	17820
Watts		260	190	320	430	650	1020	1250	2000	3000	4400
Volts		115	115	115	115	115	115	115	230	230	230
Inlet ID		1"	2"	2"	2"	3"	3"	3"	3"	3"	3"
Outlet ID		1"	2"	2"	2"	3"	3"	3"	3"	3"	3"
Minimum Pipe		1-1/4"	2"	2"	2"	3"	3"	3"	3"	3"	3"
Cord Length		8 ft	8 ft	8 ft	8 ft	8 ft	8 ft	8 ft	none	none	none
Size (LxWxH)		10x8x7	22x10x13	22x10x13	22x10x13	32x13x15	32x13x15	32x13x15	32x13x15	32x13x15	32x13x15
Weight		8	43	44	47	58	62	77	66	67	77
Warranty		1 year	3 years	3 years	3 years	3 years	3 years	3 years	3 years	3 years	3 years

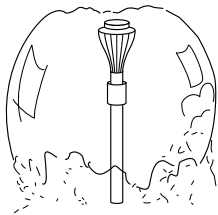
FOUNTAINHEADS

A fountain adds sound and motion to a pond, aerates and circulates the water to improve water quality, and lowers the air temperature around the pond by evaporative cooling. We stock ten professional-quality fountainheads made from brass, stainless-steel, or sturdy plastic, all with one-inch threads. Comet creates a pencil-thin jet of water that can be angled up to twelve degrees: multiple Comets are used in groups to create rings or arches. Frothy, Cascade, and Geyser create vertical water displays with minimal horizontal spread. Trumpet and Lava create displays that spread wider than their height: children delight in poking their fingers through the spherical sheet of water created by Lava. Vulcan creates a multi-tiered effect with both vertical rise and horizontal spread. Bursting Stars creates a spectacular multi-tiered rotating display with small droplets that sparkle in the light. Larger versions of many of these fountainheads are available to create spectacular public displays.

We also offer three superior fountain pumps (Nautilus 500, 1600, 2600) that include everything required for a plug-in fountain system: a reliable energy-efficient pump, an extremely effective slotted strainer housing with extendable wings, a built-in flow-control valve, and a plastic Vulcan multi-tier fountainhead mounted on an adjustable extension attached to a swivel joint. To complete the system, an optional Oase adjustable low-voltage light can be attached directly to the top of Nautilus pumps. The chart below shows the approximate performance of the Nautilus 1600 and 2600 pumps with a variety of compatible fountainheads. Heavy-water brass versions of the Frothy and Vulcan are also available but are not shown because they require larger pumps.



Oase Nautilus pump with flow regulator, extension, and Vulcan fountainhead



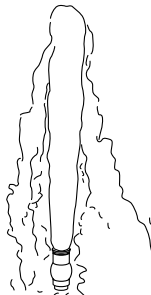
Lava



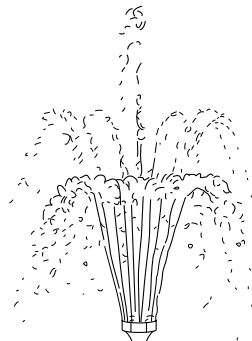
Trumpet



Comet



Frothy



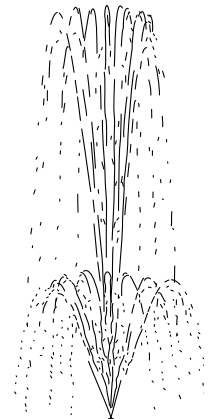
Vulcan



Geyser

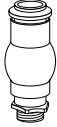
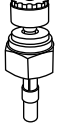


Cascade



Bursting Stars

FOUNTAINHEAD PERFORMANCE WITH OASE NAUTILUS PUMPS

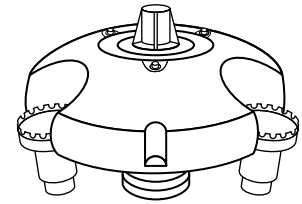
								
Name	Lava	Trumpet	Comet	Frothy	Vulcan	Geyser	Cascade	Stars
Material	plastic	plastic	brass	stainless	plastic	brass	brass	brass
N1600	36d	20h x 30d	90h	32h	87h x 60d	42h	28h	52h x 42d
N2600	60d	28h x 35d	144h	63h	166h x 100d	82h	50h	70h x 58d

FLOATING FOUNTAINS

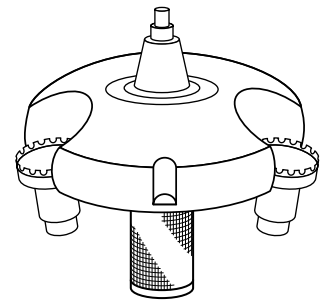
A floating fountain consists of a pump and fountain nozzle mounted on a molded plastic float anchored in the middle of a pond. Besides providing an exciting water display, floating fountains aerate and circulate pond water, promoting the growth of natural bacteria that purify the water and control the accumulation of organic matter. When the fish population is low, a properly sized floating fountain can be sufficient to keep a pond attractive and odor free.

We offer four fountains, all with oil-free pumps and three-year warranties. The Pond Jet is a light-duty fountain designed for ponds smaller than 3000 square feet: it features a super-efficient 2.6 amp 115 volt motor. The Mini heavy-duty fountains use the same float as the Pond Jet, but incorporate more powerful pumps with large inlet strainers designed to draw from deep in the pond (four-foot minimum depth). The 1/2 HP version (1200w/115v) is recommended for ponds up to 10,000 square feet; the 1 HP unit (1900w/230v) is recommended for ponds up to 20,000 square feet. The Midi 2 HP heavy-duty fountain (2700w/230v) features a more powerful pump with a much larger float and strainer and is suitable for ponds up to 40,000 square feet with five-foot minimum depth. Floating fountains up to 15 HP are available.

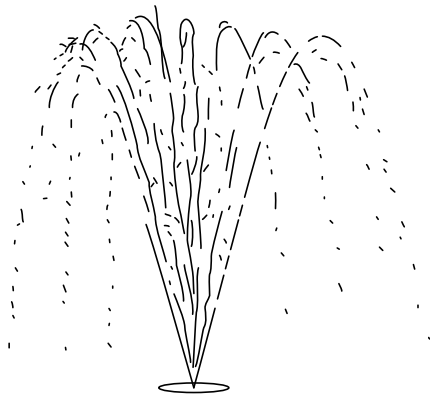
An arch fountain nozzle and a 75 foot power cord are included with the Pond Jet, but nozzles and cords must be ordered separately with all other fountains. Automatic controls are included with all fountains except the Pond Jet. Lights are available for a spectacular nighttime display.



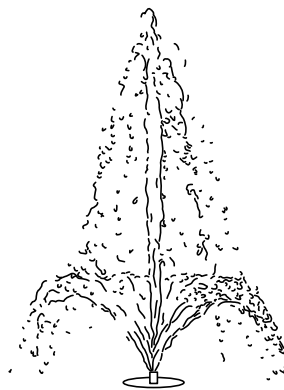
Pond Jet



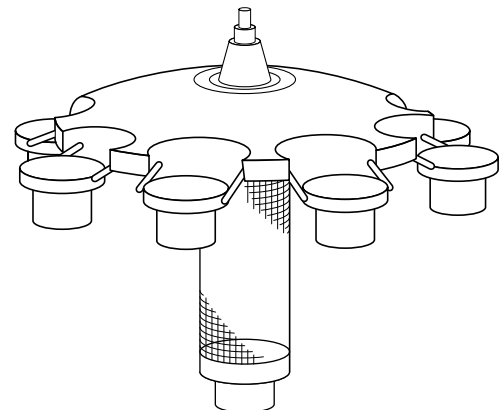
1/2 HP + 1 HP Mini



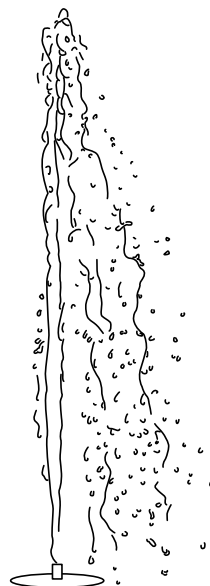
Arch



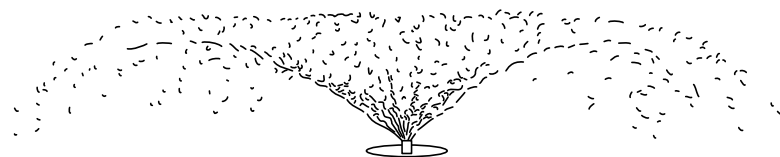
Trumpet-Jet



2 HP Midi



Grand Geyser



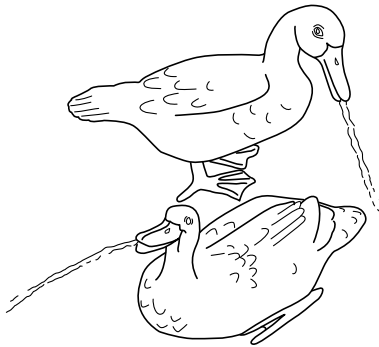
Wide Trumpet

Fountain Size (feet)				
	Arch	Grand Geyser	Wide Trumpet	Trumpet-Jet
Pond Jet	10d x 10h	-	-	-
1/2 HP	14d x 11h	4d x 8h	15d x 2h	22d x 10h
1 HP	21d x 18h	5d x 12h	26d x 3h	26d x 16h
2 HP	26d x 20h	6d x 18h	36d x 6h	36d x 22h

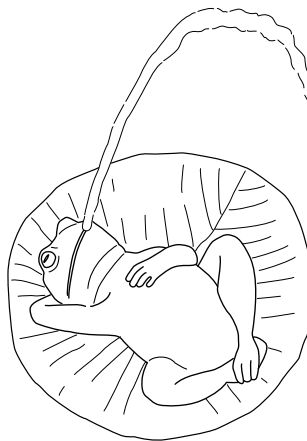
FOUNTAIN STATUARY

These full-size handcrafted brass fountains are cast in Thailand by skilled artisans using the ancient lost wax method which accurately renders even the finest details. The standard finish is a beautiful bronze/green weathered look called "verdigris" (except for the lazy frog which consists of a bronze frog on a verdigris lily pad). Each is supplied fully plumbed and can be operated with our smallest submersible pumps.

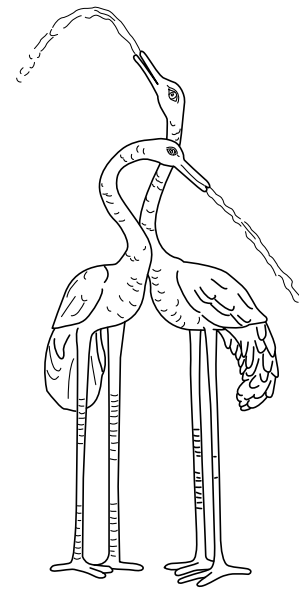
For a realistic appearance, stand the cranes or ducks in shallow water near the pond edge, support the swan and the crouching frog on an inconspicuous base in deeper water, and position the turtles and jumping frog on a rock just outside the pond. For a more whimsical look, mount the lazy frog, hippo head, or swimming fish in deep water. The leaping fish and lazy frog can be used as an alternative to a conventional fountainhead in the center of a small formal pond.



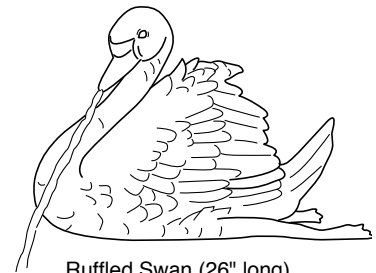
Duck Pair (18" long each)



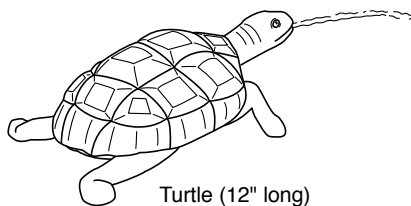
Lazy Frog on Lily Pad (14" long)



Crane Pair (42" tall)



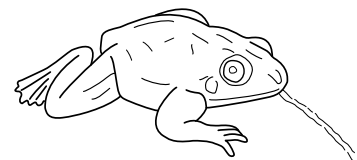
Ruffled Swan (26" long)



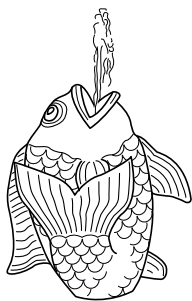
Turtle (12" long)



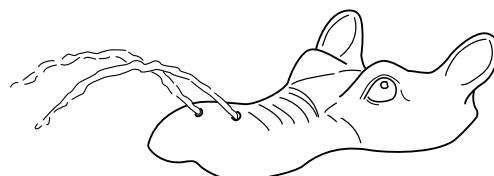
Crouching Frog (14" long)



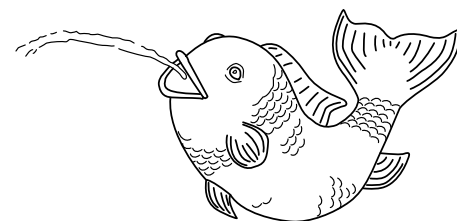
Jumping Frog (12" long)



Leaping Fish (12" tall)



Hippo Head (18" long)

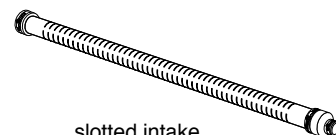


Swimming Fish (14" long)

PRE-FILTERS

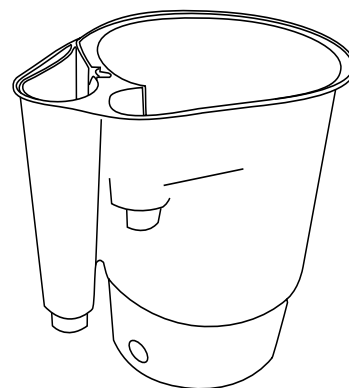
We highly recommend using a pre-filter in every pond to block or remove solid matter, reducing the frequency of pump maintenance and filter cleaning. Pre-filters include slotted pipe intake systems, vortex pre-filters, external skimmers, slotted pump vaults, and slotted drain covers.

