Flare Trouble Shooting Guide

1. What is the area of concern:
   - Ignition system / pilot failure (go to question 2)
   - Smoking flare
   - Noisy flare

2. Type of ignition system / problem:
   - Flame Front Generator (go to question 3)
   - Self-Inspirating Ignition (go to question 5)
   - SM/FF Pilot (Electric Spark Ignition) (go to question 6)
   - Frequent Pilot failure (see solution section H on page 4)

3. Which problem are you experiencing with the FFG?
   - Spark does not appear in ignition chamber. (see solution section A on page 1)
   - Spark appears, but there is no fireball generated. (see solution section B on page 2)
   - Fireball is generated but pilots don't light. (see solution section C on page 2)
   - Pilots are lit but will not prove. (see solution section D on page 3)
   - The pilot will light manually but not automatically. (go to question 4)
   - Detonation is occurring in the FFG line. (see solution section C on page 2)

4. Does your automatic system have temperature switches or a PLC?
   - Temperature switches (see solution section F page 3)
   - PLC (see solution section G page 4)

5. Which problem are you experiencing with the Self Inspirating Ignition?

6. Which problem are you experiencing with the SM/FF Pilot?
   - SM/FF Pilot will not light. (see solution section E page 3)
   - Pilots are lit but will not prove. (see solution section D on page 3)

A. Spark does not appear in ignition chamber.

Possible Cause	Solution
Moisture	Make sure the ignition chamber is free of moisture, both inside the chamber and above the spark plug where the ignition wire connects.
Pressure	High pressure inside the ignition chamber will prevent a spark from occurring. Make sure an ignition line to a pilot is open and clear of obstructions or condensate. Turn on the ignition air, then shut off the air. The pressure indicator should quickly drop to zero differential pressure.
Power	Confirm that the primary power is reaching the ignition transformer. Confirm that the output of the transformer is approximately 6000 volts.
Continuity	Check cable from transformer to spark plug. Replace if frayed or cracked. Confirm connections are tight at both ends. Check that the casing of the ignition transformer and the ignition chamber are grounded.

B. Spark appears, but there is no fireball generated.

Possible Cause	Solution
Improper Mixture	Confirm the air and gas orifices are sized as shown on the drawing and are correct for the ignition gas utilized. Set the air and gas pressures as indicated on the FFG drawing. On a new installation, make sure the ignition gas has flowed long enough to purge all the air from the upstream piping. Leave the air set at the recommended pressure and adjust the gas until ignition is achieved. The proper mixture will produce a strong blue flash and a pressure spike on the gauges.
Faulty solenoid valve	In automatic systems, solenoid valves are used to control the ignition air and fuel. A faulty valve can cause a pulsating flow which will prevent the correct mixture from being generated. A pulsating flow can be deduced from watching the needle of the pressure gauge.

C. Fireball is generated but pilots don't light.

Possible Cause	Solution
Condensate in ignition line	Open ignition line drain valves to drain condensate. If drain valves are not available, allow ignition air to flow through line for a period of time to dry out the line.
Failure of pilot verification system	See solution section D page 3
Detonation in FFG line	A loud bang during ignition indicates a detonation is occurring in the ignition line. This is typically caused by short FFG lines. Reduce the gas pressure to around 2 psig. Reduce the air pressure to below 2 psig. Press the ignition pushbutton and verify if ignition is occurring in the sight glass. If not, increase the air pressure slightly. Press the ignition pushbutton and verify if ignition is occurring in the sight glass. Repeat incrementing the air pressure and pressing the ignition pushbutton until ignition occurs. Once ignition is achieved, allow sufficient time for the ignition line to fill with fuel / air mixture.
Pilot gas failure	Verify that the pilot gas is at the correct pressure and flowing to the pilot. Verify that the pilot gas orifice is clear and sized according to the drawings. On a new installation, make sure the pilot gas has flowed long enough to purge all the air from the upstream piping. For a quick check, Appendix A may be used to confirm either a leaky piping system, or a plugged orifice, strainer, etc.

D. Pilots are lit but will not prove.

Possible Cause	Solution
Broken Thermocouple	Disconnect thermocouples from terminals in panel and check continuity. If an open circuit is detected, replace thermocouple at first opportunity.
Pilot Proved set-point too high	Use a volt-ohm meter to read the milli-volt signal from the thermocouple. If the signal is greater than 10 milli-volts and not falling, the pilot is lit. Lower the set-point until the pilot proves.
Incorrect Wiring	Confirm that the thermocouples are correctly wired, yellow to (+), red to (-). Confirm that the ignition lines are paired up with the correct thermocouples.

