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MEMO TO : Oil and Gas Production Companies

FROM : James L. Semerad
Director
Division of Air Quality

RE : High Efficiency Program
Specifically Applies to Flares (Steffes, LLC)
For Upstream Production Facilities

DATE : March 15, 2021

The North Dakota Department of Environmental Quality – Division of Air Quality (Department) has completed a detailed review of the September 2015 Passive Fourier-Transform Infrared Spectroscopy (PFTIR) test report submitted by Spectrum Environmental Solutions to document carbon monoxide (CO) emission factors and volatile organic compounds (VOC) destruction and removal efficiency (DRE) on the pressure-assisted Steffes, LLC (Steffes) flare tips listed in Table 1:

Table 1: Tested Steffes Flare Tip Models

High-Pressure	SHP-6
	SHC-6
Low-Pressure	SVG-3B4

Testing of each model was conducted at various ambient temperatures, flowrates, and pressures and the results were calculated as combustion efficiency. Each flare model appeared to achieve at least 99.0% average combustion efficiency under all tested scenarios. Although the relationship between destruction efficiency and combustion efficiency is not constant, the February 2018 update to the Environmental Protection Agency's (EPA's) AP-42, Chapter 13.5 on industrial flares states that:

> *"The destruction efficiency of a flare will always be greater than the combustion efficiency of a flare. It is generally estimated that a combustion efficiency of 96.5% is equivalent to a destruction efficiency of 98%."*

Based on this relationship and the results of the extensive September 2015 testing, it appears that greater than 99.0% average destruction efficiency was achieved by the Steffes flare tip models listed in Table 1.

In addition, testing was conducted to document CO emission factors on the flare tips in Table 1. Based on the results of the testing, it appears that the high-pressure flare tips are able to achieve the proposed CO emission factor of 0.015 lb/MMBtu, and the low-pressure flare tip is able to

achieve the proposed 0.030 lb/MMBtu CO emission factor. The evaluation reports filed by the Department are enclosed.

The Department is confident in its detailed review of the testing and is approving the Steffes flare tips in Table 1 for the following reasons:

- Testing submitted to the Department was substantial and has undergone complete review.
- The Department's observations during upstream inspections have documented that Steffes flares appear to operate effectively and within the confines of the High Efficiency Program.

Therefore, pursuant to the authority provided under the North Dakota Administrative Code (NDAC), the Department will allow individual companies to request approval for the following Steffes flares in Table 1 as part of the Department's High Efficiency Program:

- Use of 99.0% DRE
- A CO emission factor of 0.015 lb/MMBtu for the high-pressure flares
- A CO emission factor of 0.030 lb/MMBtu for the low-pressure flare

Each company must submit an application to enter the High Efficiency Program, which allows the use of all Department approved "High Efficiency" flares. The Department reserves the right to deny the use of 99.0% DRE and/or a CO emission factor other than the EPA's accepted AP-42 value for any facility.

The following conditions, as stated by Spectrum Environmental Solutions in their June 19, 2018 letter to Steffes LLC, must be met by any company to be approved for the Department's High Efficiency Program:

1. Flares must be installed and maintained per Steffes' requirements.
2. Flow rates to the flares must be within Steffes' requirements for the tip being used.
3. Smokeless operations must be confirmed per EPA 40 CFR §60.18; however, the 400 ft/sec flare tip velocity limitation in 40 CFR §60.18 may be exceeded provided that compliance with the maximum allowable flow rates listed in Table 2 below are ensured.
4. The net heating value of the flared gas must remain above 1,055 Btu/scf.
5. Liquid knockout systems must be properly designed and maintained in order to prevent liquid from building up in piping or being sent through the flare.

The Department requires that the following conditions also be met for approval into the High Efficiency Program:

6. The Department shall be notified of all facilities where 99.0% DRE and/or a CO emission factor other than the EPA's accepted AP-42 value will used with a complete amended registration submitted online via CERIS-ND prior to the use of 99.0% DRE and/or an approved alternative CO emission factor.

7. Registrations that request the use of 99.0% DRE and/or a CO emission factor other than the EPA's accepted AP-42 value should clearly state that 99.0% DRE and/or an approved alternative CO emission factor will be used. Each registration must include the following:

   - The flare manufacturer and model number
   - The manufacture date of the flare
   - The installation date of the flare
   - The serial number of the flare
   - The estimated flow rate of natural gas to the flare (MMscf/yr)
   - A copy of the Department approval allowing the use of 99.0% DRE and/or an approved alternative CO emission factor
   - Whether the facility is new or being re-registered within the High Efficiency Program
   - An assessment of sales-line capacity at the site
     i. If applicable, an explanation shall also be provided as to why a new well must be drilled when gas takeaway capacity is not available for sales-lines and alternatives that have been reviewed to limit flaring.

8. If necessary, companies may replace a previously installed and approved flare tip with another approved Steffes flare tip. A revised registration will not be required.