SLOTTED PIPE INTAKE SYSTEMS: We offer black PVC slotted pipe intake systems in 2", 3", and 4" diameters. In the simplest configuration, one end is closed with a rubber cap and the other is supplied with appropriate fittings to connect with any size tubing or pipe. Standard pipe lengths are 2 feet and 4 feet, but multiple pipes can be connected to create intake systems of any size and shape (see GRAVEL FILTERS). Slotted intakes can only be used with in-line submersible and external pumps: when external pumps are used a check valve is often connected to the suction end of the slotted intake.



slotted intake

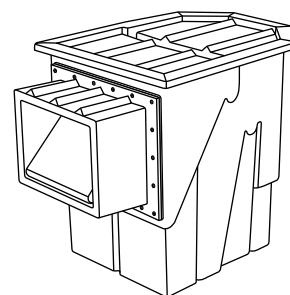
VORTEX PRE-FILTERS: Vortex pre-filters are molded plastic cylindrical tanks designed to separate solids from pond water using centrifugal forces. Since they can handle very high solids loads without clogging, they are ideal for koi ponds. Our vortex pre-filter performs significantly better than traditional designs with tangential inlet pipes because water enters from a side chamber through a tall, narrow slot that forms a thin sheet of water spinning just inside the tank wall. This creates a sharply defined central vortex column that drops solid matter to the conical bottom of the tank. Clear water is drawn out through an outlet near the top of the tank to be conveyed to a pump or filter, and the accumulated solids are occasionally flushed through a 2" drain pipe.



vortex prefilter

Vortex pre-filters are normally installed underground in a pit and are fed by gravity from a bottom drain, but they can also be installed above ground and pump fed to improve the performance of existing above-ground filters. For optimal performance, flow rates should not exceed 3500 GPH. A base and lid are included (32" x 44" x 41" tall).

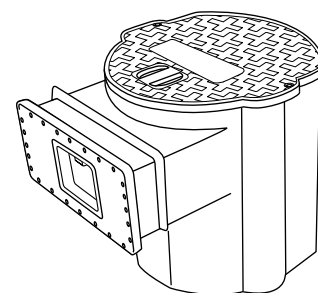
EXTERNAL SKIMMERS: External skimmers are watertight molded plastic enclosures buried in the ground at the pond edge, just above the waterline. Typically submersible pumps are installed within skimmers, but skimmers can also be connected to external pumps. When water flows into the skimmer from the surface of the pond, leaf nets or baskets within the skimmer collect leaves and floating debris before they can reach the pump. Often, filter pads or brushes are used to provide additional straining as well as biological filtration. Installing a pump within a skimmer significantly reduces pump and filter maintenance, and when maintenance is required the pump is easy to access. Skimmers also provide a means to hide submersible pumps and make it easy to connect submersible pumps to external filters or waterfalls because there is no need to run a hose over the pond edge. Water leaving the pump flows through a discharge assembly and into a flexible pipe that passes through the side wall of the skimmer and runs underground to the filter or waterfall.



Elite Professional Skimmer

Our *Elite Professional Skimmers* are made of sturdy polyethylene and feature a projecting weir housing that makes it easy to conceal the skimmer at the pond edge. Features include a large leaf net, a built-in overflow system, and a sturdy lid designed to be covered with gravel and plants. We offer three sizes: the smallest has an 8" weir, making it ideal for pumps from 1200 GPH to 3000 GPH (Elite 8", 23" x 19.5" x 23" tall), the mid-size has a 10" weir and is recommended for pumps from 3000 GPH to 6000 GPH (Elite 10", 25" x 23" x 29" tall), and a 15" weir for pumps from 6000 GPH to 9,000 GPH (Elite 15", 25" x 23" x 29" tall).

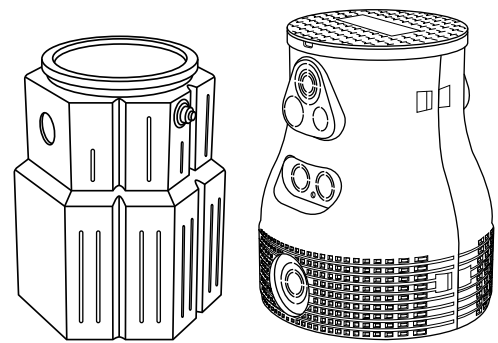
We also offer two *Skimmerfilters* made of injection-molded polyethylene that feature molded plastic leaf basket and provision for internal UV sterilizers. The standard model (25" x 24" x 25" tall) accepts a 6" weir for pumps from 600 GPH to 2000 GPH, an 8.5" weir for pumps from 1200 GPH to 3000 GPH, and a 16" weir for pumps from 3000 GPH to 5000 GPH. The Compact Skimmerfilter (18" x 23" x 20" tall) accepts a 6" weir for pumps from 600 GPH to 2000 GPH and an 8.5" weir for pumps from 1200 GPH to 3000 GPH.



Skimmerfilter

We can supply a discharge assembly for any Elite Professional Skimmer or Skimmerfilter. A discharge assembly include all necessary fittings and check valves to connect the selected pump to the selected hose or pipe, and provides an easy means to disconnect skimmer pumps for maintenance and winterization. Other popular accessories include automatic water fill valves and automatic shutoff switches.

SLOTTED VAULTS: A slotted vault is a molded plastic enclosure designed to be installed within a pond, typically buried in gravel (see A PONDLESS WATERCOURSE). Typically submersible pumps are installed within slotted vaults, but suction lines from external pumps can also be connected to a port in a slotted vault. In contrast with skimmers that only draw from the water surface, slotted vaults draw water from the middle and lower sections of a pond through their slots. This turns the surrounding gravel bed into a giant gravel filter, providing mechanical and biological filtration. It also makes submersible pumps easily accessible. Discharge lines run through the sidewall of the vault, through the gravel bed and to external filters or waterfalls, completely hidden from view. Autofill valves are frequently installed in slotted vaults since the water level in a pondless watercourse is invisible.



Pump Canyon

Waterfall Well

We offer four slotted vaults. The *Waterfall Well* is supplied in two halves that interlock to form a sturdy enclosure (21" x 21" x 24" high) and is recommended for pumps up to 5000 GPH. An optional extension (18" high) is available for deep burial with pumps up to 10,000 GPH. The *Pump Canyon* is supplied as a single unit in three different sizes: the smallest is recommended for pumps up to 2500 GPH (14" x 12" x 17" high), the mid-size is recommended for pumps up to 5000 GPH (17" x 16" x 21" high), and the large size for pumps up to 10000 GPH (27" x 24" x 30" high).

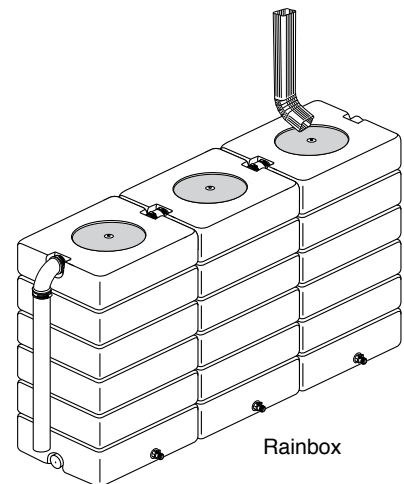
AUTOFILL SYSTEMS

RAINBOX: The Rainbox is a modular rainwater collection system that can provide clean, chlorine-free water to keep ponds filled. Water from a downspout is diverted onto the top of a module where it is filtered and stored. Low-pressure autofill valves in skimmers and pump vaults can be connected to a 3/4" threaded fitting at the base of the module. Each module holds 75 gallons of water; for greater storage multiple modules can be interconnected by attaching flexible couplings to the built-in top and bottom ports. The compact rectangular design occupies minimum space (20" x 24 x 42") and is both child safe and mosquito proof. For long life, it is made of thick UV-resistant black polyethylene much thicker than that used on typical garden "rainbarrels".

AUTOFILL VALVES: We supply reliable plastic autofill valves suitable for use in any skimmer or pump vault. They are designed to work with any water pressure, even the very low pressures typical of gravity-fed rainwater systems



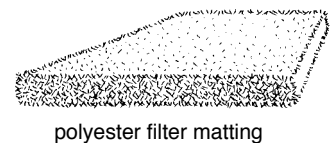
autofill valve



Rainbox

FILTER MEDIA

POLYESTER FILTER MATTING: This is the same green filter matting used in our skimmers and waterfall filters. It is dense enough to provide effective mechanical filtration of floating solids, but not so dense as to restrict water flow. It makes an ideal pre-filter for biological filter media such as our ceramic rock, and can be used to replace deteriorated foam pads. Standard rolls are 2' x 20' x 2" and 3' x 15' x 2", but we will cut 2' or 3' increments in length, respectively.



polyester filter matting

CERAMIC FILTER ROCK: Ceramic filter rock is a lightweight, durable, porous ceramic media that is ideal for biological filtration. It has many times the surface area of an equivalent volume of gravel or plastic media and is much more resistant to clogging than lava rock. Use it to fill the nylon mesh bags furnished with our waterfall filters (also sold separately), to enhance the performance of bog filters, and to replace the inferior plastic media supplied with many inexpensive pond filters. A twenty-five pound bag of ceramic rock has a volume of approximately one-half cubic foot and fills one nylon bag.



ceramic rock in nylon-mesh bag

PLASTIC RIBBON MEDIA: This plastic ribbon media resembles plastic pallet strapping, but is made from a special blend of polypropylene and calcium carbonate that encourages rapid bacterial growth. It resists clogging and channeling, and is easy to clean. The surface is embossed to provide maximum surface area, approximately 180 square feet per roll. It is sold in self-dispensing rolls - simply position the roll above a filter and start unwinding from the center.



plastic ribbon media

WATERFALL FILTERS AND WEIRS

Waterfall filters and weirs simplify the process of building waterfalls by creating a wide sheet of water flowing across a level plastic surface. Spray foam is used to bed one or more wide flat rocks over the surface, concealing the plastic and forcing the water to flow over the rocks to start the waterfall.

WATERFALL FILTERS: A waterfall filter is a molded plastic tank filled with filter media that serves both as a pond filter and as the headwaters for a waterfall. This tank is normally dug into a hillside above the pond and carefully concealed with rocks and plants so that it becomes invisible. If the site has no hills, it can be set onto flat ground and soil from the pond excavation can be used to create a hillside around it. Although vortex filters, pressure filters, and gravel filters are preferable for koi ponds, waterfall filters offer inexpensive and low-maintenance filtration for typical landscape water features with low biological loads.

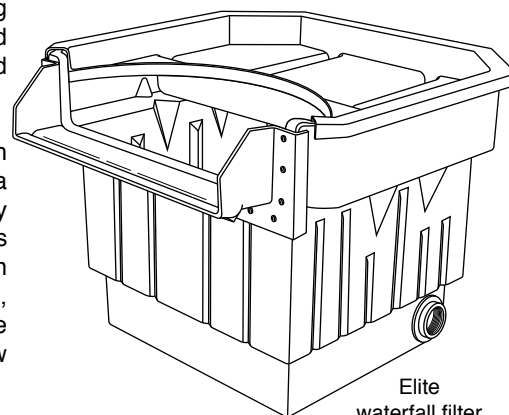
Elite Waterfall Filters are made of thick rotational-molded black polyethylene and use a detachable lip that makes it easy to attach rubber liners to the tank. Water is pumped into a settling chamber at the bottom of the filter through one of the two fittings provided; the other can be used for backwashing. From there it flows upward through two layers of thick plastic filter matting (*Matala*) and through several inches of filter rock until it reaches the lip at the top of the filter and spills out to begin the waterfall. We offer four sizes: small (14" spillway, 2500 GPH maximum, 25" x 19" x 23" tall), standard (22" spillway, 5000 GPH maximum, 31" x 26" x 23" tall), large (30" spillway, 7500 GPH maximum, 41" x 26" x 27" tall), and extra-large (40" spillway, 10,000 GPH maximum, 48" x 33" x 31"). The nylon mesh filter bag supplied with the filters can be filled with our super-efficient ceramic filter rock, with locally available lava rock, or with plastic bioballs. These filters are supplied with a unique lid designed to be filled with rocks, soil, and plants for concealment while allowing access to the filter media without the need to remove the lid.

Livingponds Waterfall Filters are made of injection molded black polyethylene and also use a detachable lip for easy liner attachment. Water is pumped into a chamber at the top of the back of the filter from where it flows down to a settling chamber at the front of the filter and upward through a ribbon filter media (*Springflow*) and a layer of polyester matting until it reaches the lip at the top of the filter and spills out to begin the waterfall. A backwash fitting is provided at the bottom.

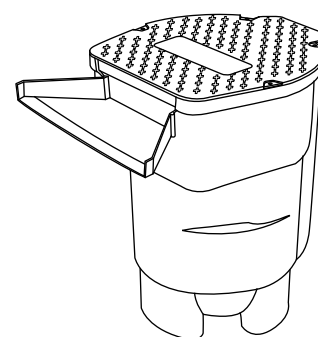
WATERFALL WEIRS: Waterfall weirs differ from waterfall filters in that their primary purpose is to serve as the headwaters for a waterfall while providing little or no filtration. They may be dug into a hillside above the pond or installed within the pond: in either case they are carefully concealed with rocks and plants so they become invisible.

Cascading Falls are truncated versions of the Elite Waterfall Filters and feature the same sturdy construction and plastic filter matting. They are also supplied with a similar lid designed to be filled with rocks, soil, and plants for concealment while allowing access to the filter media within. We offer five sizes: mini (10" spillway, 1500 GPH maximum, 10"x8"x8" tall), small (14" spillway, 2500 GPH maximum, 24" x 15" x 15" tall), standard (22" spillway, 5000 GPH maximum, 34" x 16" x 14" tall), large (30" spillway, 7500 GPH maximum, 41" x 16" x 16" tall), and extra-large (40" spillway, 10,000 GPH maximum, 52"x16"x16"). All except the mini size have 2" threaded ports at either end.