E. SM/FF Pilot will not light.

Possible Cause	Solution
Faulty Circuit	Verify that the ignition transformer is receiving the correct voltage power. Verify that the wiring between the transformer and ignition probe is correct.
Pilot gas failure	Verify that the pilot gas is at the correct pressure and flowing to the pilot. Verify that the pilot gas orifice is clear and sized according to the drawings. On a new installation, make sure the pilot gas has flowed long enough to purge all the air from the upstream piping
Ignition transformer orientation incorrect.	Verify that the ignition transformer is oriented with the top of the transformer positioned correctly. Incorrect orientation will not allow the mercury switch to operate properly and thus prevent a spark from being generated.
Failure of pilot verification system	See solution section D page 3
Degradation of pilot tip	Severe pilot damage can cause the electronic ignition system to fail. Replace pilot as soon as possible.

F. Temperature Switches.

Possible Cause	Solution
Incorrect timer settings	A timer is used to set the amount of time between ignition attempts. It is critical that enough time elapses between ignition attempts to allow the ignition line to completely fill will the fuel air mixture. Increase the amount of time between ignition attempts.

G. PLC.

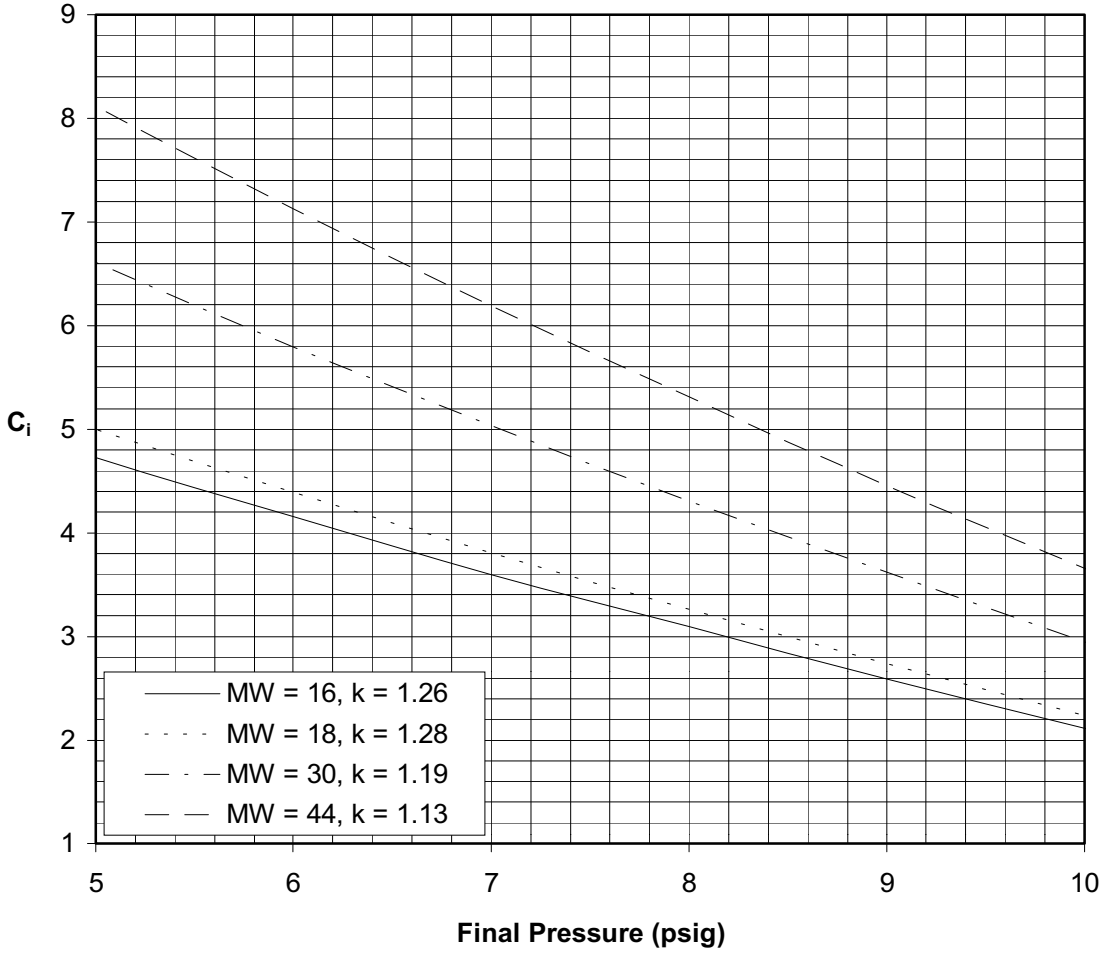
Possible Cause	Solution
Incorrect timer settings	Timers are utilized in the PLC program to set the amount of time between ignition attempts. It is critical that enough time elapses between ignition attempts to allow the ignition line to completely fill will the fuel air mixture. Increase the amount of time between ignition attempts.
PLC fault	Inspect PLC for a fault light. If fault light is present, cycle power to the panel. If fault light persists, contact PLC vendor.

