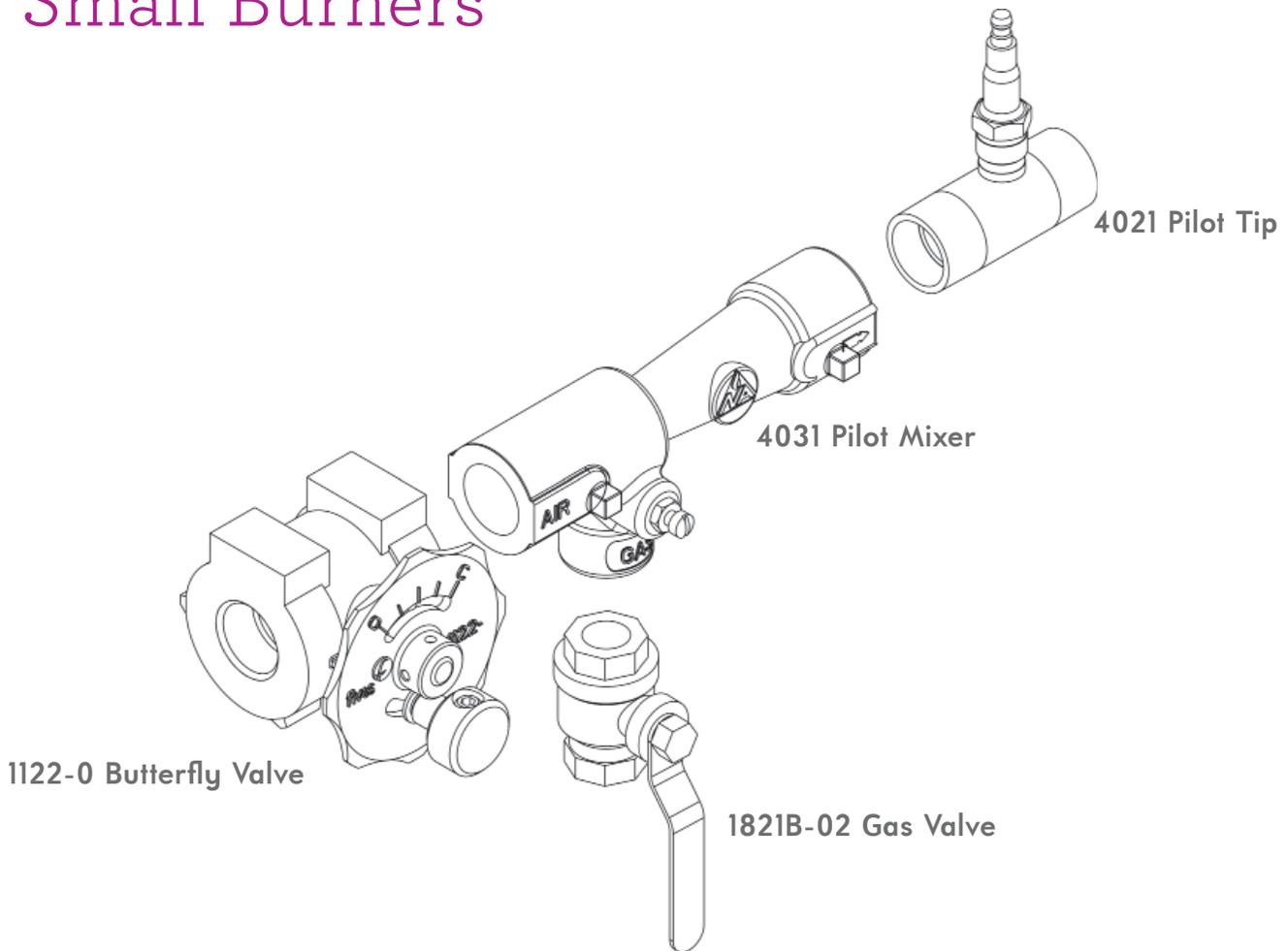


# North American 3/4" Pilots for Small Burners



## 4011/4021 Pilot components for burners with 3/4" pilot connection

- Reliable premix pilot components for lighting gas or oil burners with 3/4" pilot connection
- Featuring the versatile 4021 pilot tip and 4031 pilot mixer
- Spark ignition or manual lighting options
- Models for threaded 3/4" ports, slip fit 1" or slip fit 1 1/8" pilot ports
- Includes a 1122-0 manual air butterfly valve with knurled locking knob and a manual gas ball valve