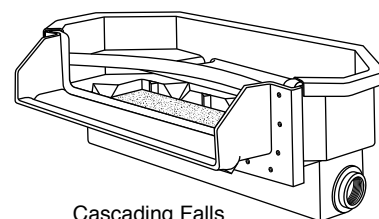
Filter Weirs are made of injection molded black polyethylene and use a clamping plate for liner attachment. In spite of their name, they have very little filter media capacity. However, they are well made and provide an inexpensive means to start a waterfall. We offer two sizes: one with a 16" spillway (2500 GPH maximum, 18" x 10" x 11" tall) and one with a 31" spillway (7500 GPH maximum, 33" x 12" x 10" tall).



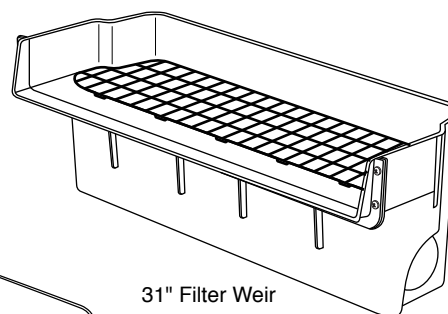
Elite waterfall filter



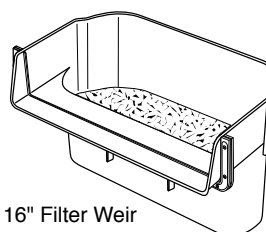
Livingponds waterfall filter



Cascading Falls



31" Filter Weir



16" Filter Weir

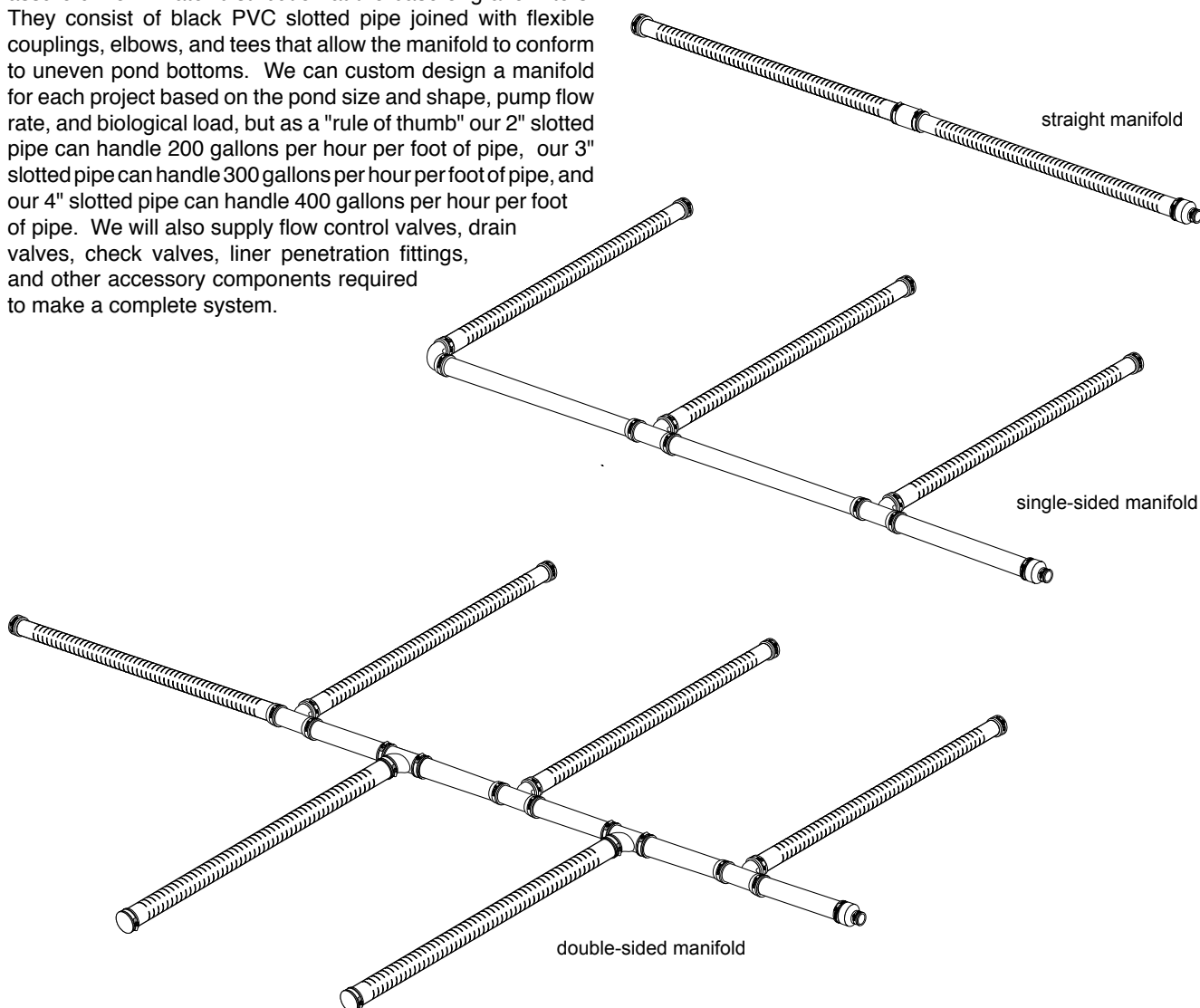
GRAVEL FILTERS

Gravel filters are built on site using rubber liners, protection fabrics, slotted pipe assemblies, plants, and lots of gravel. They have no pre-defined shape and become part of the pond landscape. There are two basic designs designated by the direction of water movement: downflow and upflow.

TYPES OF GRAVEL FILTERS: Downflow gravel filters are used on the suction side of a pump and are usually built at the bottom of the primary pond (see A LILY POND for an example). A protection fabric is laid over the pond liner, a slotted pipe manifold is installed over the fabric, and the manifold is covered with a layer of pea gravel at least twice as thick as the pipe diameter. Wash all of the pea gravel repeatedly before installation to remove all traces of sand, and screen particles larger than 3/8" from a portion of the gravel to be placed immediately adjacent to the slotted pipe.

Upflow gravel filters are used on the pressure side of a pump and are usually built at the bottom of the uppermost pond in a multi-pond system, or in a separate marsh or bog pond (see A LILY POND and MARSH POND for examples). Like downflow gravel filters, a protection fabric is laid over the pond liner and a slotted pipe manifold is installed over the fabric. If the primary purpose of the upflow filter is to invisibly distribute water to form a header pool, the manifold is covered with a layer of pea gravel at least twice as thick as the pipe diameter. If the primary purpose of the upflow filter is to provide mechanical and biological filtration, the manifold is covered with a layer of 3/4" to 1-1/2" gravel at least twice as thick as the pipe diameter, and the large gravel is covered with 6" to 12" of pea gravel which is planted with water iris, cattails, and rushes, and other vegetation that thrives in saturated soil. In either case, wash all of the gravel repeatedly before installation to remove all traces of sand.

SLOTTED PIPE MANIFOLDS: Our slotted pipe manifolds assure uniform water distribution at the base of gravel filters. They consist of black PVC slotted pipe joined with flexible couplings, elbows, and tees that allow the manifold to conform to uneven pond bottoms. We can custom design a manifold for each project based on the pond size and shape, pump flow rate, and biological load, but as a "rule of thumb" our 2" slotted pipe can handle 200 gallons per hour per foot of pipe, our 3" slotted pipe can handle 300 gallons per hour per foot of pipe, and our 4" slotted pipe can handle 400 gallons per hour per foot of pipe. We will also supply flow control valves, drain valves, check valves, liner penetration fittings, and other accessory components required to make a complete system.



PRESSURE FILTERS

Pressure filters are sealed plastic tanks containing a filter media that provides mechanical filtration and supports bacterial colonies that provide biological filtration. They are built using the same tanks and control valves used for swimming pool filters, but have been completely re-engineered internally. Originally developed for the commercial aquaculture industry, this type of filter is ideal for koi ponds or any ponds with a significant fish population. We offer two versions with proven reliability. One uses a hollow plastic media that is very resistant to clogging but requires considerable water for backwashing; the other uses solid plastic media that clogs easier but includes an air blower that provides very effective backwashing with a minimum of water.

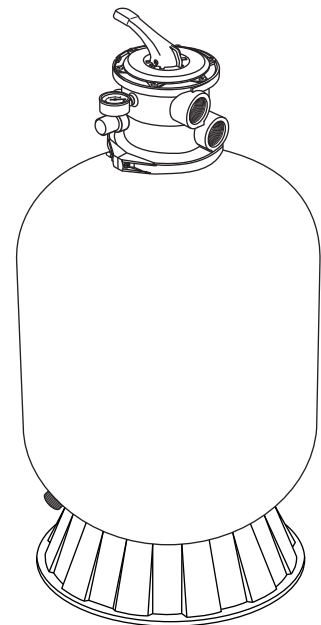
DESIGNING FOR PRESSURE FILTERS: Since pressure filters do not rely on gravity flow on either the inlet or outlet side, they have few design limitations. When used with submersible pumps, water can be pumped over the pond edge or through the side of the pond to the filter. The filter can be located either above or below the water surface and can be a considerable distance away. With external pumps, water can be drawn over the pond edge, through the side of the pond, or through the bottom of the pond. When water is drawn over the pond edge, the pump must be located above the water surface and the suction line cannot dip before reaching the pump inlet. When water is drawn through the side of the pond or through the bottom of the pond the filter can be located either above or below the water surface and dips in the line are only a problem when they occur above the water surface. The distance between the pond and the pump should be kept as small as possible, but long suction lines are possible with proper pipe sizing.

When filled with water, pressure filters are very heavy and require a strong, level base. When pressure filters are installed in pits, outbuildings, and other confined spaces, the clear ceiling height of the space must be at least twice the height of the tank so the control valve and internal plumbing can be removed. We provide unions for each of the pipe connections to facilitate disassembly of the tank for annual cleaning. During the backwash and rinse cycles, waste will flow through the backwash port which needs to be plumbed to an ornamental plant garden or other suitable site.

Effective pre-filtration will significantly reduce maintenance requirements for pressure filters. The ideal technique for heavy solids loads is to use an external pump to draw from a vortex prefilter that is gravity fed from a bottom drain (see A KOI POND), but this is the most difficult to install. More typically, the external pump draws through a slotted pipe intake assembly.

HOLLOW MEDIA PRESSURE FILTERS: Hollow media pressure filters contain millions of small ribbed plastic tubes that float in the upper half of the tank. Water enters and exits the filter through a sophisticated yet easy-to-use multi-port valve with filter, backwash, and rinse settings. With the valve set to filter, the water flows out of slots at the bottom of the tank, passes through the floating plastic media where it is mechanically strained and biologically filtered, and flows out through slots at the top. During backwash, internal jets generate a cyclonic action that blasts the media apart, then lifts and spins it, separating the waste and flushing it away.

We offer eight hollow-media pressure filters for ponds up to 60,000 gallons; for larger ponds, several filters can be ganged together. The following chart shows specifications for each.



typical
pressure filter

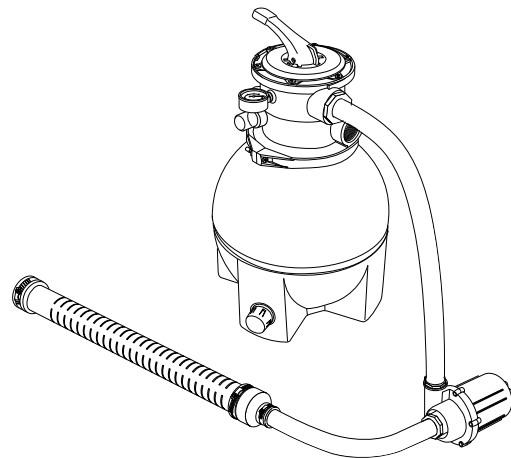
HOLLOW MEDIA PRESSURE FILTER SPECIFICATIONS								
Model	Pond	Fish	Flow	Ports	Pump	Waste	Media	Size
1000	1000 gal	100 lbs	1000 gph	1.5"	EP12	50 gal	5 lbs	15"d x 27"h
2000	2000 gal	200 lbs	2000 gph	1.5"	EP12	100 gal	10 lbs	17"d x 36"h
4000	4000 gal	400 lbs	4000 gph	1.5"	EP25	150 gal	24 lbs	21"d x 41"h
6000	6000 gal	650 lbs	6000 gph	2"	EP33	200 gal	36 lbs	22"d x 44"h
10000	10000 gal	1300 lbs	7500 gph	2"	EP50	300 gal	48 lbs	25"d x 46"h
20000	20000 gal	2000 lbs	7500 gph	2"	EP75	450 gal	84 lbs	31"d x 50"h
30000	30000 gal	3000 lbs	7500 gph	2"	EP100	600 gal	120 lbs	40"d x 49"h
30000	30000 gal	3000 lbs	15000 gph	3"	EP150	600 gal	60 lbs	40"d x 49"h
60000	60000 gal	6000 lbs	15000 gph	3"	EP150	750 gal	100 lbs	54"d x 46"h

Routine maintenance takes about fifteen minutes each week. First, the pump is turned off and the control valve is rotated to the backwash position. Next, the pump is run for thirty to sixty seconds to carry the accumulated organic matter flows through the waste outlet for disposal. When the sight glass is clear, the pump is turned off, the control valve is rotated to the rinse position, and the pump is run again for a few seconds until the sight glass is again clear. This backwash/rinse sequence is repeated three times. Finally, the valve is returned to the filter position and normal operation resumes.

