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Automated Fire 101

When planning the install of Automated Fire Features there are a few important elements that need to be considered to ensure successful long term, reliable operation.

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Gas Considerations

1. **Gas Pressure** – In most instances the gas pressure you will be working with is 7" W.C. (1/4 psi) for Natural Gas or 11" W.C. (1/3 psi) for Propane. (Note: W.C. stands for "Water Column" which is the unit of measure when using a manometer to measure the gas pressure). In some instances, however you may be working with higher gas pressures upwards of 2 psi. The AWEIS can operate with gas pressures of 2 psi or less HOWEVER for it to work properly the Pilot Burner orifice MUST BE THE CORRECT SIZE for the gas pressure being supplied. The Pilot Burner orifice in a feature using 2 psi gas pressure is much smaller than the orifice in a feature using ¼ psi gas pressure. Why? The orifice is smaller when the gas pressure is higher to reduce the amount of gas flowing toward the igniter. If you install an AWEIS configured for low pressure (1/4 psi) when in fact you have 2 psi gas pressure the gas WILL NOT IGNITE. In this instance it would appear there is something wrong with the Pilot Burner when in fact IT IS NOT defective – it is just configured incorrectly for the gas pressure supplied. When placing your order you should indicate what gas pressure you are working with to ensure the AWEIS you receive is configured properly for the gas pressure on your job.
2. **Gas Type** -
3. **Gas Volume** – When it comes to troubleshooting, gas volume is the #1 issue we experience. If the AWEIS is not getting enough gas to supply the burner attached to it, it WILL NOT work properly. So how do we ensure we get enough gas to the AWEIS to ensure it will operate properly? First determine the amount of gas needed for the burners and then reference the table below to determine the gas line size needed to supply that amount of gas. *Note: The table below is only a ROUGH estimate of gas line size. For a more accurate determination of gas line size we recommend you consult your licensed plumber who is trained on determining gas line size based on additional factors not considered in the table below.*

Table 1: Gas Requirements for Round / Spiral / Square / Rectangle Burners

Fire Ring Size	Gas Required (Btu/hr)		Fire Ring Size	Gas Required (Btu/hr)
6" / 8" (Round / Spiral)	25K		Vulcan / Tiki Torch	25K
12" (Round / Spiral)	60K		6" (Square)	40K
18" (Round / Spiral)	150K		12" (Square)	90K
24" (Round / Spiral)	185K		18" (Square)	150K
30" HC (Round / Spiral)	260K		24" (Square)	230K
36" HC (Round / Spiral)	325K		36" (Square)	300K
48" HC (Round / Spiral)	575K		48" (Square)	400K

Calculating the Gas Requirements for Linear, H-Shaped and Custom Burners

To calculate the gas requirements for Linear, H-Shaped or Custom Burners multiply the linear feet of the burner by 15,000 Btu/hr per foot to get the total gas required. As an example, an H Burner measuring 6' long by 6" wide has a total length of 12' 6". In feet the total length is 12.5 feet. Multiply 12.5 feet by 15,000 Btu/hr/feet to get a total gas required of 187,500 Btu/hr.

Example of How to Calculate Gas Pipe Size based on Gas Requirements for Fire Features using Low Pressure Gas

Features: 4 Fire Bowls with 12" Round Fire Rings
Gas Type: Natural Gas
Gas Pressure: Low Pressure
Distance from Gas Meter to 1st Fire Bowl: 75'
Distance from Gas Meter to 4th (Last) Fire Bowl: 150'

Step 1: Reference Table 1 to determine the Gas needed for each fire bowl
In our example Table 1 shows the 12" fire ring requires 60K Btu/hr each. Therefore 4 rings require a total of 240K Btu/hr.

Step 2: Reference Table 2 (below) to determine Gas pipe size needed to deliver 240K Btu/hr to 150'
In our example the furthest fire bowl is 150' from the gas meter so we will use 150' to determine gas pipe size.
In Table 2 go to the column labeled "150" and then go down in the column looking for a number greater than 240K.
From the table we see in the 4th row the number 340K.
Next move left in the 4th row to see the required pipe size in the first column which is 1 ¼".
Conclusion: In order to deliver enough gas to support all 4 fire bowls we need to install a minimum of 1 ¼" pipe.

Table 2: Gas Capacity of Pipe for Low Pressure Gas (0.5 psi or less)

Pipe Size (inches)	Pipe Length (feet)					
	10	20	40	80	150	300
½	175K	120K	82K	57K	41K	30K
¾	360K	250K	170K	118K	87K	65K
1	680K	465K	320K	220K	160K	120K
1 ¼	1,400K	950K	660K	460K	340K	240K
1 ½	2,100K	1,460K	990K	690K	500K	350K
2	3,950K	2,750K	1,900K	1,300K	960K	710K

Note 1: When referencing Table 2 you always want to pick a pipe size that delivers MORE gas than what is needed as shown in example above.
Note 2: Table 2 is a conservative estimate of pipe size. For more accurate calculations consult a licensed gas plumber.

Table 3 (below) is identical to Table 2 except it shows the gas capacity of a pipe when "Medium" Pressure gas is used. Two (2) psi Gas Pressure is considered "Medium Pressure". As you can see the amount of gas delivered at this higher pressure is considerably higher than the corresponding value in the Low Pressure table.

As an example at Low Pressure a ½" gas line will deliver 57,000 Btu/hr over the distance of 80 feet. If we then look at the Medium Pressure table we see the ½" pipe can deliver 532,000 Btu/hr over the distance of 80 feet – that is almost ten times the gas!

When you are planning the gas piping for your job you may consider using the higher "Medium Pressure" gas if you have long pipe runs on your project. This is a technique some plumbers will use to cut costs. By keeping the gas pressure higher they can reduce pipe size for the long pipe runs and then when they get closer to the features they reduce the pressure using a step-down gas pressure regulator.

Table 3: Gas Capacity of Pipe for Medium Pressure Gas (2.0 psi)

Pipe Size (inches)	Pipe Length (feet)					
	10	20	40	80	150	300
½	1,506K	1,065K	753K	532K	372K	260K
¾	3,041K	2,150K	1,521K	1,075K	751K	525K
1	5,561K	3,932K	2,781K	1,966K	1,373K	961K
1 ¼	11,415K	8,072K	5,708K	4,036K	2,817K	1,971K
1 ½	17,106K	12,096K	8,553K	6,048K	4,222K	2,955K
2	32,944K	23,295K	16,472K	11,647K	8,130K	5,691K

3. **Manual Gas Shutoff** – The national code related to the gas plumbing of a fire feature requires a manual gas shutoff be located within 6' of the fire feature AND be easily accessible. The rationale behind the code pertains to all fire features however the code itself was adopted specifically for manually lit fire features. It was determined that at a distance of 6' the average person could turn the gas on and light the feature quick enough so that gas accumulation would be minimal and therefore the hazard of an "explosion" would not exist. Given the fact automated fire features do not require a person to light the feature by hand you would think this code does not apply to automated fire features however it does apply and will continue to apply until the code itself is changed.