# Capacity | 4011/4021 Pilot

Table 1

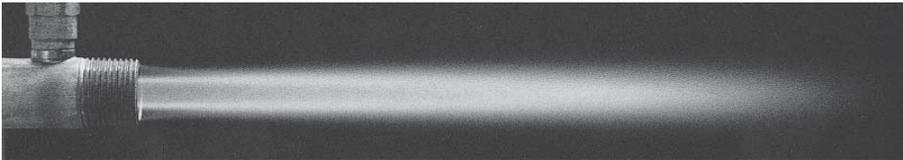
4021 Mixture P. "w.c. (mbar)	4031 Inlet Air P. "w.c. [osi] (mbar)	4031 Mixer DP "w.c. (mbar)	Air Flow scfh (Nm3/h)	Capacity Btu/h HHV (kW LHV)	Flame Length inches (mm)
1" (2.5)	2.9" [1.7] (18)	1.9" (15.5)	120 (3.4)	12,000 (3.5)	5" (130)
2" (5.0)	5.8" [3.4] (35)	3.8" (30)	165 (4.7)	16,000 (4.7)	7" (180)
4" (10)	12.0" [6.9] (72)	8.0" (62)	245 (6.9)	24,000 (7.0)	8" (200)
7" (17)	22.5" [12.9] (125)	15.5" (108)	325 (9.2)	32,000 (9.4)	9" (230)
9" (20)	29" [16.6] (160)	20" (140)	370 (10.5)	36,000 (10.5)	10" (250)
12" (30)	38" [22.2] (215)	26" (185)	425 (12)	42,000 (12.3)	10" (250)

Table 1 above, and the figures below show pressures and capacity data for all 4011 pilot sets while burning. Note that these pressures, flows and flame lengths will vary depending on air/fuel ratio and burner mounting geometry, For most application set the air pressure into the 4031 mixer to 6-8 osi (10.5-14"w.c.) or mixture pressure to 3-5"w.c.

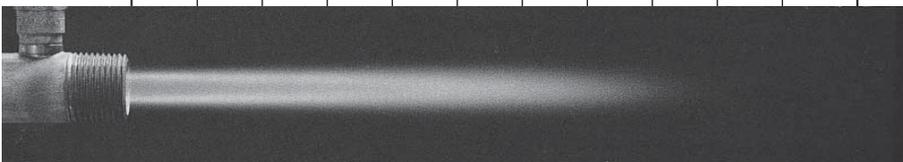
Maximum Mixture Pressure for stability or lighting with a cold tip firing in the open:

4021-12, 14, 16 (spark ignited) 12"w.c. / 4021-11, 13, 15 (manual) 9"w.c.

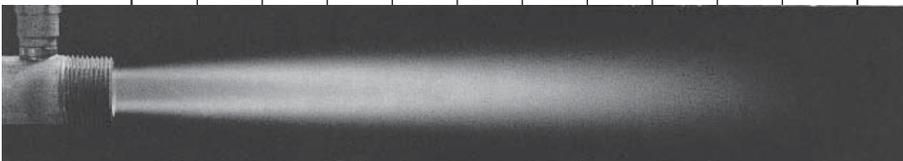
## 4021 Pilot Flames



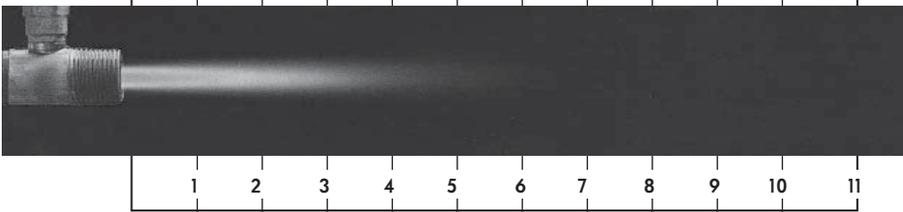
Stoichiometric ratio and 7"w.c. mixture pressure, produced by 16 osi air into 4031 Mixer--30,000 Btu/hr.



The same 7"w.c. mixture pressure with air/gas ratio set at 25% excess air.



The same 7"w.c. mixture pressure with air/gas ratio set at 15% excess fuel.



Stoichiometric ratio and 1"w.c. mixture pressure (12,500 Btu/h HHV).