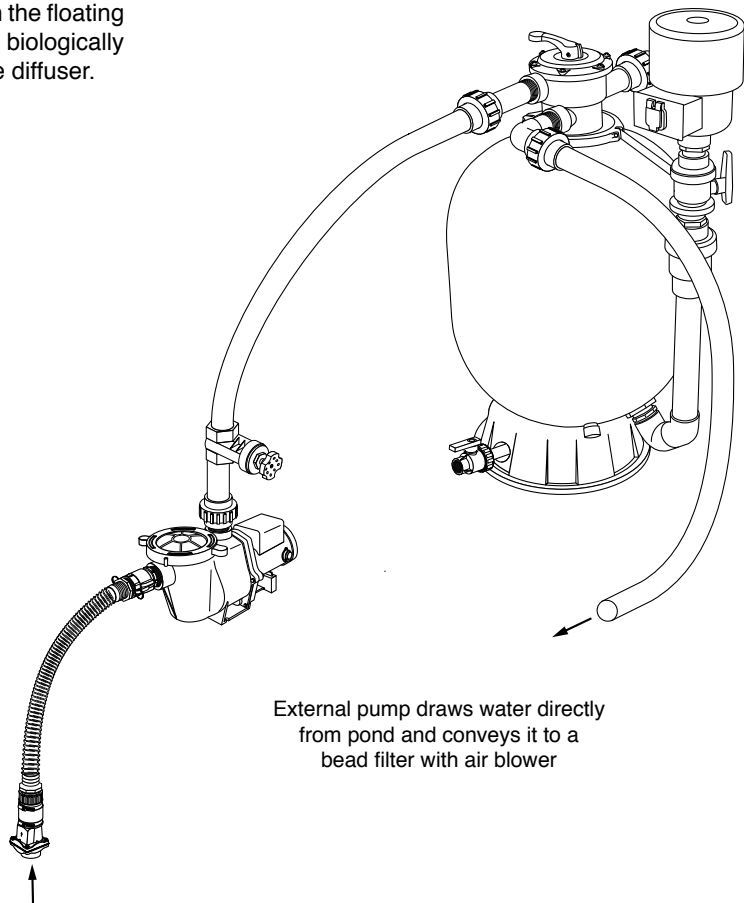
SOLID MEDIA PRESSURE FILTERS: Solid media pressure filters, often called *bead filters*, contain millions of 1/8" diameter solid plastic spheres that float in the upper half of the tank. Water enters and exits the filter through a sophisticated yet easy-to-use multi-port valve with filter, backwash, and rinse settings. In the bead filter we offer, the water then passes through the patented low-friction central diffuser column that virtually eliminates the frequent clogging associated with other bead systems on the market. With the valve set to filter, the water flows out of slots at the bottom of the diffuser column, passes through the floating plastic media where it is mechanically strained and biologically filtered, and flows out through slots at the top of the diffuser.

Routine maintenance takes about fifteen minutes, once each week. First, the pump is turned off, the control valve is rotated to the rinse position, and the air blower is operated for a few minutes to break up the beads and dislodge organic matter. Next, the control valve is rotated to the backwash position and the pump is turned on to carry accumulated organic matter through the waste line for disposal. When the sight glass is clear, the pump is turned off, the control valve is rotated to the rinse position, and the pump is turned on again. After the sight glass is again clear, the valve is returned to the filter position and the sludge valve is opened for a few seconds to purge sludge that accumulates at the bottom of the tank.

We offer four solid-media pressure filters for ponds up to 28,000 gallons; for larger ponds, several filters can be ganged together. The following chart shows specifications for each filter. All are supplied with air blowers to permit backwashing with low-pressure energy-efficient pumps: note the dramatically lower waste water volume when compared with hollow media filters without air blowers.



submersible pump draws water through slotted pipe and conveys it to a hollow media pressure filter



External pump draws water directly from pond and conveys it to a bead filter with air blower

SOLID MEDIA PRESSURE FILTER SPECIFICATIONS

Model	Pond	Fish	Filtration	Backwash	Pump	Waste	Beads	Size
1.1B	3500 gal	65 lbs	3000 gph	2000 gph	EP12	30 gal	40 lbs	18"d x 38"h
2.2B	7500 gal	150 lbs	4000 gph	2500 gph	EP25	50 gal	80 lbs	24"d x 46"h
4.4C	14000 gal	300 lbs	6000 gph	4000 gph	EP33	60 gal	160 lbs	30"d x 46"h
8.8C	28000 gal	480 lbs	6000 gph	4000 gph	EP33	80 gal	320 lbs	36"d x 48"h

VORTEX FILTERS

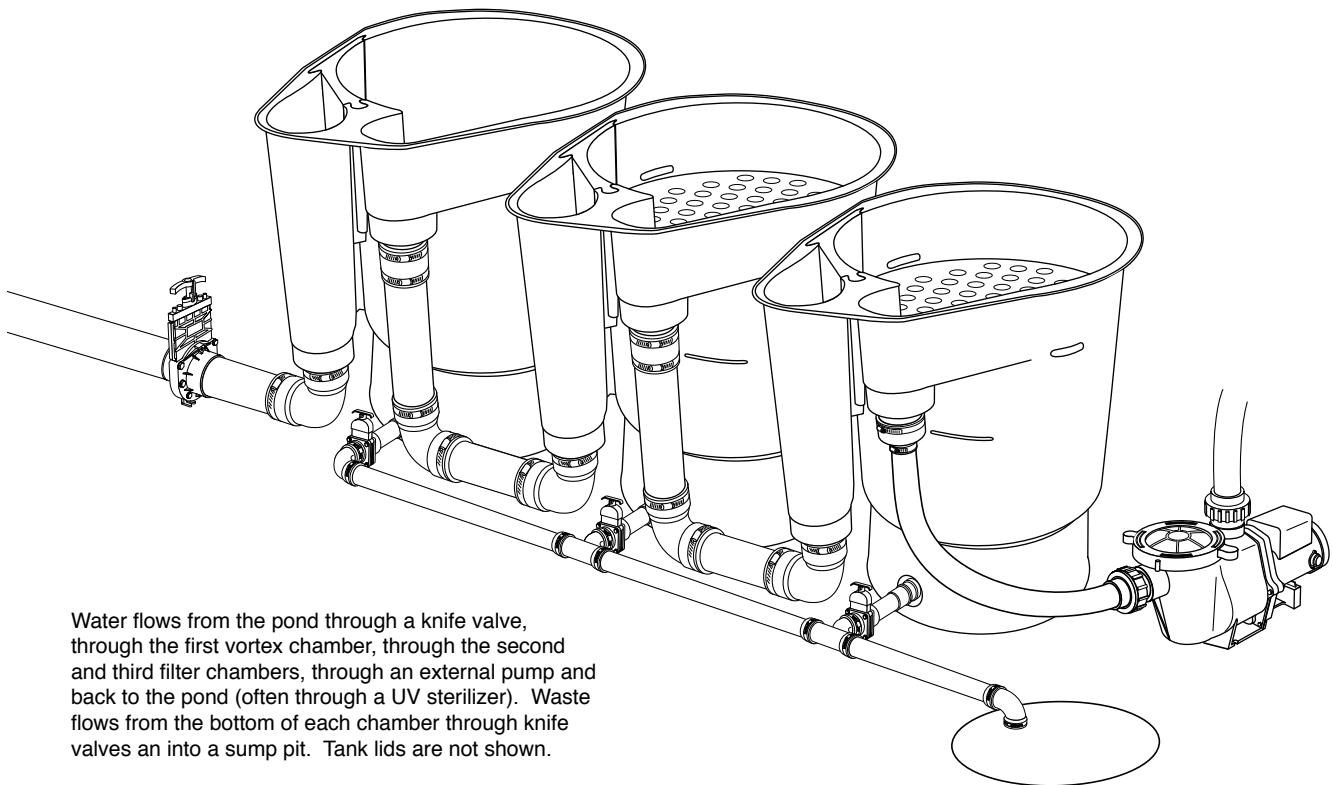
Vortex filters offer reliable, ultra-low-maintenance filtration for ponds where significant amounts of organic matter accumulate on the bottom, such as koi ponds. Fish waste, uneaten food, leaves, and other bottom debris flow into a bottom drain, through a large-diameter pipe, and into the first chamber of the filter where a rotating vortex causes them to settle. The water then flows into a second chamber where it spins around and drops more solid matter before flowing up through biological filter media. Depending on the pond size, the same process may be repeated in a third or fourth filter chamber. An external pump draws filtered water from the final chamber and pumps it back to the pond, preferably through a UV sterilizer.

PondTechnology vortex filters are by far the most efficient vortex filter systems available today. Unlike other vortex systems, pond water enters each chamber through an intake manifold with a vertical slot that creates a thin film of water near the exterior wall of the tank, greatly enhancing solids separation. The filter media is a superior-quality, thick, reticulated-foam pad designed for optimum biological surface area with minimal resistance to water flow.

INSTALLATION: Since the four-inch inlet pipe offers very little resistance to water flow, vortex filters can be situated a considerable distance from the pond. The top of the filter chambers must be positioned just above the water level of the pond, so vortex filters are usually installed in pits made of concrete, concrete block, or treated lumber. Pit installation also protects the chambers from freezing weather. Since vortex tanks are quite heavy when filled, the bottom of the pit should be concrete or paver blocks set on very well-compacted gravel. The pit must be large enough to accommodate the filter chambers (each measures 32" x 44" x 41" high), an ultraviolet sterilizer, all necessary plumbing, and a plastic sump pit if required. Although all of our filters are supplied with lids, plumbing fittings, pipes, and valves must be ordered separately.

MAINTENANCE: Each chamber has a conical lower section with a 2" drain fitting. The drains are connected through knife valves to a pipe running into a sump well that is automatically evacuated by a sump pump. If the land slopes away from the pond, it may be possible to drain to daylight instead. The valve on each drain line should be opened briefly every week to flush accumulated solids. Every two months, debris on the filters pads should be dislodged and the pads should be flipped over.

SIZING: A vortex chamber can be used as a prefilter for bead filters, bog filters, or any other filter system. A vortex chamber with a single filter chamber will provide both prefiltration and filtration for moderately stocked koi ponds up to 5000 gallons. A vortex chamber with two filter chambers will provide both prefiltration and filtration for moderately stocked koi ponds up to 8000 gallons. In all cases, water flow rates should not exceed 3500 GPH through any chamber. If greater circulation rates are desired, additional water can be drawn from a skimmer directly into the pump, or water can flow through two parallel filter systems, each fed from a separate bottom drain.



UV STERILIZERS

Our UV sterilizers consist of a long-life ultraviolet (UV) lamp inside a quartz glass sleeve that is suspended in the center of a black plastic pipe. When pond water is pumped through the space between the quartz sleeve and the plastic pipe, the intense ultraviolet radiation emitted by the lamp effectively kills floating microorganisms, such as bacteria, viruses, molds, and algae, by breaking down their DNA molecules. The process is environmentally safe and does not leave any residue in the water.

We recommend routine use of UV sterilizers in ponds with substantial fish populations as a means to control algae growth and reduce the spread of fish diseases. They are also effective for eliminating green water in any pond where other methods have proven unsuccessful. UV sterilizers can be used as the only means of water treatment in ponds with minimal organic matter and no fish, such as formal ponds with fountains, but when fish are present they should always be used in conjunction with mechanical and biological filtration to remove suspended organic matter or toxic dissolved organic compounds. UV sterilizers have no effect on string algae and other aquatic life that remain in the pond and do not pass by the UV lamp.

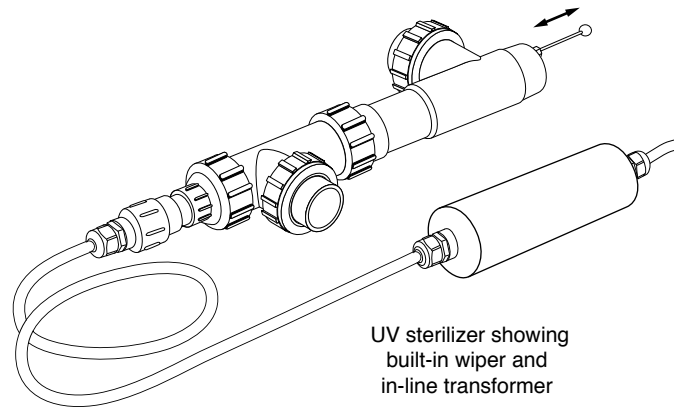
SELECTING A UV STERILIZER: Our UV's use superior-quality, ultra-compact, high-output lamps. This allows both the enclosure and the quartz sleeve to be very short which reduces the likelihood of glass breakage and permits easy installation in tight spaces. A built-in wiper permits rapid cleaning of the exterior of the quartz tube without the need to open the unit, further reducing the risk of glass breakage. The inlet and outlet can be rotated to any angle, and both included built-in 2" unions. We can supply reducing fittings as needed to fit any size pipe or hose.

Performance of single and paired UV sterilizers with light, normal, and heavy fish stocking levels can be found in the chart below. For optimal results, the total UV lamp wattage must be properly matched to the pond size, and the water must not pass through the UV sterilizer faster than the maximum flow rate. We stock three UV sterilizers with lamp wattages of 15 watts, 25 watts, and 57 watts. When two 57 watt sterilizers are ganged together, the maximum

flow rate and pond capacity are doubled; when four 57 watt sterilizers are ganged together, the maximum flow rate and pond capacity are quadrupled. Higher-wattage UV's are available for ponds of any size and pumps of any flow rate.

INSTALLATION: It is best to install the UV sterilizer between the filter and the pond so that water passes through the UV after it has passed through the filter and most of the organic matter has been removed. In this case, the UV must be positioned so that it is always completely filled with water. With gravity return filters such as waterfall filters and gravel filters, the UV sterilizer must be installed between the pump and filter, in which case it will always be filled. Whenever possible, all of the water that flows through the pond pump and filter should pass through the UV. However, if the UV wattage is sufficient for the pond volume but the desired pump flow rate exceeds the maximum flow rate for the UV, some of the water can be diverted around the UV using a three-way valve assembly.