H. Pilot fails frequently.

Possible Cause	Solution
Pilot gas failure	Verify that the pilot gas is at the correct pressure and flowing to the pilot. Verify that the pilot gas orifice is clear and sized according to the drawings. Verify that all strainers are clear. On a new installation, make sure the pilot gas has flowed long enough to purge all the air from the upstream piping. For a quick check, Appendix A may be used to confirm either a leaky piping system, or a plugged orifice, strainer, etc.
Intermittent gas Pressure	Short duration reductions in pilot gas supply pressure can cause pilot failure. Certain plant operations can cause such dips. A clue that this may be the case is the pilot failure appears to occur around the same time every hour, day, week, etc. To determine if such dips are occurring, log the pilot gas pressure over the time in question. If such dips are occurring, steps should be taken to ensure a constant gas supply pressure.
Blockage between mixer and Pilot tip	Pilots that have experienced long term exposure to high temperatures can become deformed or damaged. Such tips should be replaced. Pilots that have sat idle for long periods may have acquired wasp's nests or other obstructions inside the pilot or around the tip. Clean out all such obstructions.
High winds	High winds can cause the pilot extinguish. Increasing the gas pressure can help stiffen the flame and make it less susceptible to being blown out by the wind. Wind shields can be supplied around the pilot mixer to improve flame stability.
Failure of pilot verification system	See solution section D page 3

Pressure Decay of a Flare Pilot at 15 psig

time = C_i x L x F_{ID} / (F_O x # of Orifices)



time indicates how long it takes for the pressure in a pilot fuel line to change from 15 psig to 5 – 10 psig
L is the length of pipe from the shut off valve to the orifice tip