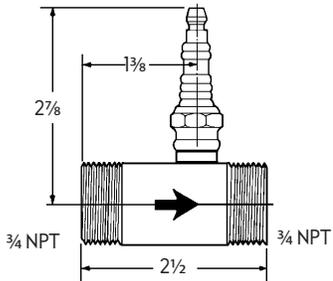


Scale: length in inches

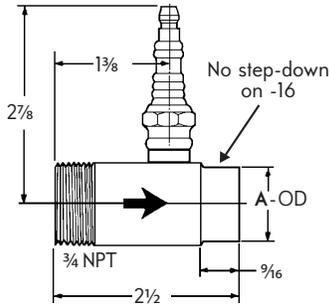
# Set Components | 4011/4021 Pilot

## 4021 PILOT TIPS

**Spark Ignited**  
(wt. 5.6 oz.)

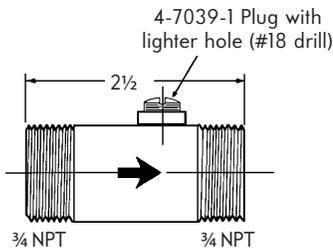


**Threaded**  
4021-12

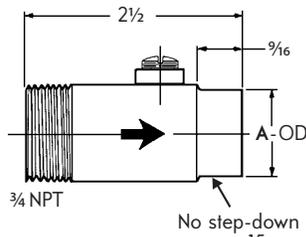


**Slip-Fit**  
4021-14: "A" = 1"  
4021-16: "A" = 1 1/8"

**Manually Lit**  
(wt. 3.5 oz.)

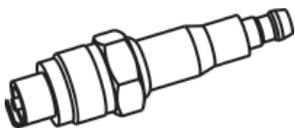


**Threaded**  
4021-11



**Slip-Fit**  
4021-13: "A" = 1"  
4021-15: "A" = 1 1/8"

- All pilot tip inlet threads are 3/4" NPT, as are discharges of 4021-11 and -12.
  - 4021-13 and -14 have 1" Ø slip fit and 4021-15 and -16 have 1 1/8" Ø slip fit
  - Spark ignited and manual lit tips can be converted to the other by changing plugs.
  - The spark plug ships with a 0.034 Inch gap, in some cases a slightly larger gap (0.05) is more reliable.
- The maximum gap is about 0.090" (electrode at 45° angle).

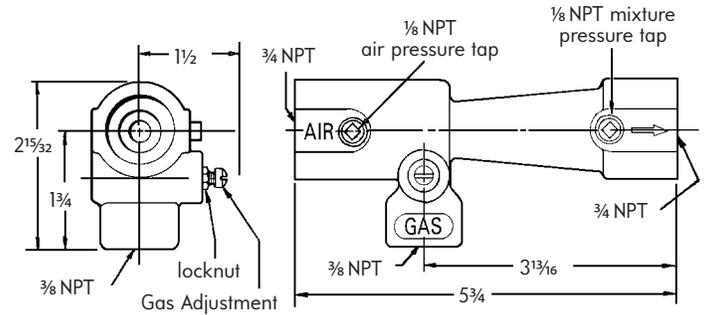


Spark plug  
Part number R240-2465  
(included with -12, -14, -16)



Lighter hole plug  
Part number 4-7039-1  
(included with -11, -13, -15)

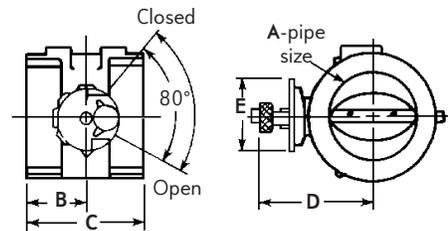
## 4031 PILOT MIXER (wt. 27 oz.)



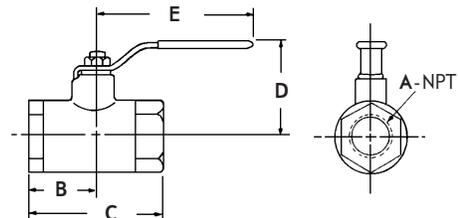
The 4031 Mixer's built-in gas adjustment is a precision needle valve, providing 14 full turns from closed to open. It sets desired gas flow at pressures between zero and 24 osi (42" w.c.).

The inlet air tap or the air/fuel mixture pressure tap on the 4031 mixer should be cross connected to the pilot gas regulator so that the pilot's air/fuel ratio will not be affected by changes in back pressure at the pilot tip. The inlet pressure to the pilot gas regulator should be at least 2 osi (3.5" w.c.) greater than the connected pilot air or mixture pressure.

## VALVES



The 1122-0 Air Butterfly Valve sets pilot firing rate with a knurled knob locking device that prevents accidental changing of valve setting. The knurled knob can be set by hand or it can be replaced with a socket head cap screw (provided in the knob) to secure the valve position setting and discourage tampering.