MAINTENANCE: Every few weeks, operate the wiper mechanism several times to clean the surface of the quartz sleeve, and verify that the bulb is functioning from the glow through the clear end cap. A UV lamp can last for many years, but the UV radiation it emits drops significantly as it ages. In cold climates where the pond is only operated from spring to fall, the bulb should be replaced every two years; in warmer climates where the pond is operated year-round, it should be replaced each year. The quartz sleeve can last for many years if it is handled carefully, and the UV housing has a lifetime warranty. At the end of each season, remove the UV by separating the unions, clean it thoroughly, and store it where it won't freeze.



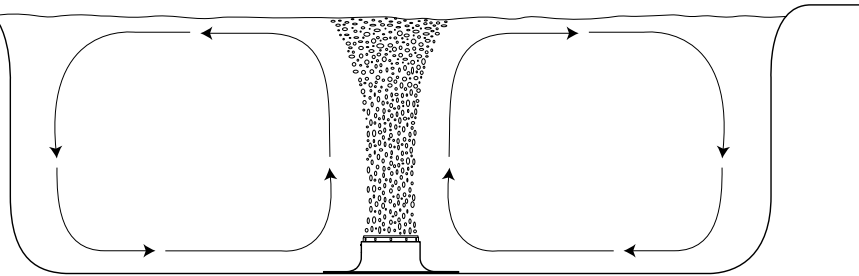
UV sterilizer showing built-in wiper and in-line transformer

UV STERILIZER SPECIFICATIONS						
Type of UV	Maximum Flow	Light Stocking	Normal Stocking	Heavy Stocking	Length	Fittings
15 watt	700 GPH	1000 gal	500 gal	200 gal	23"	2" socket
25 watt	1200 GPH	2500 gal	1200 gal	600 gal	26"	2" socket
57 watt	3200 GPH	5000 gal	2500 gal	1200 gal	26"	2" socket
2 x 57 watt	6400 GPH	10000 gal	5000 gal	2500 gal	26"	2" socket
4 x 57 watt	12800 GPH	20000 gal	10000 gal	5000 gal	26"	2" socket

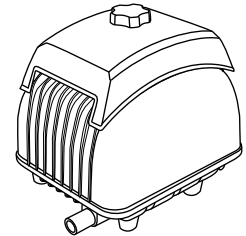
AERATION SYSTEMS

Compressed-air aeration offers a simple and inexpensive way to dramatically improve water quality in larger ponds. A compressor outside the pond pumps air through small diameter hoses to a weighted diffuser located at the bottom of the pond. The diffuser generates millions of air bubbles each minute; as these bubbles float to surface, they carry water with them. When this water reaches the surface it spreads outward, allowing dissolved gases in the water to escape into the atmosphere and oxygen in the atmosphere to diffuse into the water. Since this aerated water came from the bottom of the pond, it is colder than the surface water and gradually descends to the bottom of the pond where it drifts towards the diffuser and completes the circulation loop. Larger ponds may require multiple compressors and diffusers, depending on depth and shape. This process can move millions of gallons of water daily using only a tiny fraction of the energy that would be required to pump the same volume.

Rising air bubbles carry water to the surface. This water spreads outward, exchanges gases with the atmosphere, and then sinks to the bottom, closing the loop.

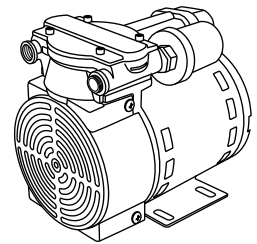


LINEAR COMPRESSORS: *PondTechnology* linear compressors are extraordinarily quiet and energy-efficient, so they are the compressor of choice for shallow ponds. We offer two models: PA04 (1.7 cfm and 35 watts at 4 ft depth) is normally used with a single diffuser when ponds are 3 ft to 6 ft deep and two diffusers when ponds are less than 3 ft deep; PA08 (3.2 cfm and 80 watts at 4 ft depth) is normally used with two diffusers when ponds are 3 ft to 6 ft deep and four diffusers when ponds are less than 3 ft deep. Both compressors are enclosed in water-resistant cast aluminum enclosures suitable for exterior use provided they are mounted above the high water level of the pond in a location that can never flood.



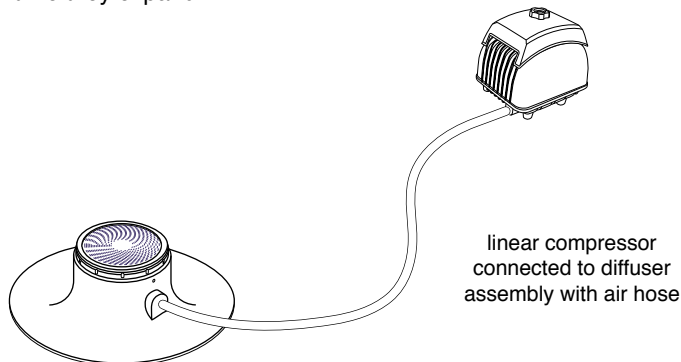
linear compressor

ROCKING-PISTON COMPRESSORS: *PondTechnology* rocking piston compressors are recommended for ponds too deep for our linear compressors because they are efficient, reliable, and quieter than most other high-pressure compressors. Our rocking piston compressor PA20 (1.8 cfm and 240 watts at 20 ft depth) can operate a diffuser at depths up to one hundred feet with thousands of feet of hose! This type of compressor cannot be exposed to the elements and requires some sound shielding, so it should be installed in a garage, shed, or other out-building at a height above the high water level of the pond.

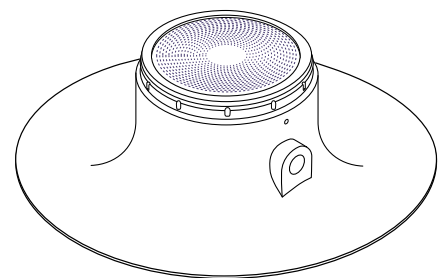


rocking-piston compressor

WEIGHTED DIFFUSER ASSEMBLIES: Our weighted diffuser assembly consists of a disc diffuser mounted on a 2 ft diameter black plastic base. The base is hydrodynamically designed to minimize turbulence and reduce bottom scouring, and it contains an internal cavity that is filled with ballast to prevent floating. The air hose from the compressor passes through a side port and connects to a hose fitting attached to the underside of the disc diffuser. The diffuser contains a 9" diameter black EPDM rubber disc with thousands of tiny slits that form a series of concentric circles: when compressed air enters the cavity behind this rubber disc, the disc expands to form a dome, the slits expand, and air escapes as tiny bubbles. Disc diffusers are more reliable and require less maintenance than diffusers using porous ceramics or plastics because rubber discs last for many years and clean themselves each time they expand.

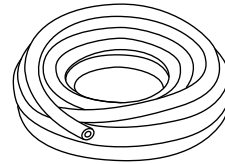


linear compressor
connected to diffuser
assembly with air hose



weighted diffuser assembly

SELF-SINKING AIR HOSE: When ordinary hose is used to deliver air from a compressor to a diffuser, it floats to the water surface. One solution is to tie bricks onto aeration hose, but the hose still floats in between the bricks, and the bricks eventually deteriorate. A better solution is to use our self-sinking air hose, a heavy wall black tubing made from a very dense PVC compound. This tubing stays neatly on the pond bottom without the need for ballast, and is extraordinarily tough and abuse resistant. We normally supply 5/8" ID since the large cross-section assures there will be virtually no pressure loss even with more than one thousand feet of hose. We stock 25 ft, 50 ft, and 100 ft lengths; for longer runs, 100 ft lengths can be joined with our barbed couplings and heavy-duty stainless-steel hose clamps.



self-sinking air hose



actual size hose cross-section

DESIGNING AN AERATION SYSTEM: The adjacent chart can be used to determine the zone of aeration for each diffuser based on depth. To design an aeration system, simply layout on a drawing of the pond or lake a series of circles with a diameter corresponding to the water depth at the center of each circle. Note that deep ponds require fewer diffusers than shallow ponds because each diffuser creates a larger circulating loop. As a consequence, a single diffuser may suffice for a deep one-acre farm pond whereas multiple diffusers may be required for a shallow backyard pond!

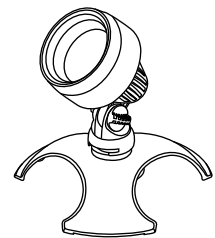
When multiple diffusers are operated by the same air pump, they must be installed at the same depth to assure equal air distribution. We will supply a valve manifold for final balancing.

ZONE OF AERATION AT VARYING DIFFUSER DEPTHS			
Depth	Diameter	Area	Acres
2 ft	25 ft	500 sq ft	1/80 ac
4 ft	50 ft	2,000 sq ft	1/20 ac
6 ft	75 ft	5,000 sq ft	1/8 ac
8 ft	100 ft	10,000 sq ft	1/4 ac
12 ft	150 ft	20,000 sq ft	1/2 ac
16 ft	200 ft	40,000 sq ft	1 ac
20 ft	250 ft	60,000 sq ft	1-1/2 ac
24 ft	300 ft	80,000 sq ft	2 ac

UNDERWATER LIGHTING

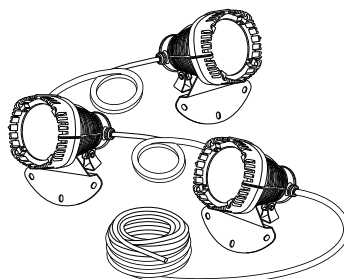
Underwater lighting makes it possible to enjoy water gardens as much at night as during the day. For general-purpose illumination of waterfalls and fountains in backyard garden ponds, low-voltage lights are the best choice since they are economical to operate, safe to install, and easy to conceal. For floating fountains and very large waterfalls, line-voltage lights are essential to obtain adequate illumination.

LOW-VOLTAGE LIGHTS: We offer a superior-quality, ultra-compact, low voltage (12 vac), 20 watt, halogen lights that can be adjusted from a spotlight (20° beam) to a floodlight (40° beam). For a dramatic effect, aim lights at a waterfall, or mount them on the base of an Oase pump and fountain assembly to light the water display from below. Note that unlike other underwater lights, these lights can also be used out of the water for general landscape lighting: included plastic stakes facilitate in-ground installation. Each light is supplied with 15-foot power cord that must be connected to a weatherproof transformer mounted on a post or building wall near the pond. We recommend our 60 watt transformer (one to three lights) or our 200 watt transformer (four to ten lights) which include a ground shield for safety and a built-in timer for energy efficiency.

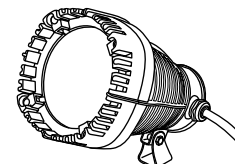


low-voltage light

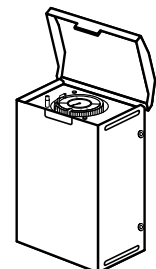
LINE-VOLTAGE LIGHTS: Our heavy-duty 120 watt line-voltage spotlight (9° beam) is ideal where higher light levels are needed. We stock individual lights with a 15-foot power cord, as well as sets of three lights at the end of a 75, 100, or 150 foot power cord designed to be mounted on floating fountains. On special order we can supply custom-daisy chained configurations with lights up to 500 watts connected by any length of power cords. Line-voltage lights must be used underwater.



3 light set for fountains



line-voltage light



transformer

SOLVING ALGAE PROBLEMS

Although algae are an essential part of the natural ecosystem in any healthy pond, uncontrolled algae growth can produce green water, low oxygen levels, and unpleasant odors. We suggest the following measures to keep algae from proliferating:

LIMIT THE FISH POPULATION: Fish waste is a rich source of rapid-release plant nutrients which makes it an ideal food supply for algae. The single best way to avoid algae problems is to keep the fish population as low as possible—we recommend no more than one inch of fish for every square foot of pond surface. As fish grow and reproduce, give some away to new pond owners, but never release them into the wild since they can disrupt natural ecosystems. Consider adding a predator fish as a means of population control.



limit fish



add plants

ADD PLANTS: Plants shade the water and extract nutrients from the water, depriving algae of the sunlight and food they need to flourish. Consequently, the best plants for algae control are those with extensive leaf structures such as water lilies, or those that have a voracious appetite for nutrients such as water hyacinths or anacharis. Rapid-growing plants should be pruned or harvested frequently and added to the compost pile.



add bacteria

KEEP THE POND CLEAN: While plants are beneficial, their dead leaves can become a major nutrient source for algae. Trim brown leaves from aquatic plants, use a fish net to collect leaves that fall to the bottom, and cover the pond with a leaf net in the Autumn before surrounding trees lose their leaves. If organic matter accumulates, it may be necessary to empty and clean the pond in the early Spring, but never during other seasons since cleaning removes the beneficial microorganisms essential to maintaining clean water and disrupts the operation of biological filters.

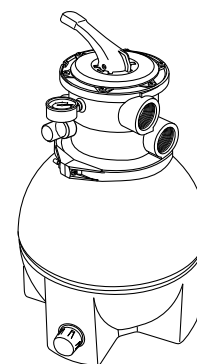
ADD BACTERIA: By supplementing the natural bacterial population with large infusions of liquid or dry bacteria, it's often possible to solve algae problems and simultaneously eliminate excess organic matter that collects at the pond bottom and can serve as a continuing nutrient source. The introduced bacteria grow rapidly, consuming all the available nutrients in the pond water, starving the algae. At the same time, the bacteria transform some of the dissolved nitrogen compounds that would otherwise become algae food into nitrogen gas that diffuses into the air. Some bacterial preparations also include enzymes that break down accumulated leaves and other organic matter, releasing nutrients into the water that are then consumed by the bacteria.



try barley straw

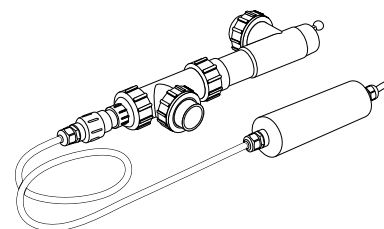
TRY BARLEY STRAW: For centuries farmers have thrown bales of barley straw into ponds as a means of controlling algae, since as the straw decomposes it emits a natural algal growth inhibitor. Although pond keepers have had mixed results, barley straw is inexpensive and worth trying.