   There are 2 types of Manual Gas Shutoffs; Ball Valves and Key Valves. Both valves types are available in different sizes. The most common sizes used are ½" and ¾" depending on the pipe size being installed. The size valve you use depends on the gas requirements of the burner in the feature. If the burner requires 150K Btu/hr or less the ½" size is the right choice. If however the burner requires more than 150K Btu/hr but less than 300K Btu/hr the ¾" size is the right choice. If the burner requires more than 300K Btu/hr you will NOT be able to use a Key Valve because ¾" is the largest size they come in but you can use a larger Ball Valve. A 1" Ball Valve will handle up to 600K Btu/hr.

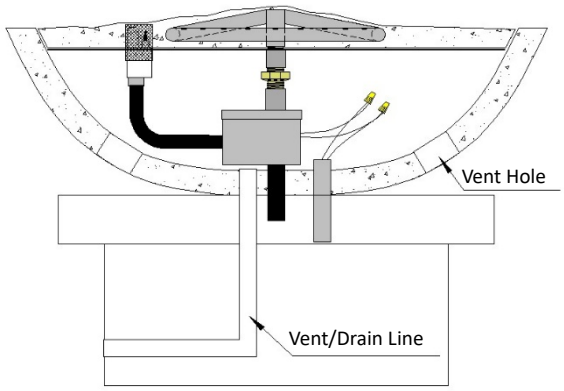
4. **Fire Feature Venting** – Ventilation is a MUST for all fire features. The most hazardous situation involving fire features occurs when gas seeps into a feature that has no ventilation. This "trapped" gas is a bomb waiting to go off the moment the fire feature is lit. There are a few ways gas can seep into a feature. Over time debris/rust can enter the AWEIS valve through the Outlet port and this debris can collect on the seal inside the valve. The next time the AWEIS is used it may not close completely due to the debris on the seal causing the valve to have a slight leak. This leak allows gas to flow to the main burner. Another way gas can seep into a fire feature is if a leak develops in the plumbing leading to the AWEIS.

If the gas type is Natural Gas the gas will drift harmlessly away because Natural Gas is lighter than air and so it rises into the atmosphere. Propane on the other hand is heavier than air and therefore it sinks down into the feature after it leaves the main burner. Of the two gases Propane is far more dangerous due to the fact it is sinks however that is not to say precautions must not be taken for Natural Gas as well. In certain scenarios Natural Gas is just as dangerous as Propane.

Ventilation when using Propane

As mentioned above Propane is heavier than air and therefore any unburned or leaking propane will drift down into the feature and accumulate in the bottom of the feature if there is no ventilation. Therefore either vent holes OR a vent line must be provided as shown in the drawing at right to allow the propane to vent from the bottom of the feature and prevent any accumulation of trapped gas.

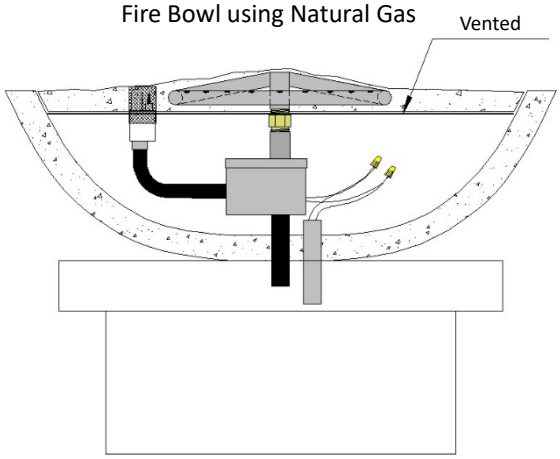
Fire Bowl using Propane



Ventilation when using Natural Gas

As mentioned above Natural Gas is lighter than air therefore any unburned or leaking natural gas will drift up and away from the feature if it has a way out. In the illustration at right if a leak were to develop below the Burner Pan the ONLY way the gas would be able to vent is through vent holes or a vent "gap" at the edge of the burner pan. Without either of these two venting options the Natural Gas could accumulate in the bottom of the bowl and become just as dangerous as Propane.

Fire Bowl using Natural Gas



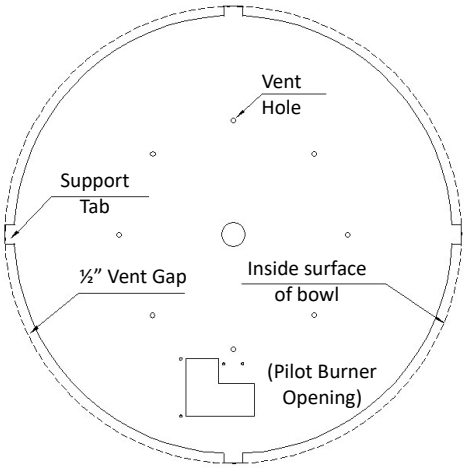
Vented Burner Pan Options (Natural Gas ONLY)

Shown at right is a Flat Burner Pan with both Vent Holes and a ½" Vent Gap at the edge of the pan.

Vent Holes are typically ¼" in diameter and they are located directly below the fire ring.

The Vent Gap is created by cutting the burner pan such that 4 support tabs are located on the outer edge of the pan for the purposes of supporting the pan in the bowl.

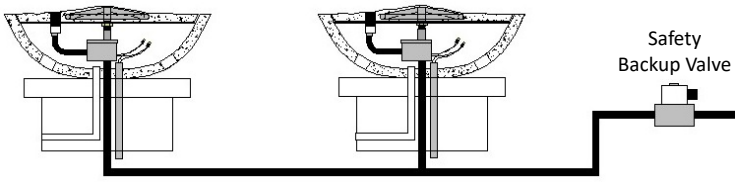
WARNING
DO NOT USE VENTED BURNER PANS WITH PROPANE
ONLY USE WITH NATURAL GAS!



