

Lagoon Aeration Technology Transfer

Attaching Feedlines to Laterals with Polyethylene Branch Saddles

AerResearch recommends that special attention be paid to the problem of obtaining a strong connection of the feedline to the air supply lateral.

AerResearch air supply laterals are typically polyethylene (PE) or polyvinylchloride (PVC) pipe. The feedline to be attached to the lateral is typically either PE pipe, Ethylene Propylene Diene Monomer (EPDM) vacuum hose, or a combination of EPDM vacuum hose segments with rigid segments of PVC pipe.

Laterals:

PE laterals have the advantage of greater resistance to ultraviolet degradation, and they are less subject to brittle failure. However, they are softer and this creates a requirement for shorter distances between supports. PE components cannot be connected with solvent cement welding, glues, or mastics – they must be connected by thermal welding – a process which results in extremely strong connections. Threaded connections are an option which is not recommended by PE manufacturers.

PVC laterals have the advantages of greater stiffness which allows longer distances between supports. Additionally, PVC components are available with threaded outlets. PVC components are subject to brittle failure, and should be protected from impacts or tension stresses – especially if they have thin walls. PVC components are easily connected by either threads or by solvent cement welding. PVC laterals should be submerged to avoid exposure to sunlight and the resulting ultraviolet degradation.

PE laterals tend to show advantages when laterals are to be floated on the water surface, but PVC laterals tend to show advantages when laterals are to be submerged.

Feedlines:

PE feedlines have the advantage of allowing an extremely strong thermally welded connection to the lateral if the lateral is also PE. They have a low cost, but are relatively stiff and subject to kinking. EPDM feedlines are more flexible and resistant to kinking, but require a threaded connection to the lateral. Feedlines with segments of EPDM and PVC retain flexibility where it is needed while providing stiffness at other locations.

Branch Saddles:

The device recommended for attachment of feedlines to the air supply lateral is called a branch saddle. Branch saddles are of several types, but all include an end (saddle) curved to match the curvature of the pipe to which it will be attached and an outlet (nozzle) for attachment of the feedline.

Molded branch saddles are available from manufacturers of PE pipe and fittings. The outlet of molded branch saddles are designed for either butt-fusion thermal welding or socket thermal welding. PE manufacturers do not offer threaded connections.



AerResearch branch saddles are typically PE or PVC. In either case, the branch saddles and their attachment to the lateral are factory fabricated. Branch saddles are shipped attached to segments of the lateral. The segments can be either short pieces which are field-installed into the lateral or longer segments (up to forty feet) which are match-marked for simplified field assembly.

Socket-Welded Branch Saddles For PE Laterals And Feedlines:

PE feedlines can be attached to PE laterals by thermally welded PE branch saddles.



PE feedline socket thermal welded into branch saddle which is saddle thermal welded to lateral pipe.

An advantage of thermally welded PE pipe and fittings is that they are widely used in such applications as the distribution of natural gas. This means that local contractors with experience and expertise are likely to be available to properly install the system. However, the installation equipment requires relatively sophisticated equipment, a source of electricity and experienced operators to assure quality field connections. The equipment and power may not be available in lagoon basins which are large or likely to be wet or muddy.

Thermal welding of PE pipe and fittings is the strongest connection system available. However, the use of PE pipe and fittings may not be desirable. PE pipe used for laterals is so soft that it can be shipped in coils, yet PE pipe used for feedlines it is too stiff to be considered “flexible” for such applications as retrievable lagoon aerators. Perhaps the most troublesome feature of PE pipe used for feedlines is that they are easy to “kink” when aerators are retrieved and replaced.

AerResearch recommends specifications which include restrictions against the use of (1) branch saddle outlets which are butt-fusion welded to the feedline, since the butt-fusion welding is significantly weaker than socket fusion welding and (2) PE pipes which have thin walls. Note that the PE pipe industry uses “DR” ratings to specify pipe wall thickness, and that the higher DR ratings indicate thinner walls. AerResearch recommends that typical feedlines be DR-11 and that typical lateral pipes be DR-17, minimum.