9. Following the installation or maintenance of any approved flare tip, an EPA Reference Method 22 observation shall be conducted for two hours or fifteen minutes, respectively. The EPA Reference Method 22 observation shall be performed as soon as practicable but no later than 30 days after any new flare tip is installed or maintenance is performed.

10. If a company wishes to use 99.0% DRE or a CO emission factor other than the EPA's accepted AP-42 value with a flare model different than those listed in Table 1, additional testing, Department review, and Department approval will be required.

11. If a company wishes to use a flare stack operating with multiple tips and 99.0% DRE and/or a CO emission factor other than the EPA's accepted AP-42 value, the multi-tip

configuration must be consistent with those documented in Appendix A. Note that emissions from each stack must be calculated separately.

12. The flare must be operated in accordance with all manufacturer's requirements during all operations, inclusive of any requirements not included above. Troubleshooting and inspection schedules are included in Appendix B and Appendix C.

13. The Department believes that proper operations and maintenance of any flare or flare tip is essential to achieving 99.0% DRE. All required inspections in Appendix B shall be followed.

14. Flow rates to the pressure-assisted Steffes flares must remain within the restrictions listed in Table 2:

Table 2: Steffes Flare Tip Minimum and Maximum Allowable Flow Rates

Steffes Flare Tip Model	**Minimum Allowable Flow Rate (MMscfd)**	**Maximum Allowable Flow Rate (MMscfd)**
SHC-6	0.500	7.0
SHP-6	0.500	2.2
SVG-3B4	0.025	0.2

If multiple flare stacks are located at a High Efficiency approved facility, a separate flow meter must be installed to measure the flow rate to each individual flare stack. Flow meters must be located past any shut-off valves. Due to safety sensitivities or the potential error margin in some measurement devices (e.g. acoustic), especially in low-pressure and low-flow volumes, engineering calculations will be used in conjunction with measurement devices for comparison and flow rate verification. As an alternative to direct flare stack measurement or metering, a "Surveillance Method" may be utilized if locations are to be equipped with gas meters downstream of the separator. The equation below represents the flare volume gas-oil ratio (GOR) as a basis for this approach:

$$Flare = Gas\ Surv - Gas\ Sales - Gas\ Lease\ Use - Gas\ Injected - MRU\ Inlet + MRU\ Outlet - NGL$$

Where:

Gas Surv	= Gas meter directly downstream of separator
Gas Sales	= Gas sales meter value
Gas Lease Use	= Gas used for various equipment on location
Gas Injected	= Gas injected on gas lift locations only
MRU Inlet / Outlet *	= Mobile refrigeration unit (MRU) inlet and outlet values
NGL *	= Natural Gas Liquid (NGL) knockout unit

* only applicable to facilities with MRUs or NGLs

This alternative method shall be based on a production gas meter and not a GOR estimation method. Where multiple flare stacks are present and interconnected through a common header, equal flow shall be maintained through each flare stack.

If the daily flow rate to any individual flare stack is outside the allowable flow rate specified in Table 2 above, that day's emissions shall be calculated using 98.0% DRE and EPA's accepted AP-42 emission factor for CO. For flare stacks with multiple tips, as described in Appendix A, the flow rates in Table 2 above will apply to each tip in aggregate (e.g., a dual tip SHC-6 flare would be allowed a 14 MMscfd maximum flow rate).

15. Companies shall maintain the following records for a period of five years. The records shall be available for Department review upon request.

- All deviations above the maximum allowable flow rate or below the minimum flow rates specified in Table 2 above.
- Corrective action that was taken to resolve the deviation in flow rate.
- Emission calculations showing that 98.0% DRE was used instead of 99.0% and EPA's accepted emission factor was used for emission calculations during the period of deviating flow rates.
- Records of the manufacturer, model number, manufacture date, installation date, and serial number of any flare tips used.
- Records of any inspections, troubleshooting, and maintenance.
- Annual records of the net heating value of the flared gas for a period of five years from the date of sampling at any site where a CO emission factor other than the EPA's accepted AP-42 value and/or 99.0% DRE is used.

16. The Department shall be notified when a facility will no longer use 99.0% DRE and/or a CO emission factor other than the EPA's accepted AP-42 value with an amended registration online via CERIS-ND within 30-days of the use of a different DRE and/or CO emission factor.

17. All conditions listed above are requirements to comply with the Department's High Efficiency Program. Non-compliance with any of the above conditions is grounds for suspension or removal from the High Efficiency Program and/or enforcement action initiated by the Department.

Important Considerations and Requirements:

A company's installation of an approved Steffes flare and compliance with the conditions enumerated above satisfies the company's obligation to comply with the control requirements of the NDAC Chapter 33.1-15-07. Pursuant to its authority under the NDAC, the Department may enforce any failure by a company to install, operate, or maintain the flares consistent with the above operating conditions, records retention and notification requirements. If violations of the above-described conditions are identified or leaks that are indicative of a violation are discovered,

the Department may initiate an enforcement action. *Pursuant to the authority under North Dakota Century Code Chapter 23.1-06-14, any air pollution control equipment, inclusive of flares that are not operating properly, are subject to a fine of not more than ten thousand dollars per day per violation.*

Furthermore, this approval is granted only under the conditions outlined in each company's approved application and herein. If new information becomes available, the Department reserves the right to modify or rescind the approval.