5. **Purging of New Gas Lines** – It is HIGHLY recommended all new gas lines be purged of both Air and DEBRIS prior to installing an Electronic Ignition System on the gas line. Debris in new gas lines is the number one cause of leaking valves. Even though both the Inlet and Outlet of the AWEIS has a fine stainless steel screen installed to try and prevent debris from entering, fine dust and small pieces of debris can get through the screen. All new gas lines that have been buried in the ground must be pressure tested up to 60 psi to ensure there are no leaks. After the inspection is complete most plumbers will release the pressure in the line at one location in the gas line by opening up a ball valve or similar. Our recommendation is to release that pressure by opening up the ball valves (or key valves) associated with all the fire features. As an example if there are four automated fire features on a job, open up the first key valve for a few seconds and then close it. Then move on to the next key valve and do the same thing until you have purged the debris out of all four gas lines. At 60 psi it does not take long to get all the debris out of a gas line in just a few seconds and you will be amazed at the amount of debris that flies out when you open that valve!
   After the gas has been turned on and you are about to install the AWEIS we recommend you open each key valve until you smell gas before installing the AWEIS. By doing this the fire feature will ignite immediately after you have turned on the power to the AWEIS otherwise you may have to wait a long time for all the air to purge out through the Pilot Burner before gas finally gets through the gas line to the feature.

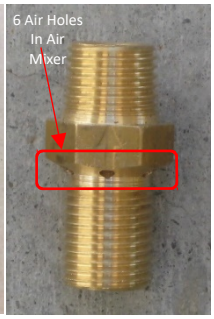
6. **Additional Propane Precaution** – as mentioned previously Propane is heavier than air and as a result unburned Propane descends as opposed to drift up into the atmosphere like Natural Gas. Though proper ventilation of the fire feature helps considerably we highly recommend additional precautions to ensure the safety of Propane powered fire features.

Safety Backup Valve – it is recommended an electrically operated valve be added to the gas line supplying gas to the fire features. This valve turns On and Off with the Fire Features. This extra valve adds a layer of redundancy so that if a leak does develop in the fire feature no gas will flow because of the extra valve being closed.



7. Main Burner Orifice – Regardless which gas type you are using an orifice MUST be installed in the gas inlet of the burner. The orifice limits the amount of gas flowing to the burner which in turn ensures the flame is a safe and reasonable height so as not to be a safety risk for people or property near the feature. Pictured at right is a Natural Gas Orifice and an LP (Propane) Air Mixer. The LP Air Mixer has 6 holes that differentiate it from a Natural Gas orifice. To ensure proper operation of the Air Mixer it needs to be installed with a coupling and close pipe nipple as shown in the far-right photo. Natural Gas orifices can be installed without the coupling and close nipple needed for LP Air Mixers.


Natural Gas Orifice



LP Air Mixer Orifice

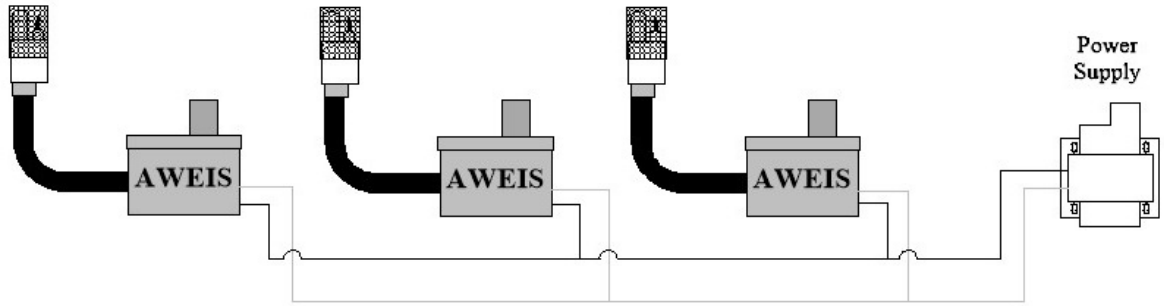

LP Air Mixer
Configured for
Install

Electrical Considerations

1. **Wire Gauge** – it is recommended no less than 12-gauge wire (12 AWG Solid or Stranded) be used for ALL installations. Wire sizes greater than 12 AWG are acceptable as well.

2. **Power Requirements**
   Tiki Torches / Vulcan Fire Module – Minimum of 35 Watts @ 24 VAC for each
   AWEIS – Minimum 50 Watts each (24VAC Systems). Minimum 60 Watts each (30VDC Systems)

3. **Daisy Chain Wiring of multiple features vs. Home Runs to each feature** – it is not required that a dedicated pair of wires be run to each fire feature. Daisy chain wiring is acceptable. When Daisy Chain wiring multiple features polarity between fire features is important as shown in the illustration below.



4. **Determining the Proper Power Supply for your Job** - Refer to Tables A thru D below to determine the proper power supply needed to provide enough power for the wiring method you are using, the number of features you are installing, and the length of the wire runs to each feature.

Table A
Recommended Power Source when Daisy Chain Wiring of Fire Features (30VDC)

# Fire Features	Distance (feet) from Power Source to Furthest Fire Feature							
	50	100	150	200	250	300	400	500
1	185	185	185	185	185	185	185	185
2	185	185	185	185	185	185		
3	185	185	185	185				
4	320	320	320			(Not enough power supplied by either power sources at these distances)		

Table B
Recommended Power Source when Home Runs Installed to each Fire Feature (30VDC)

# Fire Features	Distance (feet) from Power Source to Furthest Fire Feature							
	50	100	150	200	250	300	400	500
1	185	185	185	185	185	185	185	185
2	185	185	185	185	185	185	185	185
3	185	185	185	185	185	185	185	185
4	320	320	320	320	320	320	320	320

Table C
Recommended Power Source when Daisy Chain Wiring of Fire Features (24VAC)

# Fire Features	Distance (feet) from Power Source to Furthest Fire Feature							
	50	100	150	200	250	300	400	500
1	50	50	50	50	50	50	50	50
2	100	100	100	100	100	100		
3	150	150	150	150				
4	200	200	200			(Not enough power can be supplied over 12 AWG wire for these distances)		

Table D

Recommended Power Source when Home Runs Installed to each Fire Feature (24VAC)

# Fire Features	Distance (feet) from Power Source to Furthest Fire Feature							
	50	**100**	**150**	**200**	**250**	**300**	**400**	**500**
1	50	50	50	50	50	50	50	50
2	100	100	100	100	100	100	100	100
3	150	150	150	150	150	150	150	150
4	200	200	200	200	200	200	200	200

5. **Fire Features near a Swimming Pool or Spa (within 5')** – On January 1, 2018 the National Electrical Code (NFPA 70) 2017 Edition took effect. In this edition a paragraph was added pertaining to "Low Voltage Gas Fired Fireplaces, Firepits and Similar Equipment" also known as "Automated Fire Features"**.** In previous editions automated fire features were not even recognized so this is a big step in the right direction for automated fire features. In essence this is what the paragraph states: You can install Electronic Ignition Fire Features close to the pool (within 5') if you abide by the following:
   1. The Electronic Ignition System must be a listed (certified) as a low voltage Ignition System
   2. The power supply used to power the Ignition System must be certified for use with submersible swimming pool and spa lights and be labeled as such.
   3. The power supply must not exceed 15 VAC or 30 VDC.
   4. The Power Supply Junction Box AND Gas Pipe must be bonded using 8 AWG or larger Copper Bonding Conductor.