F_{ID} for 1 inch Pipe

Schedule No.		F_{ID}
40	(Standard)	1.10
80	(Extra Strength)	0.916

F_O for Various Tip Bores

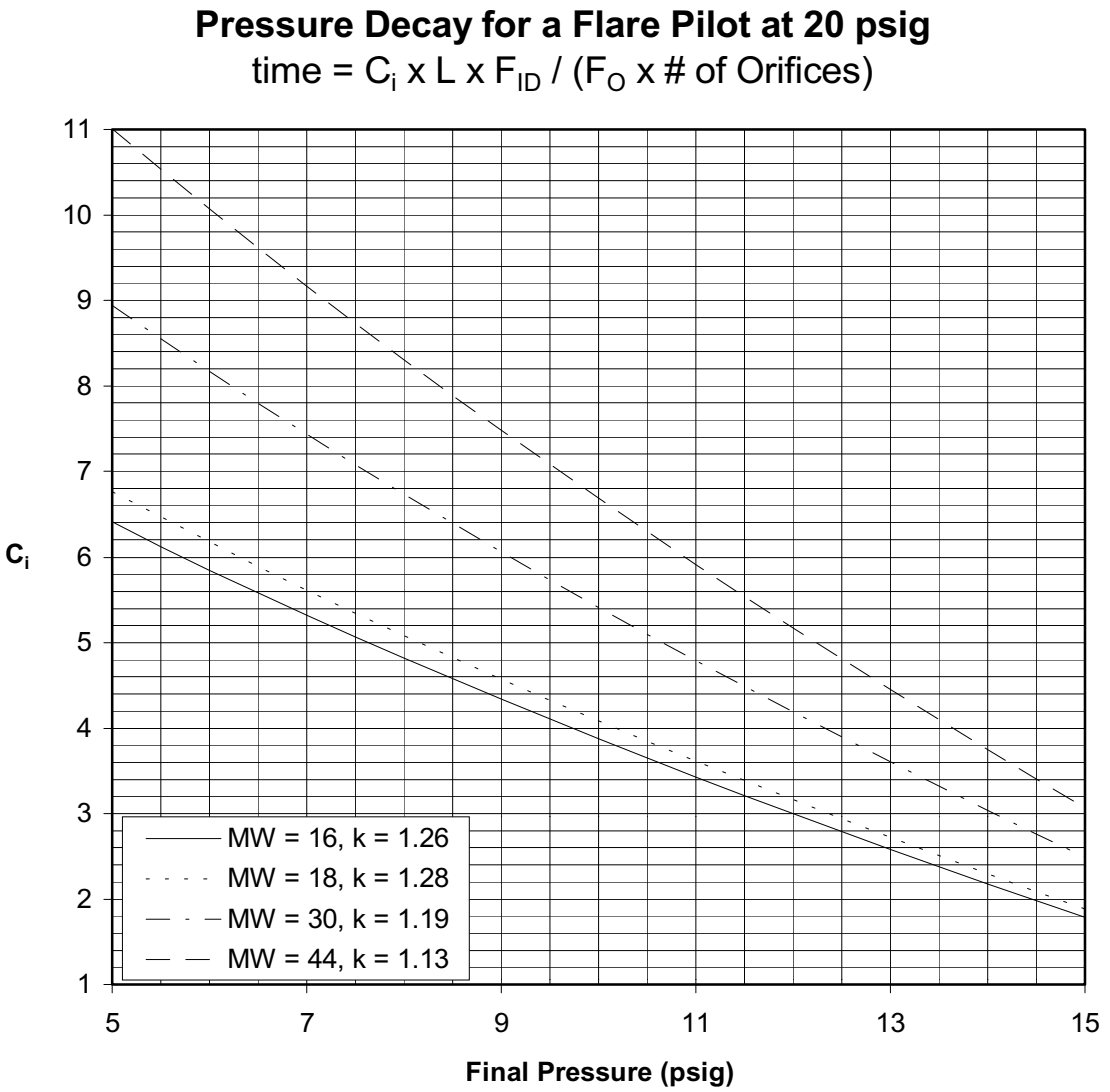
Drill Size	F_O
3/64	17.3
#55	21.0
#54	23.8
#53	27.8
1/16	30.7
7/64	93.8

Example:

The pilot uses methane, MW = 18 and k = 1.26. The pipe from a shutoff valve to pilot tip is 350 ft of schedule 40, 1 inch pipe. The fuel line pressure is set to 15 psig then the shut-off valve is closed. When the pressure reads 5 psig, the valve is reopened. The flare has three pilots with #54 tip bores.

L = 350 ft F_{ID} = 1.10 F_O = 23.8
# of orifices = 3 C_i = 5

$$\text{time} = \frac{5.0 \times 350 \times 1.10}{23.8 \times 3} = 30 \text{ seconds}$$



time predicts how long it should take for the pressure in the pilot fuel line to change from 20 psig to 5 – 15psig in seconds.
L is the length of pipe from the shut-off valve to the orifice tip in feet.

F_{ID} for 1 inch Pipe

Schedule No.	F_{ID}
40 (Standard)	1.10
80 (Extra Strength)	0.916

F_O for Various Tip Bores

Drill Size	F_O
3/64	17.3
#55	21.0
#54	23.8
#53	27.8
1/16	30.7
7/64	93.8

Example:

The pilot uses methane, MW = 18 and k = 1.26. The pipe from a shutoff valve to pilot tip is 350 ft of schedule 40, 1 inch pipe. The fuel line pressure is set to 20 psig then the shut-off valve is closed. When the pressure reads 10 psig, the valve is reopened. The flare has three pilots with #54 tip bores.

L = 350 ft F_{ID} = 1.10 F_O = 23.8
# of orifices = 3 C_i = 4.1

$$\text{time} = \frac{4.1 \times 350 \times 1.10}{23.8 \times 3} = 25 \text{ seconds}$$