The 1821B-02 Ball Valve is a manual gas shut-off valve

**Table 2**

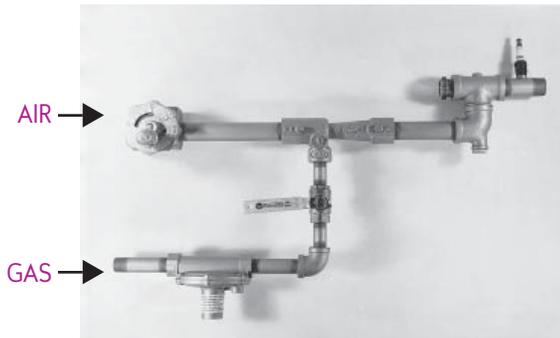
Valve	dimensions in inches					wt, lb
	A	B	C	D	E	
<b>1122-0 (air)</b>	3/4	1 3/16	2 3/8	2 3/4	3	2
<b>1821B-02 (gas)</b>	3/8	1 5/16	1 27/32	1 13/32	2 31/32	0.5

# Ordering Information | 4011/4021 Pilot

Table 3

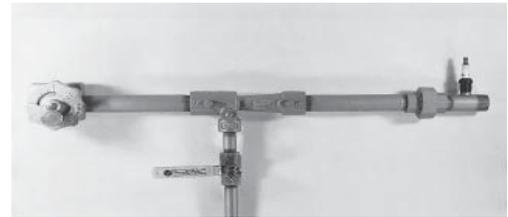
4011 Set	4021 Pilot Tip	(pilot tip exit connection)	(Ignition)
4011-11	4021-11	¾" NPT	Manual Light
4011-12	4021-12	¾" NPT	Spark Ignited
4011-13	4021-13	1" Ø Slip Fit	Manual Light
4011-14	4021-14	1" Ø Slip Fit	Spark Ignited
4011-15	4021-15	1½" Ø Slip Fit	Manual Light
4011-16	4021-16	1½" Ø Slip Fit	Spark Ignited

4011 Sets include a 4021 Pilot Tip, 4031 Pilot Mixer, 1122-0 Butterfly Valve and 1821B-02 Gas Valve



4011 Pilot Set with 4041 Universal Pilot Fitting, 7350 Regulator, and piping.

Two of many possible piping configurations are shown below and to the left. A tip can be screwed directly into a 4031 Mixer.



4011 Pilot Set with piping, including a union.

## OPTIONAL NORTH AMERICAN PILOT ACCESSORIES

7350- -A and 7350 Pilot Ratio Regulator

See Bulletin 7350 for more detailed information.

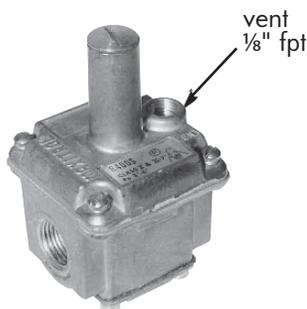
**Maximum Inlet Pressure\*:** 7350- -A: 1 psi, 7350: 5 psi  
 \*For CSI compliant systems inlet must be less than 0.5 psi

**Outlet Pressure Range:** 7350- -A: 1.5"w.c. to 1"w.c.  
 7350: 3"w.c. to 6"w.c.

**Gases:** Natural, LP, LP gas-air

Table 4

Capacity, scfh of 0.6 gravity gas	pres. drop across regulator, "w.c.		
	0.1	0.2	0.3
7350-02-A	54	77	95
7350-01-A	60	85	105
7350-02	54	77	95
7350-01	60	85	105



### When to use the 7350-01-A or -02-A

- The 7350-\_-A provides better air/fuel ratio control when used as a cross connected ratio regulator. This is because it delivers a lower gas pressure to the mixer, which makes the gas adjustment screw less sensitive.

- The 7350-\_-A must be piped horizontally, and the maximum inlet gas pressure to the 7350-\_-A is 1 psi.

### When to use the 7350-01 or -02

- The 7350-01 or -02 can be used with up to 5 psi inlet pressure.

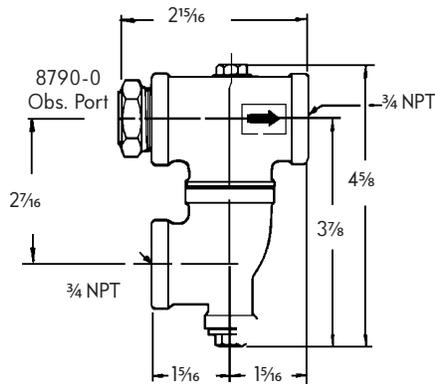
- The 7350-01 or -02 can be piped in any orientation.

### For both regulators

The inlet pressure to the pilot gas ratio regulator must be at least 3.5"w.c., (2 psi or 20 mbar) greater than the cross-connected pressure (at the pilot air or mixture tap). In most applications this will be 0.5 to 1.0 psi.