   See Attachment 1 "Excerpts from Article 680, National Electric Code 2017 Edition" to see the actual verbiage from the National Electric Code 2017 Edition.

   The AWEIS, Tiki Torches and Vulcan Fire Module are all available in a 30VDC version and come with a 30VDC Power Supply certified for use with Submersible Swimming Pool and Spa Lights.

6. **Options for Turning Fire Features On/Off** - Automated Fire Features are turned On/Off by way of electricity. When electrical power is applied the fire feature turns ON and when power is removed it turns OFF. Power can be removed by way of a power outage or by other means. Regardless how the power is removed the fire feature will go off if it is removed. Here is a list of the possible devices that can be used to turn Automated Fire Features On and Off:

   On/Off Switch – a simple wall switch that controls High Voltage (120VAC or Higher) Power going to the transformer or power supply which supplies Low Voltage Power to the fire feature.

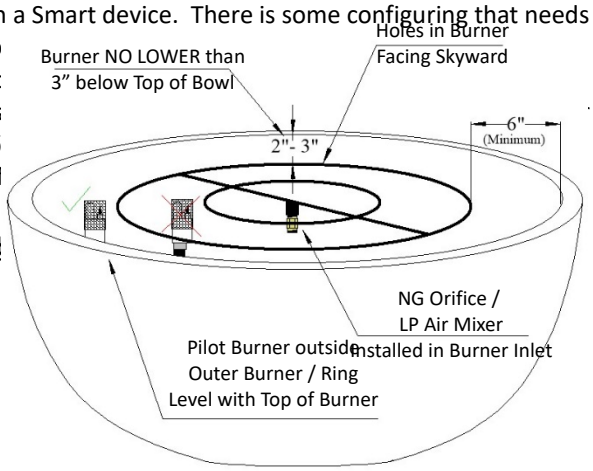
   Timer – can be either a Mechanical (Wind-Up) or Digital Timer that controls High Voltage Power going to the transformer or power supply which supplies Low Voltage Power to the fire feature. Mechanical Timers are a great option for apartments or condos due to the fact it allows the tenants to turn the feature on but then the feature turns off automatically when the time expires.

   Emergency Stop Switch – Emergency Stop Switches can be used to turn fire features On and Off however they are best used as a "Secondary" method for turning the fire feature On and Off with a wall switch or similar being used as the "Primary" means for turning the feature On and Off. Emergency Stop Switches often times are required on Commercial projects and are usually close to the feature and in plain sight. This way if there is an emergency anyone close by can turn the feature Off quickly by pushing the Emergency Stop Switch.

   Remote Control (RC Kit) – There is a remote control for just about everything these days. We offer a Remote Control Kit that is mounted in a Weatherproof Junction Box and comes with two handheld remotes. When you buy our Remote Control it is configured to your specifications. As an example if you have two fire features and you want them to be turned on independent of each other we will configure it such that one button on the remote control turns on one of the features and another button turns on the other feature.

   Smartphone / Tablet – You can also control your fire features by way of your Smartphone or Tablet. We offer a Smart Phone Remote Control similar in appearance to the RC Kit mentioned previously however it does not come with handheld remote controls due to the fact you control with a Smart device. There is some configuring that needs to be done with the Smart Phone Remote Control system in

   Swimming Pool Controller – if your fire features are being installed controlled by some sort of Pool Controller (such as a Penta features by way of these controllers if the power to your f Talk to your Swimming Pool Contractor about this option f



Fire Bowl Consid

In the illustration at right you see a proper install of a burner inside a Fire Bowl. The same guidelines apply to both Concrete and Metal Fire Bowls.

The 6" clearance shown between the Burner and the Inside Face of the bowl is a "Minimum" dimension. This clearance is meant to protect the bowl from the heat of the flames. Clearance less than 6" can cause the bowl to get so hot it cracks / warps the bowl while at the same time creating an "oven" inside the bowl which could damage the AWEIS.

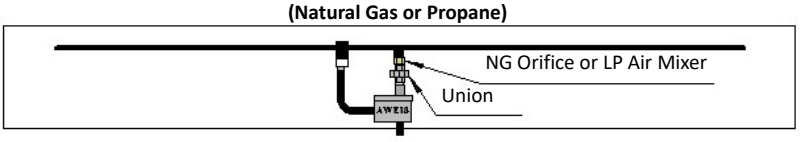
Linear Fire Feature Considerations

We have supplied components for Linear Fire Features as short as 24" and as long as 100' with many sizes in between. For Linear Fire Features with burners no longer than 20' one long burner is all that is needed as shown in the top illustration below. One AWEIS configured with one Pilot Burner is all that is needed. The size AWEIS required depends on the length (gas load) of the linear burner.
For Linear features longer than 20' we recommend multiple linear burners connected to the Outlet of the AWEIS by way of the "Outlet Gas Manifold" shown in the middle and bottom illustrations below. Configuration of the AWEIS depends on the gas being used.

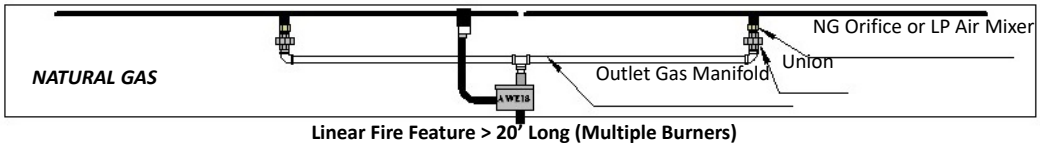
For Natural Gas One Pilot Burner located at the junction of the ends of the two burners will work. This one Pilot Burner will ignite the gas from both burners when the gas reaches the ends of the burner.