IMPROVE FILTRATION: Ponds with fish need effective filtration. An effective filter systems must provide mechanical filtration, aerobic biological filtration, and anaerobic biological filtration. Mechanical filtration separates floating solids from the water and is accomplished by leaf nets, strainer screens, foam sponges, polyester matting, or vortex tanks. Aerobic biological filtration transforms the toxic ammonia from fish waste into nitrates and is accomplished by aerobic microorganisms that thrive on the oxygen-rich external surfaces of most filter media. Anaerobic biological filtration completes the process by transforming these nitrates into nitrogen gas and is accomplished by anaerobic microorganisms that grow in places without oxygen, such as in the interior cavities of ceramic rock, reticulated foam, and some types of plastic media. Many inexpensive "biofilters" don't work very well because they have inadequate surface area to support a large population of aerobic microorganisms and very often have no media to support anaerobic microorganisms.



improve filtration

ADD A UV STERILIZER: Intense ultraviolet (UV) radiation can kill algae by breaking down their DNA molecules, an environmentally safe process that does not leave any residue in the water. A UV sterilizer is basically a plastic pipe with an ultraviolet lamp inside that is installed in the return line between a filter and a pond or between a pump and a filter. We strongly recommend UV sterilizers for ponds with substantial fish populations, especially koi ponds, to help control algae and disease-causing microorganisms. They are also a valuable tool for eliminating green water in any pond, but should not be seen as a substitute for effective filtration. Since UV sterilizers add nothing to the water, they have no effect on string algae and other aquatic life that remain in the pond and do not pass through the pumping system.



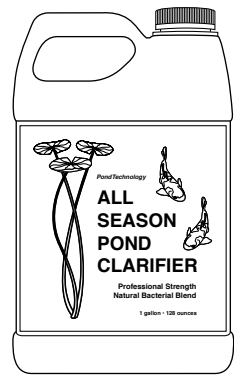
add ultraviolet sterilization

WAIT A WHILE: Spring algae problems may disappear on their own once plants begin to grow; summer algae problems may disappear after a really hot spell ends.

BIOLOGICAL CONTROLS

Microorganisms break down organic matter into basic chemical components that can be recycled into the aquatic ecosystem. Without microorganisms, ponds would rapidly turn into pools of green slime where no fish or plants could survive. Although microorganisms are present in all ponds, the most effective microorganisms for nutrient recycling are not always present when they're needed the most. By supplementing the natural microbial population with large numbers of selected strains, it's often possible to eliminate algae problems and remove excess organic matter that collects at the pond bottom. We do not recommend using oxidizers, algaecides, or herbicides because they disrupt the natural biological cycle.

LIQUID CLARIFIER: PondTechnology *All Season Pond Clarifier* is a natural microbial product formulated to improve water quality and control bottom sludge without harming aquatic life. It is a blend of many different microorganisms selected for their ability to digest organic matter and remove dissolved nutrients such as ammonia, nitrites, nitrates, and phosphates. It combines all of the features of warm-weather biological clarifiers, cold-weather biological clarifiers, sludge-control products, and bio-filter starters into a single, safe, easy-to-use product that works for ponds of any size. It is also suitable for brackish-water estuaries, sewage plants, and septic systems.



liquid clarifier

To determine the proper application rate, estimate how many gallons of water are in a pond using the following formula (be sure to measure at the longest, widest, and deepest points):

$$\text{gallons} = \text{length (ft)} \times \text{width (ft)} \times \text{depth (ft)} \times 5$$

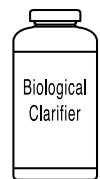
Then use the chart at the right to determine the recommended *remedial* and *maintenance* application rates in ounces per week.

Before starting a biological treatment program, remove as much organic debris as possible from the bottom of the pond with a leaf net or pond vacuum. Apply clarifier at the recommended remediation rate until the water becomes clear, typically two to four weeks. Then continue application at the recommended maintenance rate. Should water clarity deteriorate, it is safe to resume the remediation rate as often as required.

Pond Size	Remediation	Maintenance
1,000 gal	8 oz/week	2 oz/week
2,500 gal	16 oz/week	4 oz/week
5,000 gal	32 oz/week	8 oz/week
10,000 gal	64 oz/week	16 oz/week
25,000 gal	1 gal/week	32 oz/week
50,000 gal	2 gal/week	64 oz/week
100,000 gal	4 gal/week	1 gal/week
250,000 gal	8 gal/week	2 gal/week
500,000 gal	16 gal/week	4 gal/week
1,000,000 gal	32 gal/week	8 gal/week

For best results, maintain the pH between 6.5 and 8.0 using pH increasing or reducing salts followed by buffers. Always run a waterfall pump, fountain, or air compressor continuously when using biological treatments to assure good circulation and adequate aeration. Turn off ultraviolet sterilizers for 24 hours following each application so the new microorganisms can thrive.

DRY CLARIFIERS: We recommend monthly application of Biological Clarifier, a dry bacteria and enzyme mixture that helps to break down accumulated fish waste, leaves, and other organic pond debris. A 12 ounce bottle can treat 12000 gallons, and a 25 pound pail will treat an acre-foot (400,000 gallons). To solve really difficult water quality problems – such as uncontrolled growth of string algae – we suggest Clarity Max Plus. We can't guarantee it will work in every situation, but it's one of the most promising products we've seen. A 2.5 pound bottle can treat 20,000 gallons. As with liquid clarifier, for best results with dry clarifiers it is necessary to maintain the pH between 6.5 and 8.0 using pH increasing or reducing salts followed by buffers. Always run waterfall pump, fountain, or air compressor continuously when using biological treatments, and turn off ultraviolet sterilizers for 24 hours following each application.



dry clarifier

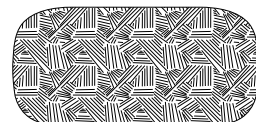
MOSQUITO DUNKS AND MOSQUITO BITS: *Bacillus thuringiensis*, often abbreviated as Bt, is a naturally occurring bacteria that paralyzes the digestive tract of insect larvae, causing them to die within a few days. Mosquito Dunk floats on the surface of ponds and slowly release a specific strain of this bacteria designed to kill mosquito larvae; Mosquito Bits are a rapid-release granular form of the same product. Although *Bacillus thuringiensis* is not suspected to cause any environmental side effects, we suggest you use it sparingly to minimize the possibility that mosquitoes will eventually become resistant.



Bt mosquito control products



BARLEY STRAW: For centuries farmers have thrown bales of barley straw into ponds to control algae, since as the straw decomposes it emits a natural algal growth inhibitor. We supply mini-bales of real Scottish barley measuring 4" x 4" x 7". One bale treats 500 gallons of water for a year. Insert the bales into the mesh bags provided and place them near flowing water where there is plenty of oxygen, such as near the base of a waterfall.



barley straw

FISH AND PLANT SUPPLIES

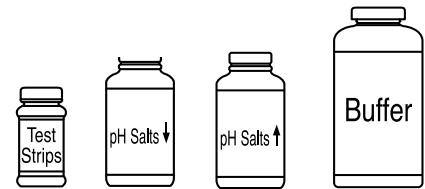
FISH FOOD: Sho-Koi Impact contains the highest quality proteins, carbohydrates, fats, vitamins and minerals found in any fish food plus spirulina, a highly nutritious algae that increases resistance to parasites, improves fertility, and naturally intensifies the colors of koi. It is also the only fish food that contains Optimûn, a safe, natural yeast extract that significantly reduces disease while increasing the efficiency of absorption of nutrients in food. It can be used in all seasons for all fish, from inexpensive goldfish to priceless competition koi, so complicated regimens of spring, summer, and fall feeding can be eliminated. The pellets float so the fish have plenty of time to locate the food, and the uneaten food can be easily netted before it can become a water-quality problem. Impact is available in 2 lb or 4 lb bottles and in 10 lb or 50 lb bulk packages.



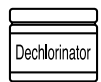
PLANT FERTILIZER: We offer two time-release tablets: Throw-Tabs supply all of the nutrients needed by aquatic plants except nitrogen and phosphorous that can cause algae growth (throw into pond, one for every floating plant); Aquatic-Tabs add nitrogen and phosphorous where needed (press into pots, two per gallon of soil).



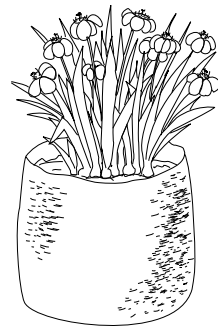
PH CONTROL: For optimum fish health, it is important to measure buffering and pH levels periodically, and then add pH increasing salts, pH reducing salts, and buffer as needed. Our test strips measure pH and buffering capacity, while simultaneously measuring nitrite levels that are symptomatic of inadequate filtration. A 2 lb bottle of buffer treats 8000 gallons, and a 2 lb bottom of pH reducing salts treats 32,000 gallons. Always adjust pH before adding buffer.



DECHLORINATOR: This dry chemical reduces chlorine and chlorine by-products in tap water to levels safe for aquatic life. Add it to new ponds or ponds that have been cleaned and refilled. An 8 ounce bottle treats 48,000 gallons which is a lifetime for many backyard ponds and quite a bargain compared to liquid dechlorinators.



FABRIC PLANTING POTS: These porous fabric containers are far superior to the plastic pots typically used for aquatic plants. Made entirely of fabric, they have no hard surfaces or sharp edges to harm fish or damage rubber pond liners, and their flexible bottoms conform to irregular pond bottoms. Air and water pass freely through the fabric walls, aerating the soil and flushing accumulated salts, so plants develop better root structures and grow faster and healthier. Standard diameters are 6", 8", 10", 12", 14", and 16": the smaller sizes are ideal for marginals while the larger ones are more suited to lilies.



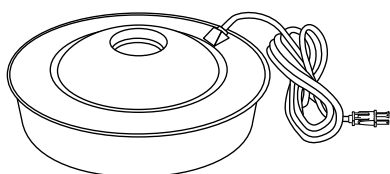
fabric planting pot

To use a fabric planting pot, fill it about half-full with screened topsoil, compact the soil, position the plant in the center, add a few more inches of screened topsoil, and compact the soil again. If the pond will contain koi, spread an inch of washed gravel placed over the soil to keep the fish from digging. Water the pot thoroughly to remove air pockets, and set the pot at the edge of the pond in a few inches of water until the soil becomes fully saturated with water. Then fold down the excess fabric and position the pot.

WINTER PROTECTION

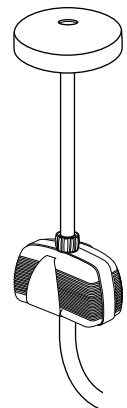
In preparation for winter, pumps and sterilizers should be removed, thoroughly cleaned, and stored indoors. External filters and plumbing should be drained, cleaned, and sealed from water entry where possible. Never drain ponds with rubber liners!

PUMP DE-ICER: If a pond contains fish, and winters are cold enough to form ice on the pond surface, a de-icer is required to keep a hole open in the ice to allow toxic gases to escape. Our pump de-icer consists of a small pump suspended 8" above the pond bottom by flexible tubing attached to a foam float at the pond surface. The pump transports the warmer water from the pond bottom to the bottom of the float where it spreads out and leaves an ice-free ring of water around the float. The pump is very efficient, consuming only 10 watts of power at a cost of less than one dollar per month. The cord length is 15 feet.



heater de-icer

HEATER DE-ICER: When daytime temperatures remain below freezing for weeks at a time, recirculating water from the bottom with a pump de-icer can cause a pond to freeze into a solid block of ice. In such weather conditions, it is essential to use a de-icer that generates its own heat. We offer an energy-efficient heater de-icer that uses only 100 watts, less than one-tenth the power consumption of other heater de-icers. The cord length is 10 feet. Please note that de-icers are not intended to be pond heaters.



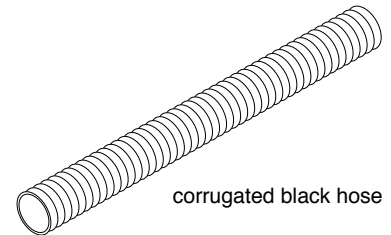
pump de-icer

POND PLUMBING

Since there are no standards for plumbing used in the water-garden industry, connecting components from different suppliers can be challenging. Three filters with what appear to be 1" threaded inlets may require three different fittings because one has an American pipe thread, one has a British pipe thread, and one has a metric pipe thread. Three hoses can all be labeled "1/2 inch" yet one will measure exactly 1/2" inside ("true-size" hose), one will measure slightly less than 1/2" inside (12mm metric hose), and one will measure 5/8" inside (1/2" pipe-size)! Even when parts do fit together, they may not look attractive because some are black, some are white, some are gray, some are beige, and some are green.

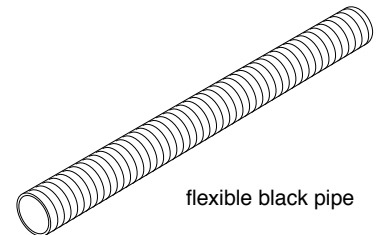
All of our hoses, pipes, valves, disconnects, and fittings are made to American pipe standards, so everything fits together perfectly. All are carefully designed and made of superior-quality materials to assure permanent watertight connections. All are black or dark gray to be inconspicuous in a natural setting.

CORRUGATED BLACK HOSE: PondTechnology corrugated PVC hose is a heavy-duty spiral-reinforced flexible black hose with a smooth interior. It is recommended for in-pond use where optimal flexibility is desirable. Since we size it to fit standard plumbing fittings, the inside diameter is larger than the nominal size (for example, 1/2" hose measures 5/8" inside) and the flow capacity is significantly higher than typical plastic tubing that is labeled by actual inside diameter. It is available in 1/2", 3/4", 1", 1-1/4", 1-1/2", and 2" diameters in rolls of 25, 50, and 100 feet, or cut to any 5 ft increment.