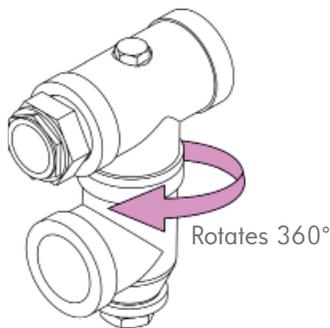
# Optional Pilot Accessories | 4011/4021 Pilot

## 4041 Universal Pilot Fitting optional (wt. 19.5 oz.)



A 4041 Fitting is piped between tip and mixer to allow mixer to be installed in a vertical or horizontal line regardless of pilot tip angle.

It also takes the place of a union for tip removal, and has an observation port for viewing. Pressure drop across it is negligible.

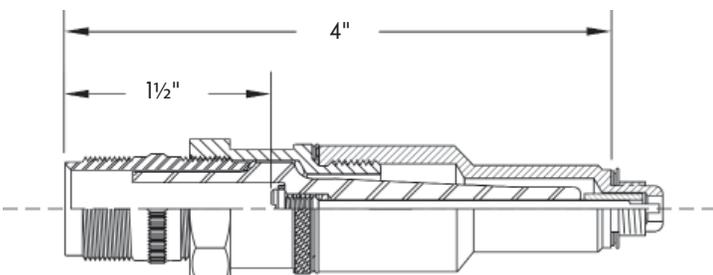


## Explosion Resistant Assembly (ERA) Igniters 10 mm ERA Igniters for Pilot Tips

See Bulletin 4055 for more detailed information

The 4055-X-ERA 10mm igniter is intended to ignite pilot tips in Class 1 Div. 2 applications. It has a 3/4"-20 threaded igniter connection for sealed aircraft type ignition wiring.

Although the wiring method used between the ignition transformer and the spark plug was designed and chosen to be suitable for use in Zone 2 hazardous locations, it DOES NOT carry certifications or third party approvals.



## 8666 Testips

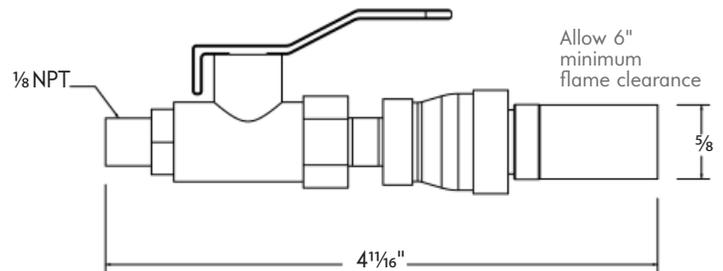
See Bulletin 8666 for more detailed information

The 8666 Testip facilitates setting air/fuel ratio when premix flames are not easily visible. The Testip is installed in a positive pressure mixture line and lit with a manual torch. Air/gas ratio is adjusted in the mixer until Testip flame seems appropriate.

Testips are turned off and removed after the ratio has been set. Since the Testip diverts some of the premix into itself, confirm the pilot ratio is still good after turning it off.

Use caution with 8666 Testips they are small burners and get very hot when run. Outdoors, the flame can be difficult to see in direct sunlight. Testips will not work in systems that operate with negative mixture pressure.

- A purple tinge indicates a lean ratio.
- A greenish-blue inner cone denotes a rich fire.
- Compare Testip flame with known correct burner ratio setting.



## Other Pilot Bulletins and Accessories

See product details on bulletins or sheets listed below

### North American Pilot Accessories:

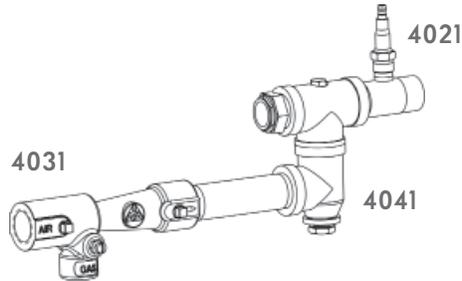
- 1400 (1486A-02B) Solenoid Valves, Specs, Dimensions
- 1821B Shutoff Valves
- 1122 Manual Butterfly Valves for Gas and Air
- 4031 Pilot Mixer
- 4065 Ignition Transformers
- 4074 Push Button Ignition Station
- 4085 Ignition Cable

### Other North American Pilots:

- 4014 Gas Boosted Pilot Assemblies
- 4015 Bulletin Gas Pilots (for large burners)
- 4018 High Pressure Gas Pilot Specifications
- 4020 Nozzle-Mix Gas Pilots for Industrial Burners
- 4027 Pilot Tips (3/4" Outlet with 1/2" Inlet)
- 8666 Testips

# Pilot Installation Tips | 4011/4021 Pilot

- To make it easier to remove a threaded pilot tip from the burner in the future. Use anti-seize compound on threaded discharges and screw hand tight into the burner mounting. Installing a pipe union or a 4041 between the pilot mixer and the pilot tip will also speed up pilot tip removal.