For Propane it is HIGHLY recommended one Pilot Burner be located AT the gas inlet of each burner. This positioning of the Pilot Burner ensures that the Propane entering the linear burner will ignite as soon as it gets to the burner as opposed to waiting for the gas to get to the end of the burner as described above for Natural Gas. With Propane it is important to ignite the gas as quickly as possible to lessen the chances of unburned Propane from seeping down into the feature.

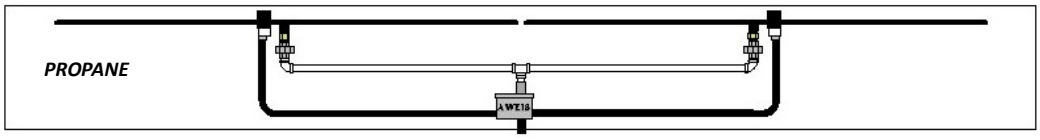
Linear Fire Feature < 20' Long (Single Burner)
(Natural Gas or Propane)



Linear Fire Feature > 20' Long (Multiple Burners)
(Natural Gas – One (1) Pilot Burner Centered)



Linear Fire Feature > 20' Long (Multiple Burners)
(Propane – Pilot Burner at each Burner Inlet)



Fire Feature Media Considerations

There are only a few media types that are ACCEPTABLE for fire features. Using the wrong type of media can be DANGEROUS to people and property near the feature. Rock that is not acceptable for fire features has small air pockets within the rock. When exposed to a flame in a fire feature the air in these pockets expands as the heat rises. At some point the air exerts enough pressure within the rock to crack the rock and send shards flying. These flying shards are a hazard you want to avoid

at all cost. For this reason it is important to use media in your fire features that is acceptable for use in these type features. The list of acceptable media includes the following:

- Lava Rock (any shape/finish but NO LARGER than 3" in diameter – larger lava causes HEAT DAMAGE)
- Fireglass (preferred size ½" or larger when used with AWEIS)
- Any media made from Refractory Material

Use of Gas Logs in an Automated Fire Feature

Use of artificial "gas" logs in a firepit or fireplace is a nice addition to these type features. Not only do they enhance the look of the feature they also provide more heat to the people sitting around it. Gas logs absorb the heat of the fire and once hot, they radiate that heat in all directions. This radiant heat makes the feature seem hotter when compared to a feature without gas logs. This extra heat can cause problems for the Pilot Burner if a gas log is positioned directly ABOVE the Pilot Burner. Therefore when installing gas logs in a feature that also has an AWEIS position the logs such that the Pilot Burner is at least approximately 6" away from the closest log.

Use of Electronic Ignition in Wood Burning Fire Feature

Wood burning fire features are SIGNIFICANTLY hotter than gas burning features. The intense heat generated in these features would destroy any electronic ignition system located inside the feature. The key to successful electronic ignition operation in a wood burning fire feature is to locate the electronics (AWEIS Ignition Control Box) outside the feature. With the AWEIS outside the feature you will need to run 2 gas lines and one (electrical) wire harness from the AWEIS Box to the fire feature. One of the gas lines will supply gas to the Pilot Burner while the other gas line supplies gas to the main burner inside the feature. The wire harness will supply the electrical power to the Pilot Burner. The Pilot Burner in a wood burning feature must be installed as low as possible in the feature to minimize the amount of radiant heat it is exposed to.

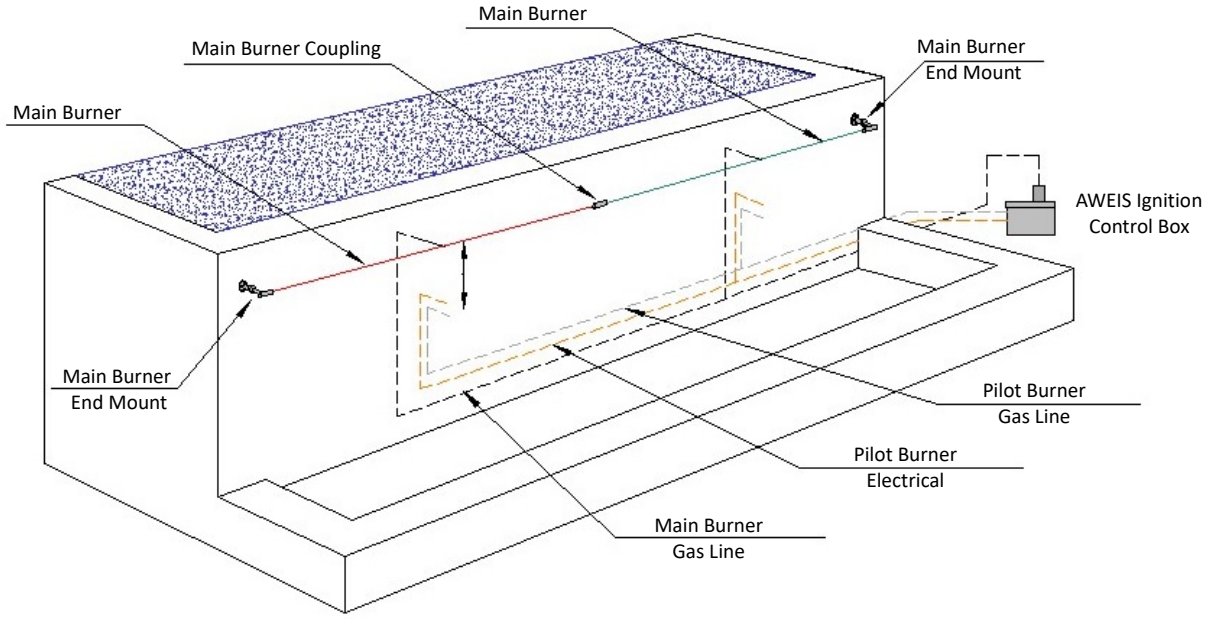
Fire Feature Drainage Considerations

As obvious as it might seem drainage of a fire feature is often overlooked. Proper drainage ensures the fire feature will not fill up with enough water to submerge the components in the feature. Occasionally however we see fire features that are either AT or BELOW ground level. In places where it rains a lot even the best drainage can be overwhelmed to the point the feature fills up with water anyway. For features located ABOVE ground level drainage is simple; either install a drain line made from pvc pipe or similar or design the feature such that there are openings in the structure to allow water to escape the feature. For features AT or BELOW ground level special precautions need to be made. With regards to protecting the AWEIS from flooding we offer an upgrade option for all AWEIS that make them waterproof. Once waterproofed the AWEIS can be submerged indefinitely without damaging it. The only remaining issue then becomes "How to remove the water from the burner after flooding occurs?" We offer burners made from 316 Stainless Steel (commonly referred to "Marine" grade stainless steel due to its resistance to rusting in wet environments) that are easily disassembled due to their construction. With one of these burners, if your feature were to fill up with water all you have to do is loosen the compression fitting holding the burner in place, rotate the burner one half turn thus allowing the water to drain out and then retighten the compression fitting.