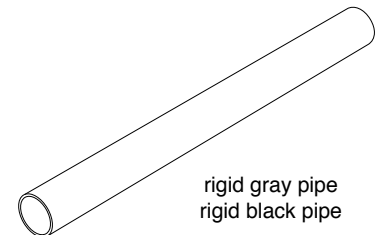
corrugated black hose

FLEXIBLE BLACK PIPE: PondTechnology flexible PVC pipe is a heavy-duty spiral-reinforced flexible black pipe that is smooth on the interior and exterior with the exception of slight ridges from the reinforcing. Since it is made with outside diameters that are the same as rigid PVC pipe, it can be glued into standard PVC pipe fittings and valves using a special flexible pipe cement. Although not as easily bendable as corrugated hose, flexible pipe is recommended for out-of-pond use where extra strength and durability is needed, such as where pipes are exposed to sunlight or are buried. This type of pipe should be used with caution in areas with severe termite infestation or where burrowing animals are very active. It is available in 1/2", 3/4", 1", 1-1/4", 1-1/2", 2" and 3" diameters in rolls of 25, 50, and 100 feet, or cut to any 5 ft increment.



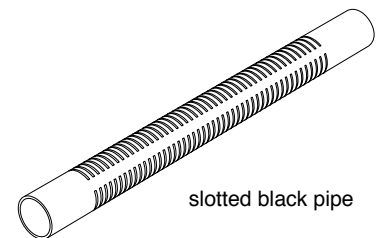
flexible black pipe

RIGID GRAY AND BLACK PIPE: PondTechnology rigid PVC pipe is a schedule 40 pipe made from an industrial-quality PVC that has much better mechanical properties than the white PVC typically used for water and sewer pipe. It is available in gray in 1/2", 3/4", 1", 1-1/4", 1-1/2", 2", 3", and 4" diameters and in black in 2", 3", and 4" diameters, both colors in 2 ft and 4 ft lengths. Use this pipe either above or below ground where the ultimate in durability is required, in conjunction with slotted pipe to make intake or discharge manifolds, or for any application where appearance is important.



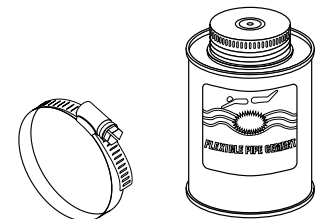
rigid gray pipe
rigid black pipe

SLOTTED BLACK PIPE: PondTechnology slotted PVC pipe is a black schedule 40 pipe made from an industrial-quality PVC. Hundreds of accurately machined slots create a large open area while blocking entry of organic matter or gravel. It is available in 2", 3", and 4" diameters in either 2 ft or 4 ft lengths. Use this pipe in conjunction with flexible PVC fittings and unslotted rigid black PVC pipe to build pump intake manifolds, discharge manifolds and gravel filters.



slotted black pipe

MARINE STAINLESS STEEL HOSE CLAMPS: For a watertight seal, corrugated hose must be securely fastened to barbed hose fittings with stainless-steel hose clamps. Inexpensive general-purpose stainless-steel hose clamps sold in home centers are made from low-quality stainless-steel bands with zinc-plated carbon steel screws that often rust in just a few months. A step up in quality are "all-stainless-steel" clamps, typically made from 301-grade stainless steel bands with 410-grade stainless steel screws, that can last a few years. Even better are "marine-grade" clamps made from only 300-series stainless-steel bands and screws, and the most durable marine grade clamps are made entirely from 316-grade stainless steel. We offer the best 316-series marine grade stainless-steel hose clamps available anywhere, made with super-thick non-perforated bands and a high-torque tightening system, in 1/2", 3/4", 1", 1-1/4", 1-1/2", and 2" sizes.

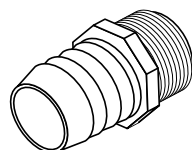


marine stainless-
steel hose clamp

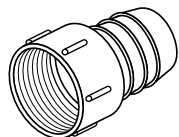
flexible pipe
cement

FLEX PIPE CEMENT: Joints involving flexible PVC pipe require a special type of pipe cement that is not commonly found in home centers. We stock 1/2 pints and pints in an environmentally-friendly low-VOC version that does not require priming.

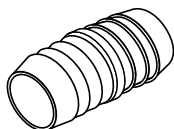
GRAY BARBED FITTINGS: Corrugated hose must be connected to pumps, filters, and valves with barbed fittings that are pressed inside the hose. For watertight seals, these fittings must be carefully designed, properly sized, and well made. Our fittings have tapered noses and properly designed barbs; they are sized to fit our hose perfectly; and they are made of premium-quality gray PVC. Standard configurations are couplings, elbows, tees, barb to male adapters, and barb to female adapters. All are available in 1/2", 3/4", 1", 1-1/4", 1-1/2", and 2" sizes; barb x male adapters are also available in both increasing and reducing sizes.



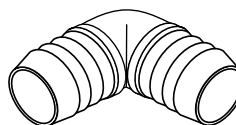
barb x male adapter



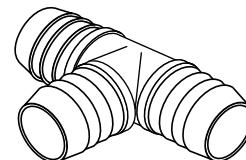
barb x female adapter



barb coupling

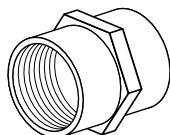


barb elbow

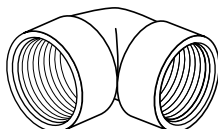


barb tee

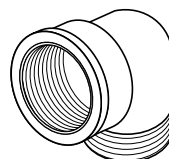
BLACK THREADED FITTINGS: We stock black polypropylene fittings with both male and female threads. Standard configurations are couplings, elbows, street elbows, tees, nipples, reducing nipples, bushings, and plugs in 1/2", 3/4", 1", 1-1/4", 1-1/2", and 2" diameters.



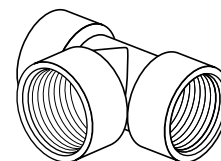
female coupling



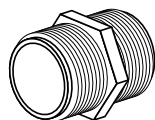
female elbow



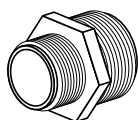
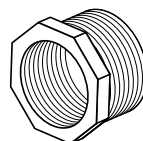
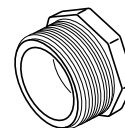
female x male street elbow



female tee



male nipple

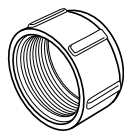
male
reducing nipplemale x female
bushing

male plug

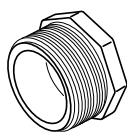
GRAY THREADED FITTINGS: We stock gray PVC threaded fittings with both male and female threads. Standard configurations are nipples, caps, plugs, bushings, elbows, and tees in 1/2", 3/4", 1", 1-1/4", 1-1/2", and 2" diameters.



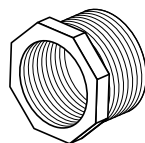
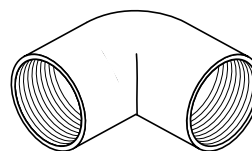
male nipple



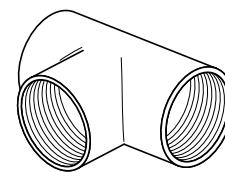
female cap



male plug

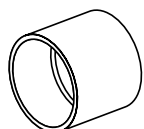
male x female
bushing

female elbow

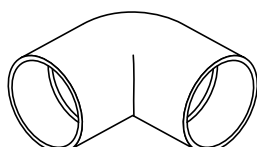


female tee

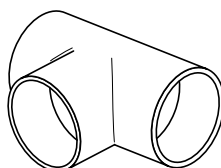
BLACK SOCKET PIPE FITTINGS: Our black PVC solvent-weld fittings are ideal for joining our flexible and rigid black PVC pipe. They are made from an industrial-quality PVC that is much stronger than commonly available white plumbing fittings. Standard configurations are couplings, elbows, tees, socket to male thread adapters, socket to female thread adapters, and socket caps in 1/2", 3/4", 1", 1-1/4", 1-1/2", and 2" diameters.



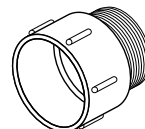
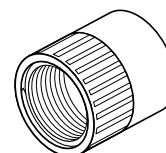
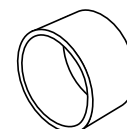
socket coupling



socket elbow

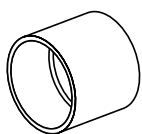


socket tee

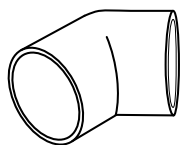
socket x male
adaptersocket x female
adapter

socket cap

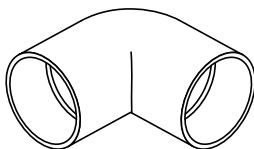
GRAY SOCKET PIPE FITTINGS: Our gray PVC solvent-weld fittings are ideal for joining our flexible or rigid gray PVC pipe. They are made from an industrial-quality PVC that is much stronger than commonly available white plumbing fittings. Standard configurations are couplings, 45° elbows, 90° elbows, tees, crosses, socket to female adapters, socket to male adapters, spigot to female adapters, spigot to socket bushings, spigot to female bushings, spigot nipples, toe nipples, socket caps, and spigot plugs in 1/2", 3/4", 1", 1-1/4", 1-1/2", 2", 3" and 4" sizes. (Note: a spigot fitting has the same outside diameter as a pipe).



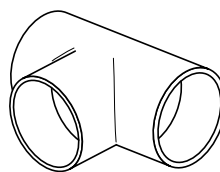
socket coupling



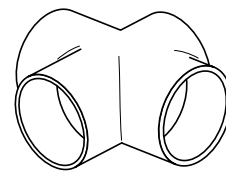
socket 45° elbow



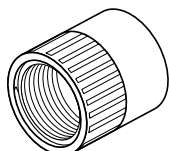
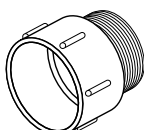
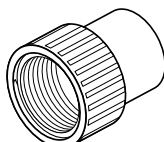
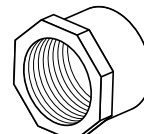
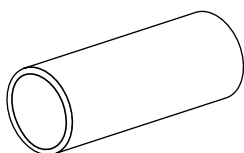
socket 90° elbow



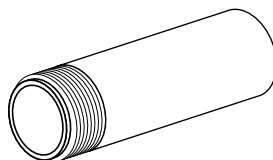
socket tee



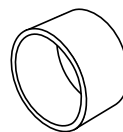
socket cross

socket x female
adaptersocket x male
adapterspigot x female
adapterspigot x socket
bushingspigot x female
bushing

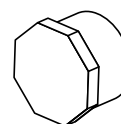
nipple (spigot)



toe nipple (male x spigot)

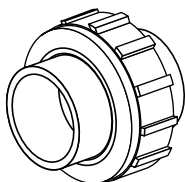
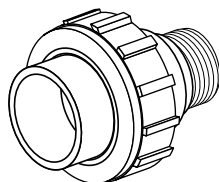
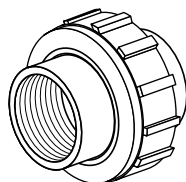
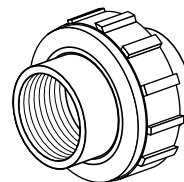
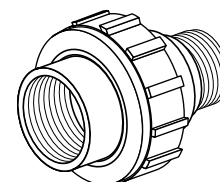


socket cap

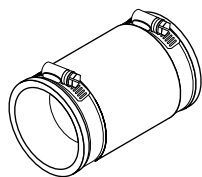
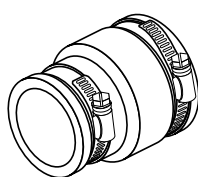
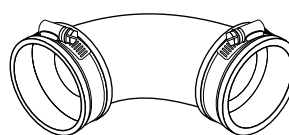
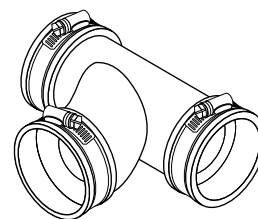


spigot plug

GRAY UNIONS: Unions provide a means to easily disconnect rigid or flexible pipe from pumps, valves, and filters. In combination with thread-to-barb adapters, they can also be used to join corrugated hose to flexible pipe. Our unions are made of gray PVC with socket fittings on both sides, threads on both sides, or a combination of sockets and threads. We offer 1/2", 3/4", 1", 1-1/4", 1-1/2", and 2" unions in all configurations, as well as 3" and 4" unions with sockets or female threads only.

socket x socket
unionsocket x male
unionfemale x female
unionsocket x female
unionfemale x male
union

BLACK FLEXIBLE CONNECTORS: Flexible connectors can be used instead of unions to connect rigid or flexible pipe to pumps, filters, check valves, and other pond components likely to need routine service. They are also invaluable for connecting dissimilar materials that cannot be joined by other means: for example, to connect PVC pipe to the inlet of a polyethylene filter. Our flexible connectors are made of thick black flexible PVC with stainless-steel hose clamps. We stock end caps, couplings, elbows, and tees in 1-1/4", 1-1/2", 2", 3", and 4" sizes as well as a range of reducing couplings for connecting unequal pipe sizes. When flexible connectors are used in pressurized lines, the system head should not exceed ten feet.

flexible
end capflexible
couplingflexible reducing
couplingflexible
elbowflexible
tee

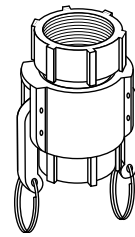
BLACK QUICK-RELEASE COUPLINGS: Quick-release couplings are ideal for making watertight connections between corrugated hose, pumps, filters, or other pond components likely to need routine service. They open and close in seconds without tools, are effortless to align, and can withstand high water pressure. Our quick-release couplings are made of black polypropylene with stainless-steel hardware and sizes up to 2" have locking safety buttons to assure closure and prevent accidental opening. We stock 1/2", 3/4", 1", 1-1/4", 1-1/2", and 2" sizes with female threads, male threads, or a combination of male and female threads.