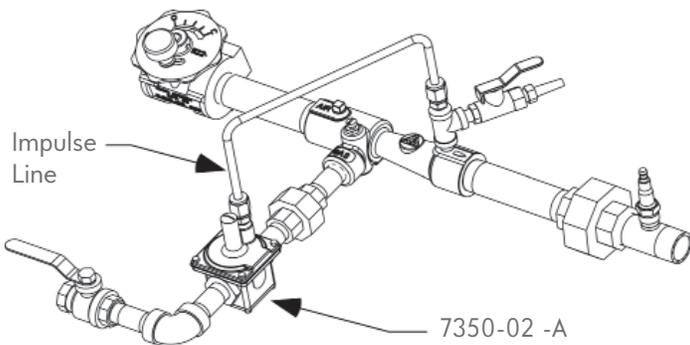


- Adding at least 5 pipe diameters of pipe between the mixer and the pilot tip adds additional mixing length to insure good quality premix.

- The preferred location for pilot tips (and UV cells) is on the top or side of a burner so that scale, dirt, and refractory crumbs cannot fall into it.

- "Zero governor" pilot systems require an atmospheric regulator (like the 7350-##-A) to supply gas at zero gauge pressure to the pilot mixer, but zero governor systems only work well in open air applications when there is no chance of back pressure.

If the burner back pressure varies (like in many pilot systems), the 7350 ratio regulator vent should be cross-connected with an impulse line to the 4031 mixture pressure tap or to the 4031 air pressure tap. Using the mixture pressure tap provides better air/fuel ratio control (especially on suction systems).

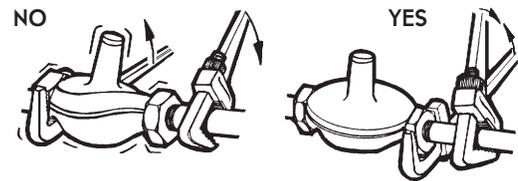


- Short run impulse lines for pilot systems should be 1/4" thin wall tubing. 304 stainless tube 1/4" OD x .035" wall is a good choice. Copper tubing can also be used, but is more susceptible to kinking.

- If the pilot regulator inlet gas pressure exceeds its pressure rating, install a pressure-reducing regulator upstream. 7344 Regulators reduce up to 25 psi gas to 4-12" w.c. For capacities or inlet pressures beyond the range of 7344 Regulators, see Bulletin 7337 and 7349. Use a separate pilot regulator. Do not run pilot gas through any of the regulators for main burner gas because those regulators cannot turn down low enough for pilot gas flow, and will therefore chatter or shut-off.

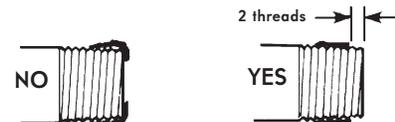
- The inlet pressure to the pilot gas ratio regulator (7350) should be at least 2 psi greater than the connected pilot air or mixture pressure.

- Avoid stressing and distorting valves and regulators, small pilot regulators may be easily damaged by incorrect use of wrenches. Put your wrench on the end nearest the pipe that it's being threaded into.

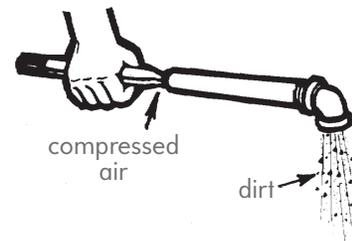


- Undersized piping and plugged lines are common causes of pilot problems. Avoid corrugated connectors and hoses, they cause more pressure loss than regular pipe and fittings. Tubing has 1/2 the area, and 4 times the pressure loss of the same "size" pipe. It's OK to use tubing that has as much flow area as pipe. (Example: use 7/8" OD x .045" wall tubing in place of 3/4" pipe)

- Avoid thread dope or Teflon tape applied over the ends of pipe thread, it can break loose and plug pilot tips.



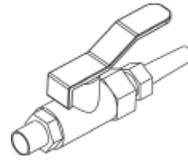
- Always blow out each fitting and section of pipe before and after installing it, (but don't put pressure on regulators and solenoid).



- A filter on the combustion air blower inlet will help prevent plugging the small openings in the pilot system with dirt and debris.