Negative Edge Fire Feature Considerations

Negative Edge Fire Features are becoming increasingly popular. This type feature is best installed in the pool prior to the concrete shell. In the illustration below you will notice the AWEIS Ignition Control Box is located to the right side of the Negative Edge some distance away from the actual feature. Often the Ignition Control Box will be installed inside a Landscape Box or similar to hide it from plain view. From the Ignition Control Box there will be one gas line supplying gas to the Main Burner(s), a second gas line supplying gas to the Pilot Burner(s) and an electrical conduit for the wire harness supplying power to the Pilot Burners as shown in the illustration below. Also shown is the hardware for mounting the main

burners to the back of the Negative Edge; the Main Burner End Mounts and the Main Burner Coupling. This hardware will be supplied to you as part of the Negative Edge Fire Feature Kit.



Fire ON Water Feature Considerations

Fire ON Water Features are becoming increasingly popular as well. Not too many years ago the gas pressure required to operate these type features was 2 psi. With advancements in technology we can operate smaller Fire ON Water features on gas pressures as low as ¼ psi. Below is a table showing the gas pressures required for submersible manifolds. Here is an example how to use the table. Assume you have standard residential Natural Gas Pressure (1/4 psi) and you want to install an H Shaped Manifold measuring 3' long. The total linear feet of this H Burner is 6'. Enter Table 1 below in the row starting with "1/4" and move right until you find "6'" in the far-right column. From the table you see you need the High Capacity SUBEIS for this feature.

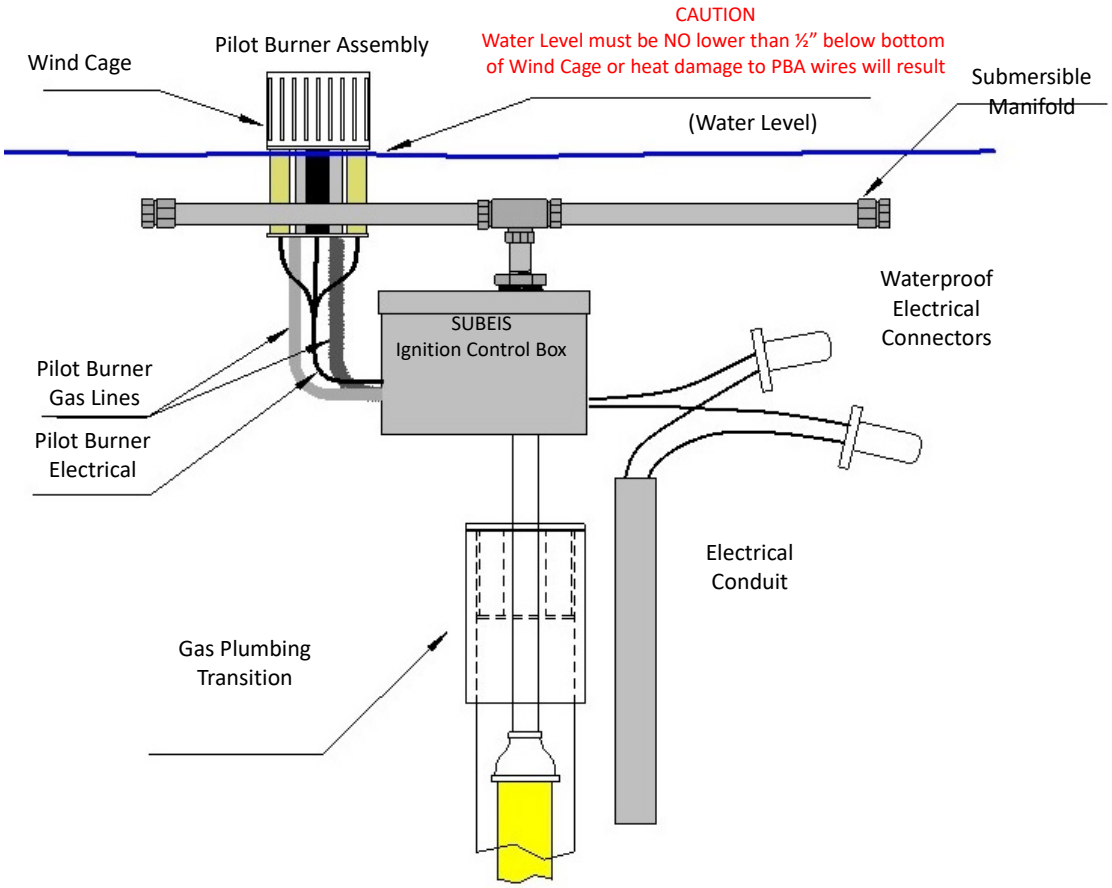
Table 1
Maximum Submersible Manifold Length for Various Gas Pressures
(Total Linear Feet of Manifold)

Gas Pressure (psi)	SUBEIS System		
	Mini Capacity	Standard Capacity	High Capacity
1/4	4'	5'	6'
1/2	12'	14'	16'
2*	20'	20'	20'

* At 2 psi the maximum linear manifold length is 20' regardless of which SUBEIS is installed.

Illustration of Typical Fire ON Water Installation

Below is an illustration showing a proper install of a SUBEIS with Submersible Manifold. The number one question we hear is "What is the deepest I can install the Submersible Manifold?" We recommend installing the Submersible Manifold NO DEEPER than 12" below the water surface. The number one troubleshooting issue we see with Fire ON Water features is the height at which the Pilot Burner Assembly is installed. Below you see the Caution regarding the height of the Pilot Burner. If the Pilot Burner is too high up out of the water the wires associated with the Pilot Burner can get burned from the flames that are on top of the water. If the Pilot Burner is too low in the water the water will prevent the Pilot Burner from operating at all. Correct vertical positioning of the Pilot Burner is the key to proper, long term operation.