GRAY KNIFE VALVES: Knife valves control water flow with a thin flat plate called a "knife" that is opened and closed by pulling or pushing a T-shaped handle. Since they can be rapidly operated, they are ideal for filter drain lines that must only be opened for a few seconds to clear waste. Knife valves are also commonly used to seal 4" bottom-drain lines feeding vortex filters because gate valves this size are very expensive. Our knife valves are made of gray PVC in 1-1/2", 2", 3", and 4" sizes, all with socket fittings on both sides. The 1-1/2" and 2" sizes have a twist-lock mechanism to reduce the likelihood of accidental opening; the 3" and 4" sizes accept a security lock. The large valves are also supplied with a safety clip to keep the valve in the open position if desired (safety clips are optional on the small sizes).

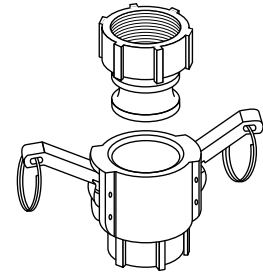
GRAY BALL VALVES: Ball valves control water flow with a plastic ball that rotates as the handle is turned. In the open position, a large hole through the ball is aligned in the direction of water flow, allowing the water to flow unobstructed; in the closed position the hole is aligned perpendicular to the direction of water flow, blocking the flow. Ball valves are more reliable and controllable than gate valves which makes them ideal for most shut-off applications in pond construction. Our gray PVC ball valves are superior-quality valves that feature "full-port" balls for low friction loss (the hole in each ball is the same diameter as the pipe size of the valve), built-in unions for ease of maintenance, and independent gasket retainers for adjustable operating pressure. We stock 1/2", 3/4", 1", 1-1/4", 1-1/2", 2", and 3" sizes with either female threads or pipe sockets.

GRAY GATE VALVES: Gate valves control water flow with a wedge-shaped internal plastic barrier, called a "gate", that rises and falls as the handle is turned. Unlike ball valves which go from fully open to fully closed with only a quarter turn of the handle, gate valves require many full turns of the handle to go from fully open to fully closed, making them ideal for precise flow regulation of pumps, filtration systems, and fountain manifolds. Gate valves are also frequently used to add back pressure to larger pond pumps operating at low head pressure to prevent pump overloading. Our gray PVC gate valves are superior-quality valves designed for years of reliable operation. We stock 1/2", 3/4", 1", 1-1/4", 1-1/2", and 2" sizes with either female threads or pipe sockets.

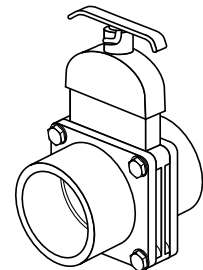
BLACK THREE-PORT ROTATING VALVES: Unlike knife, ball, and gate valves which have one inlet and one outlet, three-port valves can be configured to have one inlet and two outlets or two inlets and one outlet. Turning a large handle rotates an internal barrier that proportions the flow between the inlets and outlets, and a thumb screw locks the handle in the desired position. This feature allows three-port valves to combine water from two sources (for example, to connect both a skimmer and a bottom drain to an external pump), or to divert water to two destinations (for example, to connect a pump to two waterfalls at different elevations). Our heavy-duty three-port valves feature built-in 2" socket unions on all three ports, but 1.5" socket or female adapters are also available. We also stock a 3" three-port valve without unions.



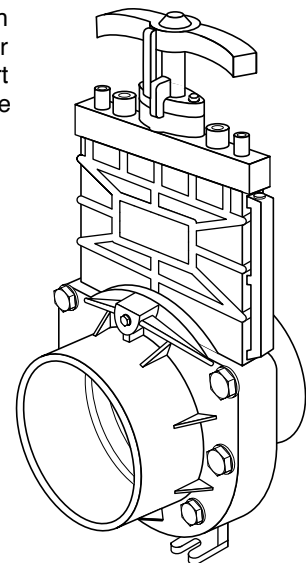
quick release
(closed)



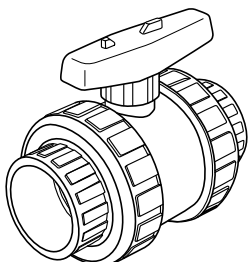
quick release
(open)



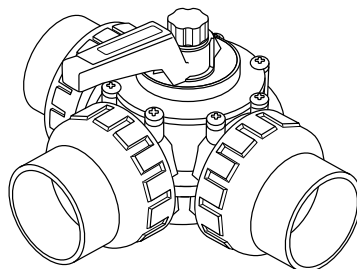
2" knife valve



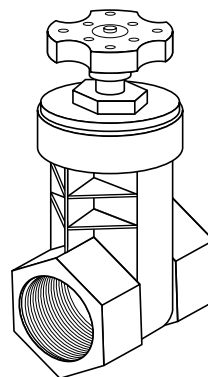
4" knife valve



ball valve
with unions

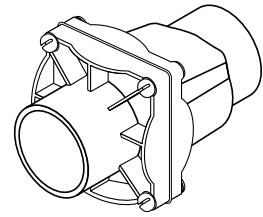


3-way valve
with unions



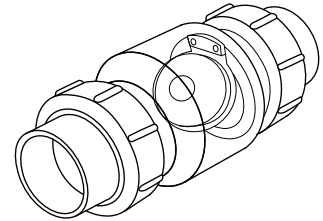
gate valve

BLACK AND CLEAR CHECK VALVES: Check valves allow water to flow in only one direction through a hose or pipe. They are normally installed between a submersible pump and a waterfall filter installed higher than the pond so that the filter will not siphon dry when the pump is disconnected for maintenance, or in the event of a power failure. Check valves are also essential in the suction line feeding an external pump to facilitate priming when the pump is positioned higher than the pond water surface. For aquatic gardening it is important to use only full-flow *swing* check valves— named for their internal flaps that swing completely out of the way in operation— instead of *spring* check valves which can clog easily and are only suitable for clear water. For typical low pressure pond applications, we offer 2" black swing check valves with spigot ends that can be connected to pipe or hose with flexible couplings and appropriate adapters. Where other sizes are required, or for higher pressure applications, we offer see-through clear swing-check valves in 1/2", 3/4", 1", 1-1/4", 1-1/2", 2", 3", and 4" pipe sizes with built-in socket or female-threaded unions.



black check valve

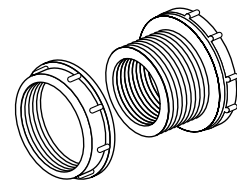
BLACK BULKHEAD FITTINGS: Bulkhead fittings are two-part assemblies used to make penetrations in rigid plastic tanks, skimmers, and filters. The threaded male part, which has a flanged base with a sealing gasket, is inserted through a hole drilled in the tank. The female part, basically a very large threaded nut, is screwed onto the male part with a strap wrench, compressing the gasket against the tank to make a watertight seal. Bulkhead fittings have internal threads that accept adapters from either side: male by socket adapters are used to connect to rigid or flex pipe, and male by barb adapters are used to connect to corrugated hose. We stock bulkheads in 1/2", 3/4", 1", 1-1/4", 1-1/2", 2", 3", and 4" pipe sizes.



clear check valve with unions

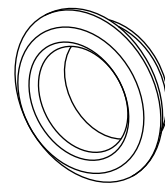
BLACK RING GASKETS: Ring gaskets offer an alternative to bulkhead fittings for penetrations through rigid plastic tanks, skimmers, and filters. When inserted through an accurately drilled hole, a pipe pushed through the gasket presses tightly against the edges of the hole to provide a watertight seal. We stock ring gaskets in 1/2", 3/4", 1", 1-1/4", 1-1/2", 2", 3", 4", and 6" pipe sizes.

BLACK LINER PENETRATION FITTINGS: PondTechnology Liner Penetration Fittings provide the ideal means to pass a pipe through a pond liner. The liner is securely clamped between a disc on the interior and a flanged base on the exterior. Two raised sealing rings on the base provide a watertight connection without using a sealant, but if desired a bead of silicone caulk can be applied in the cavity between the rings. The ring is secured to the base with heavy-duty stainless-steel screws threaded into sealed screw pockets. Both the disc and base are made of thick black ABS, and the base has stiffening ribs. Pipe sockets are molded into the base so flexible or rigid PVC pipe can be directly glued to one or both sides. Standard sizes are 2" and 3". We also offer black adapters to convert the sockets to female threads.

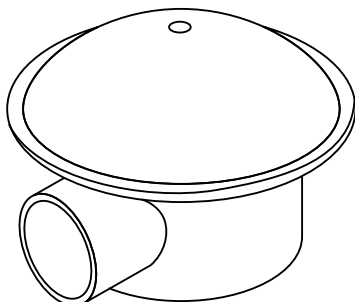


bulkhead fitting

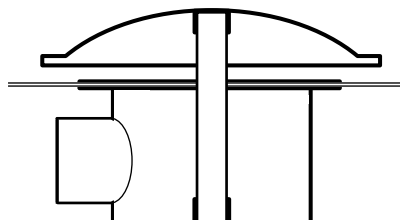
BLACK BOTTOM DRAINS: PondTechnology Bottom Drains offer the ideal means to draw solids-laden water from the bottom of ponds. Water enters under a large anti-vortex dome and flows through a 4" side outlet in the base. The dome height is set by cutting the dome support column. Our drains are injection molded for reliability and feature flange stiffeners with sealed screw pockets for superior rigidity and watertightness. They should be set in concrete, compacted sand, or compacted crushed stone. Lay the rubber liner over the drain, cut out the drain opening, apply caulk between the rubber liner and the flange, and screw the clamping ring through the rubber into the screw pockets in the flange.



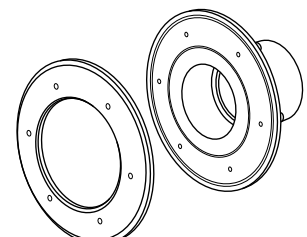
ring gasket



bottom drain with anti-vortex dome



cross-section through bottom drain



liner penetration fitting

RETURNS AND WARRANTIES

RETURNS: Liners, tapes, sealants, fish food, bacteria, chemicals, and cut-to-length merchandise are not returnable unless defective. Most other products may be returned within thirty days, provided they are clean, unused, and returned in the original packaging. We do not refund shipping, and we normally charge a small restocking fee. Before sending anything back, you must first call for a return authorization. Unless we instruct otherwise, merchandise should be returned to:

Resource Conservation Technology Inc
2233 Huntingdon Avenue
Baltimore MD 21211

LEAKING PONDS: To locate the source of a leak, first turn off the pump to rule out the possibility of a leak in the external plumbing (for example, in a hose or pipe running to a filter or a waterfall). Then allow the water level to drop until the level stabilizes, and search carefully for the hole which will be found somewhere along the water line. If the rubber surrounding the hole is still elastic and flexible, it is unlikely that the rubber has deteriorated. In such a situation, the hole was likely caused by sharp rocks, falling branches, playful dogs, or burrowing animals. Apply repair tape and consider covering the liner completely with rock and gravel, perhaps in conjunction with our Liner Protection Fabric, to prevent future damage.

If the rubber surrounding the hole seems to be brittle and cracked, the liner may have deteriorated. If this is the case, PondTechnology and PondGard Rubber Liners are warranted for a period of 20 years against premature deterioration to the point of failure because of weathering, subject to the following limitations and procedures:

- In the event of a problem, you must notify us in writing describing the nature and extent of the problem and providing proof of purchase. If we request, you must cut out and forward samples of the damaged section. If we request, you must permit our agent to inspect the liner on site.
- If we determine that deterioration is present but localized, we will provide repair materials at no charge. You will be responsible for any labor or other expenses you incur to repair the liner.
- If we determine that deterioration is extensive, we will offer a replacement liner at the current list price plus delivery charges, less an allowance for the unused service life pro-rated against the warranted life. You will be responsible for any labor or other expenses you incur to replace the liner.

This warranty will only apply to liners installed according to our written instructions. We do not warrant against damage from contact with sealing or patching materials not provided by us; with solvents, oils, strong acids, and some cleaning chemicals; or with any other substances not compatible rubber. We also do not warrant against damage from physical abuse such as that resulting from contact with sharp or rough objects above or below the liner, or from animal damage. We do not warrant seams or repairs made by our customers to be free of leaks.

None of our employees or representatives have the authority to make any claims or commitments other than those stated in this warranty and in our catalog. We will not be liable for any damages that might result from liner deterioration, such as damage to the contents or surroundings of a pond.

MALFUNCTIONING PUMPS: If a submersible pump does not pump water, unplug it and disconnect it from the hose or pipe. Then plug in the pump with the pump under water. If the pump runs well, there is a clog somewhere in the piping system. If the pump runs weakly, it is likely that debris has accumulated in the pump: clean the impeller housing thoroughly and spin the impeller several times with the power disconnected. If the pump still doesn't work, contact us for assistance. If an external pump does not run or runs weakly, disconnect the power immediately and contact us for assistance.

If a pump needs to be repaired, you will be required to return the pump your expense. If the warranty period has not expired, the pump will be repaired or replaced at the sole discretion of the manufacturer and will be returned to you at no additional cost. Please note that pump warranties usually exclude problems considered to be abuse, such as damage to the external housing indicating that the pump was dropped, impeller damage caused when a stone is sucked into the pump, or seal damage caused by excessive grit in the water. Damaged power cords, or power cords with missing plugs may also considered evidence of abuse because they often lead to pump failure by allowing water to wick through the cord and enter the motor housing. Since sooner or later even the best pumps will fail and the process of repairing or replacing a pump can take several weeks, consider purchasing an inexpensive backup pump or aeration system when you build your pond.

CONSERVATION TECHNOLOGY

tel: (800) 477-7724 fax: (410) 366-1202 email: sales@pondtechnology.com