EPDM vacuum hoses offer advantages for use as feedlines. They are much more flexible than PE pipe and they are externally reinforced so that they do not kink. However, they require a threaded connection to the lateral*

Threaded Branch Saddles For PE Laterals:

Threaded branch saddles allow the use of threaded hose shank fittings. Hose shank fittings allow PE pipes, EPDM vacuum hoses, and other tubing to be used as feedlines.



Feedlines can be attached to laterals with an insert fitting called a hose shank. This requires a threaded branch saddle.

Since the manufacturers of extruded and molded PE components do not offer threaded connections, threaded PE branch saddles must be fabricated. The reason that PE manufacturers do not offer threaded connections is that PE threads are too soft to withstand the stresses applied to threads, and threads will demonstrate “creep failure” as they flow under stress. However, threaded connections can be used to attach feedlines to PE laterals using threaded branch saddles if a few basic features are included in the design of the fabricated branch saddle.

The assembly shown above is AerResearch's standard threaded PE branch saddle. It is thermally welded to the lateral essentially the same as our socket branch saddle shown in the previous photo. Note that the branch saddle is fabricated from a thick blank of extruded PE. One end of the blank is cut to the curvature of the lateral pipe and the nozzle is internally threaded. Internal threading of the nozzle allows the use of an external reinforcing band of stainless steel. Non-reinforced PE threads should never be allowed.**

AerResearch recommends specifications which include restrictions against the use of non-reinforced (external) threads. The threads should be reinforced with stainless steel bands. The branch saddle should be factory-thermal welded to the lateral. The reinforcing bands and hose shank fittings should be factory installed to assure a tight fit.

Properly installed, the assembly consisting of lateral, branch saddle, reinforcing band and hose shank fitting will have a strength exceeding all stresses applied in use. Strength will be further assured by requiring that the assembly be put together as a single component at the manufacturer's factory.

Hose Shank Fittings:

Another important decision affecting the strength of the feedline attachment is the choice of the hose shank fitting.



Both PVC and PP Hose shank fittings are available with either internal or external threads

PVC hose shank fittings have thin walls which are subject to brittle failure, especially when cold or after several years of use. PP fittings are designed to resist brittle failure even when cold or after a long period in service. For these reasons, PP components are used in such demanding applications as bumper components of automobiles. PP is much stronger and will provide a significantly longer life than PVC when used to attach feedlines to laterals.

AerResearch recommends specifications which include restrictions against the use of PVC hose shank fittings to attach feedlines to laterals.

Summary:

AerResearch offers the strongest feedline attachment designs available in the aeration industry. The thermally welded system for attachment of PE feedlines to PE laterals was developed by the polyethylene industry and is the same system which is offered by other manufacturers of aeration equipment for this application. The threaded branch saddle design shown above was developed by AerResearch specifically for use in aeration applications and is significantly stronger than designs advertised by competing aeration companies** prior to the date of this writing.

*Other types of branch saddle include bulkhead fittings and saddle clamps. Bulkhead fittings are attached to holes in the lateral and require O-rings or gaskets for sealing. They are generally weak and difficult to install, because access to the threaded device inside the pipe is required. Saddle clamps are generally not acceptable for PE pipe, since the pipe is compressible allowing leaks to occur around the seals. When bulkhead fittings or saddle clamps are used, the specification writer should take care to obtain materials of construction which can withstand exposure to the environmental conditions and will not be heavy enough to sink laterals which are intended to float.

**One competitor has recommended externally threaded PE branch saddles with internally threaded PVC hose shank fittings. To compensate for the inability to reinforce the PE threads, they recommend set screws installed through the PVC fitting into the PE branch saddle. The set screws allow installation without tightening the tapered threads, because tightening the tapered threads will buckle the soft PE branch saddle.