Propane versus Natural Gas for Fire ON Water Features

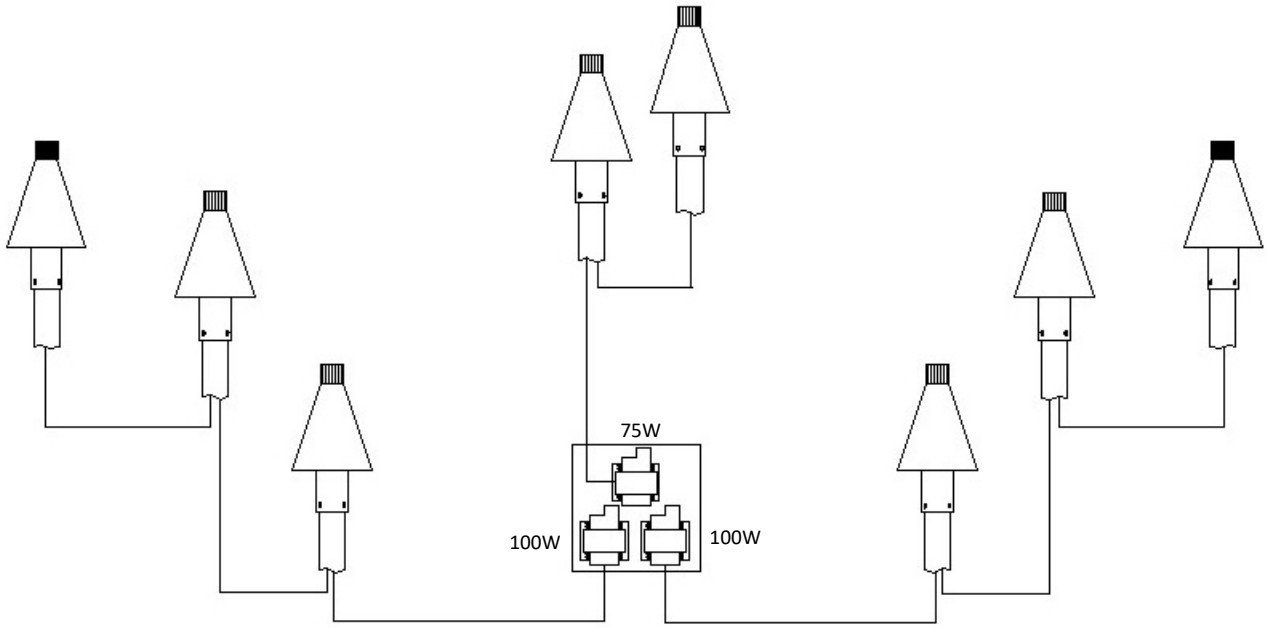
Due to the fact Propane is heavier than air any Propane that comes out of the Submersible Manifold that is not consumed by the fire will remain on the surface of the water. You can see the Propane on the surface of the water and it looks like small patches of oil on the surface – not something you want accumulating on the water surface. This same problem does not exist when using Natural Gas. Any unburned Natural Gas floats up and away from the pool. To rid your pool of these patches of oil it is recommended you add "Scum Balls" to the pool or in the skimmer for the pool. The scum balls do a great job of cleaning the pool because when the oil touches the ball it sticks to it. When the ball is saturated with Propane it will look dirty at which time you replace it.

Tiki Torch Considerations

To make the installation of Tiki Torches as simple as possible it is recommended to daisy chain tiki torches in groups of 3 or less. The recommended wire size to be installed 12 gauge or larger. Solid or stranded wire is acceptable. The maximum wire run length when daisy chaining 3 tiki torches is 150' between the furthest tiki torch and the power supply. As far as power consumption plan on 35 Watts @ 24 VAC for each tiki torch.

The following is an example of how to plan your install: Assume you are going to install 8 tiki torches. First, let's calculate the power needed. Eight tiki torches at 35 Watts each equals a total power requirement of (8 x 35) 280 Watts. The standard transformers we offer are 50, 75 and 100 Watt Transformers. We recommend the 50-Watt Transformer for one tiki torch, the 75-Watt Transformer for two tiki torches and the 100-Watt Transformer for three tiki torches. Higher wattage transformers are available upon request. Knowing we need 280 Watts we could get one transformer rated at 300 Watts (they don't make 280 Watt transformers so we need to round up) or we could go with (2) 100 Watt transformers and (1) 75 Watt transformer. Below is an illustration showing what the final install might look like. Notice the two tiki torches in the

middle are being powered by (1) 75 Watt Transformer and the two groups of three left and right are each being powered by 100 Watt Transformers.



Important Tiki Torch Ordering Instructions

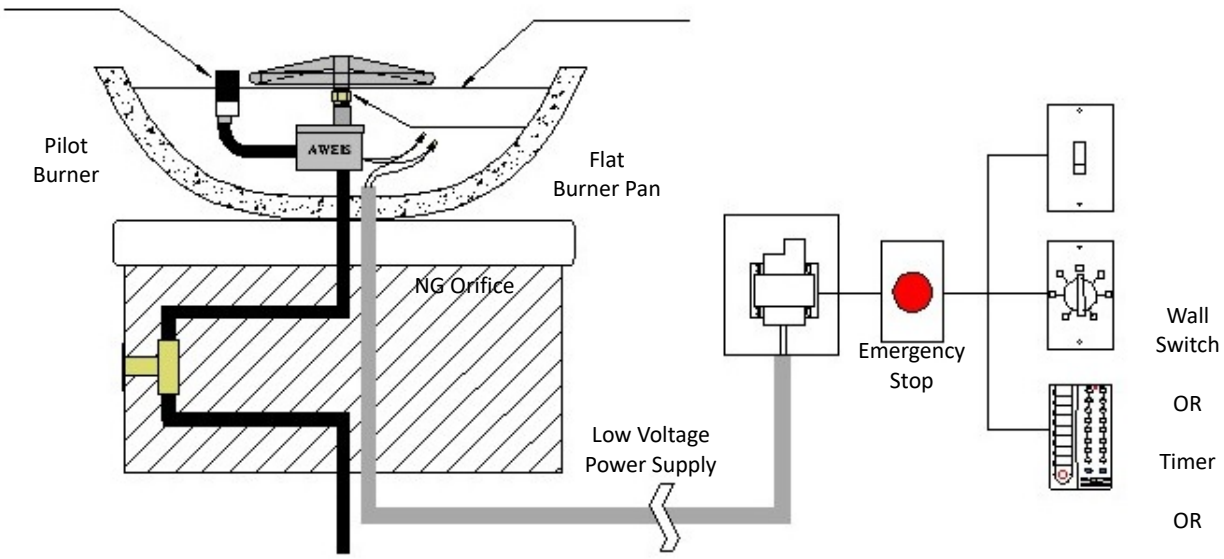
To ensure you receive the correct transformers for your install please provide the following information:

1. How many Groups of Tiki Torches you are planning.
   (In the above example there are two groups of 3 and one group of 2)
2. Whether you prefer standard transformers (50W, 75W and 100W) or one higher watt transformer.
3. The gas type you are using (Natural Gas or Propane).