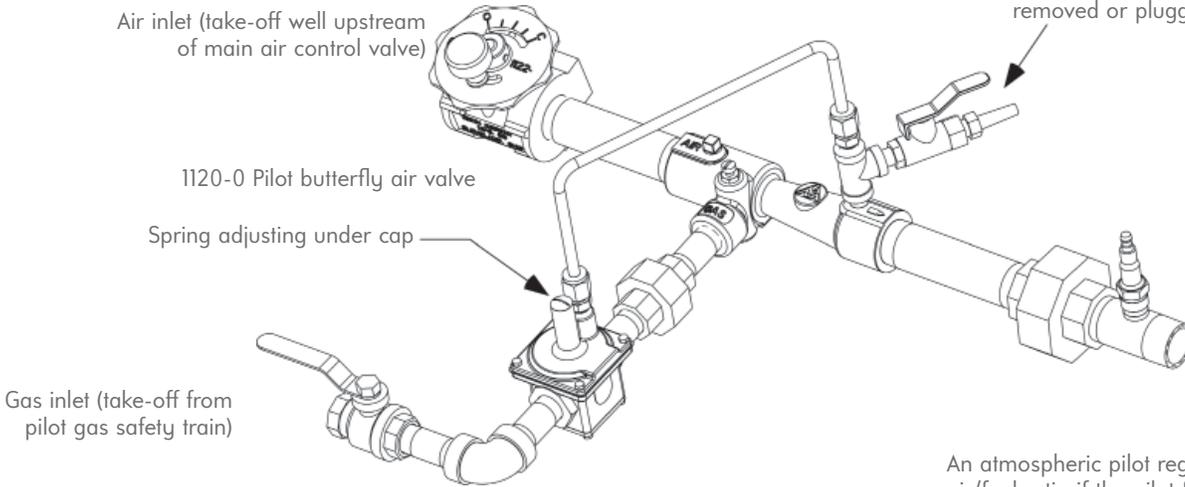
# Pilot Installation Tips | 4011/4021 Pilot

Cross-connecting a 7350-02-A pilot regulator to the mixture pressure of the 4031 mixer will provide the best ratio control for a 3/4" pilot systems. The gas pressure upstream of the pilot regulator should be set at least 2 osi (3.5"w.c.) higher than the mixture pressure. A common mixture pressure to use is 3-5"w.c. So set the gas pressure upstream of the 7350 to 5-6 osi (9-11"w.c.).



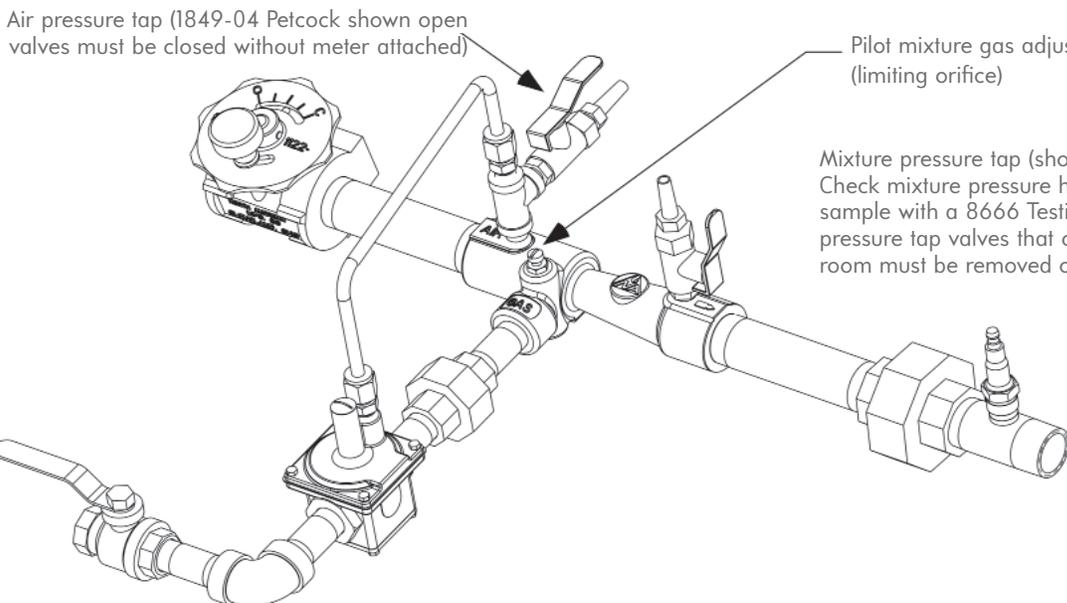
49-04 Petcock is an 1829A-04 live with 1929-04 hose nipple

Mixture pressure tap (1849-04 Petcock shown open) After set-up is done, pressure tap valves that can release fuel into the room should be removed or plugged.