Daisy Chain Wiring of Tiki Torches

As described previously when daisy chaining multiple feature ensure the polarity between the tiki torches is the same (see top of page 6 for more detail.

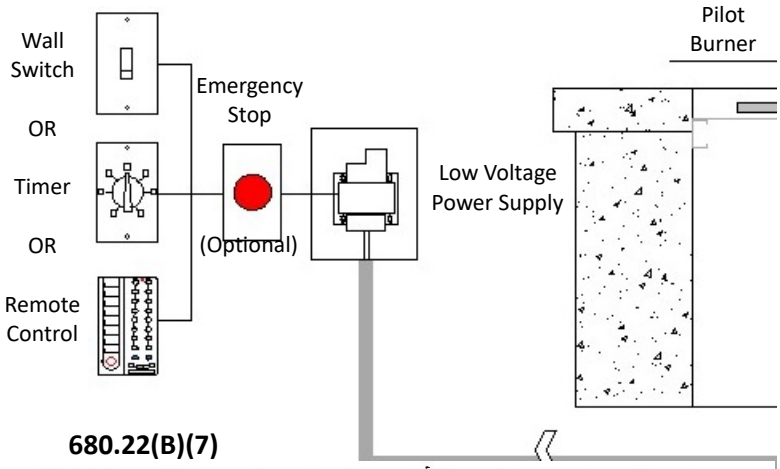
<u>Illustrations of Proper Installations</u>



Manual
Gas Shutoff
(Key Valve)

(Optional)

Typical Fire Pit Installation



680.22(B)(7)

N **(7) Low-Voltage Gas-Fired Luminaires, Decorative Fireplaces, Fire Pits, and Similar Equipment.** Listed low-voltage gas-fired luminaires, decorative fireplaces, fire pits, and similar equipment using low-voltage ignitors that do not require grounding. and are supplied by listed transformers or power supplies that comply with 680.23(A)(2) with outputs that do not exceed the low-voltage contact limit shall be permitted to be located less than 1.5 m (5 ft) from the inside walls of the pool. Metallic equipment shall be bonded in accordance with the requirements in 680.26(B). Transformers or power supplies supplying this type of equipment shall be installed in accordance with the requirements in 680.24. Metallic gas piping shall be bonded in accordance with the requirements in 250.104(B) and 680.26(B)(7).

(C) Switching Devices. Switching devices shall be located at least 1.5 m (5 ft) horizontally from the inside walls of a pool unless separated from the pool by a solid fence, wall, or other permanent barrier. Alternatively, a switch that is listed as being acceptable for use within 1.5 m (5 ft) shall be permitted.

(D) Other Outlets. Other outlets shall be not less than 3.0 m (10 ft) from the inside walls of the pool. Measurements shall be determined in accordance with 680.22(A)(5).

Informational Note: Other outlets may include, but are not limited to, remote-control, signaling, fire alarm, and communications circuits.

680.23 Underwater Luminaires. This section covers all luminaires installed below the maximum water level of the pool.

(A) General.

(1) Luminaire Design, Normal Operation. The design of an underwater luminaire supplied from a branch circuit either

680.24 Junction Boxes and Electrical Enclosures for Transformers or Ground-Fault Circuit Interrupters.

(A) Junction Boxes. A junction box connected to a conduit that extends directly to a forming shell or mounting bracket of a no-niche luminaire shall meet the requirements of this section.

(1) Construction. The junction box shall be listed, labeled, and identified as a swimming pool junction box and shall comply with the following conditions:

(1) Be equipped with threaded entries or hubs or a nonmetallic hub
(2) Be comprised of copper, brass, suitable plastic, or other approved corrosion-resistant material
(3) Be provided with electrical continuity between every connected metal conduit and the grounding terminals by means of copper, brass, or other approved corrosion-resistant metal that is integral with the box

(2) Installation. Where the luminaire operates over the low voltage contact limit, the junction box location shall comply with (A)(2)(a) and (A)(2)(b). Where the luminaire operates at the low voltage contact limit or less, the junction box location shall be permitted to comply with (A)(2)(c).

(a) *Vertical Spacing.* The junction box shall be located not less than 100 mm (4 in.), measured from the inside of the bottom of the box, above the ground level, or pool deck, or not less than 200 mm (8 in.) above the maximum pool water level, whichever provides the greater elevation.

(b) *Horizontal Spacing.* The junction box shall be located not less than 1.2 m (4 ft) from the inside wall of the pool, unless separated from the pool by a solid fence, wall, or other permanent barrier.

(c) *Flush Deck Box.* If used on a lighting system operating at the low voltage contact limit or less, a flush deck box shall be permitted if both of the following conditions are met:

(1) An approved potting compound is used to fill the box to prevent the entrance of moisture.
(2) The flush deck box is located not less than 1.2 m (4 ft) from the inside wall of the pool.

(B) Other Enclosures. An enclosure for a transformer, ground-fault circuit interrupter, or a similar device connected to a conduit that extends directly to a forming shell or mounting bracket of a no-niche luminaire shall meet the requirements of this section.

(1) Construction. The enclosure shall be listed and labeled for the purpose and meet the following requirements:

(1) Equipped with threaded entries or hubs or a nonmetallic hub
(2) Comprised of copper, brass, suitable plastic, or other approved corrosion-resistant material
(3) Provided with an approved seal, such as duct seal at the conduit connection, that prevents circulation of air between the conduit and the enclosures

680.23(A)(2)

(2) Transformers and Power Supplies. Transformers and power supplies used for the supply of underwater luminaires, together with the transformer or power supply enclosure, shall be listed, labeled, and identified for swimming pool and spa use. The transformer or power supply shall incorporate either a transformer of the isolated winding type, with an ungrounded secondary that has a grounded metal barrier between the primary and secondary windings, or one that incorporates an approved system of double insulation between the primary and secondary windings.

680.2 Definitions

Low Voltage Contact Limit. A voltage not exceeding the following values:

(1) 15 volts (RMS) for sinusoidal ac
(2) 21.2 volts peak for nonsinusoidal ac
(3) 30 volts for continuous dc
(4) 12.4 volts peak for dc that is interrupted at a rate of 10 to 200 Hz