An atmospheric pilot regulator helps maintain proper air/fuel ratio if the pilot flow conditions change. (install close to the mixer)

Cross-connecting a 7350-02-A pilot regulator to the air pressure of the 4031 mixer will provide acceptable ratio control in cases where the fuel cannot be used in the impulse line. A common air pressure to use is 6-8 osi (10.5-14"w.c.), so set the gas pressure to 10-12 osi (17-21"w.c.). For CSI compliant systems set air to 6 osi (10.4"w.c.) and gas pressure of the 7350 to 8 osi (0.5 psi), (13.8"w.c.).



Mixture pressure tap (shown open) Check mixture pressure here or take premix sample with a 8666 Testip. After set-up is done pressure tap valves that can release fuel into the room must be removed or plugged.

## JUDGING FLAMES

Premix pilots are often adjusted by sight. A 4021 Pilot Tip with air-gas mixture on stoichiometric ratio produces a sharp, forceful flame with a well defined light blue inner cone and a deeper blue outer flame envelope. This flame produces a moderate amount of noise, which decreases when adjusted toward the rich limit.

A long, bushy, yellow/orange tipped flame envelope or a green colored flame denotes rich ratio. When a pilot is set too rich, the flame will start to move away from the tip.

A short, pale blue or violet flame indicates a lean ratio. When a pilot is set too lean, it may light under hot conditions but not reliably when cold.

Rich or lean air/fuel ratios may cause pilot to have insufficient flame length or drive to satisfy a flame detector and/or to ignite the main fuel

## PILOT ADJUSTMENT

On most combustion system air and fuel pressures are 2 psi or less. Often the pressures are a small fraction of 1 psi. Pressure gauges made for low pressures are sensitive to rough handling. When servicing combustion equipment we recommend using a water or digital manometer for pressure measurement.

Flames often are not easily visible when sealed-in nozzles are used. Consider using a 8666 Testip to facilitate setting desired air/fuel mixture.

1. Before lighting any pilot, make sure the furnace has been adequately purged. This usually requires operating the main air blower long enough to make at least 4 volume changes before ignition (NFPA 86). Consult local codes for purge requirements.
2. Adjust the pilot air valve for the required pilot air pressure, generally 6 to 8 osi (10.5-14"w.c.) at the 1/8" air pressure tap in the pilot mixer air connection (or 3-5"w.c. at the 1/8" mixture pressure tap).
3. Starting from a fully closed position, open the pilot mixer gas adjusting screw about 4 turns (counterclockwise).

4. Energize both the ignition spark transformer and the pilot gas solenoid valve. If the pilot does not light, turn the gas adjusting screw in or out as required, until ignition occurs.

5. Fine-tune the pilot for best flame stability as follows: First, turn the gas adjusting screw clockwise until the pilot flame goes out. This is the "lean limit."

Next, counting the number of turns from the lean limit, turn the gas adjusting screw counterclockwise, lighting the pilot, and continuing until the rich limit is reached, ragged flame appearance and loss of the sharp inner cone.

Then, having counted the number of turns from lean to rich limit (generally 1 to 2 times), set the gas adjusting screw at mid-point between the limits. This will result in a condition near correct air/fuel ratio.

6. Slowly turn the pilot air pressure down to 1.0 osi. If the flame appears to go off ratio, remove the pilot regulator adjusting cap and adjust the pilot gas regulator spring until the flame looks correct. Turning the regulator spring adjusting screw clockwise increases the gas flow; counterclockwise decreases gas flow. Replace the cap. Turn the pilot air pressure back up to its original setting.

7. With 6 to 8 osi (10.5-14"w.c.) pilot air pressure, the mixture pressure at the 1/8" pressure tap on the mixer discharge should be 3 to 5"w.c. when the flame is burning (mixture pressures are valid only if measured when burning).

## KEEP RECORDS

## ADDITIONAL PILOT INFORMATION

- Sheet 4000-2 Industrial Burner Flame Detection
- For pilot trouble shooting see the "North American Combustion Practical Pointers" book. (for a digital copy visit [www.fivesgroup.com](http://www.fivesgroup.com) or ask your Fives North American sales representative.

**WARNING:** Situations dangerous to personnel and property may exist with the operation and maintenance of any combustion equipment. The presence of fuels, oxidants, hot and cold combustion products, hot surfaces, electrical power in control and ignition circuits, etc., are inherent with any combustion application. Components in combustion systems may exceed 160°F (71°C) surface temperatures and present hot surface contact hazard. Fives North American Combustion, Inc. suggests the use of combustion systems that are in compliance with all Safety Codes, Standards, Regulations and Directives; and care in operation.



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