An approval may be suspended if the Department initiates any enforcement action with the company; for example, documentation of unlit flare(s), excessive leaks, or improper operations and maintenance at any high efficiency facility may be grounds for suspension or revocation of the approval. If the approval is suspended, the company shall use the EPA approved AP-42 emission factor for CO and a DRE of 98.0% during the period of the enforcement action.

- The Department will provide written notification to each company of any suspensions or revocations of approval.
- Emissions shall be recalculated in accordance with the suspension or revocation.
- If recalculated emissions indicate that a facility is a major source under the Title V or Prevention of Significant Deterioration rules, the Department must be notified.

The Department will provide written notification to each company once they have been approved to utilize 99.0% DRE, a CO emission factor of 0.015 lb/MMBtu for the high-pressure flares in Table 1, and a CO emission factor of 0.030 lb/MMBtu for the low-pressure flare in Table 1 within the High Efficiency Program following the suspension.

If you have any questions concerning the above, I encourage you to contact Angela Seligman of my staff at (701)328-5291 or aseligman@nd.gov for further assistance.

JLS/ANS:saj
Attach:

North Dakota Department of Health
Test Review

Source:	Steffes LLC Flares
Company:	N/A
Permit No:	N/A
Location:	3050 Highway 22 North Dickinson, North Dakota
Tested By:	IMACC, LLC
Test Date:	8-Sep-15

SHC-6 - High Pressure Flare

Condition	Average Flowrate (Scf/day)	Exhaust Gas Flow (Scf/hr)	Vent Gas Btu rate (MMBtu/hr)	Average Pressure (psi)	Average CO_2 (ppm_{vd})	Average THC (ppm_m)	Average CO (ppm_m)	CE (%)	CO (lb/MMBtu)
1	507,816	1,348,666	22.3	3.31	23,634	49.05	3.18	99.78	0.014
2	1,061,165	2,660,294	46.6	3.21	25,070	23.68	0.88	99.90	0.004
3	3,082,034	3,806,544	135.5	4.18	50,882	49.26	1.13	99.90	0.002
4	6,027,611	4,485,112	265.0	4.62	84,515	35.2	1.65	99.96	0.002
5	7,184,964	4,197,818	315.8	5.75	107,605	65.84	1.94	99.94	0.002
6	1,110,486	2,279,056	48.8	2.79	30,587	71.14	2.20	99.76	0.007
							Average	99.87	0.005

SHP-6 - High Pressure Flare

Condition	Average Flowrate (Scf/day)	Exhaust Gas Flow (Scf/hr)	Vent Gas Btu rate (MMBtu/hr)	Average Pressure (psi)	Average CO_2 (ppm_{vd})	Average THC (ppm_m)	Average CO (ppm_m)	CE (%)	CO (lb/MMBtu)
1	536,177	1,269,424	23.6	6.52	26,509	51.95	4.32	99.79	0.017
2	1,296,603	8,945,694	57.0	8.76	9,073	26.86	2.00	99.68	0.023
3	3,324,520	15,757,059	146.1	11.93	13,182	60.34	1.20	99.54	0.009
4	6,169,092	21,626,413	271.2	14.34	17,869	40.58	1.55	99.76	0.009
5	7,182,368	19,084,648	315.7	14.95	23,480	148.51	4.16	99.35	0.018
							Average	99.63	0.015

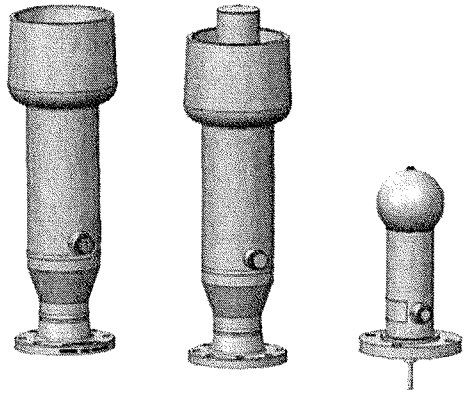
SVG-3B4 - Low Pressure Flare

Condition	Average Flowrate (Scf/day)	Exhaust Gas Flow (Scf/hr)	Vent Gas Btu rate (MMBtu/hr)	Average Pressure (psi)	Average CO_2 (ppm_{vd})	Average THC (ppm_m)	Average CO (ppm_m)	CE (%)	CO (lb/MMBtu)
1	26,502	158,061	1.2	4.79	10,482	61.77	2.32	99.39	0.023
2	102,291	333,203	4.5	6.99	19,304	8.85	3.64	99.94	0.020
3	206,648	587,727	9.1	8.69	22,065	49.29	5.51	99.75	0.026
							Average	99.69	0.023

Reviewed By: _____ Date Reviewed: April 8, 2019

Appendix A

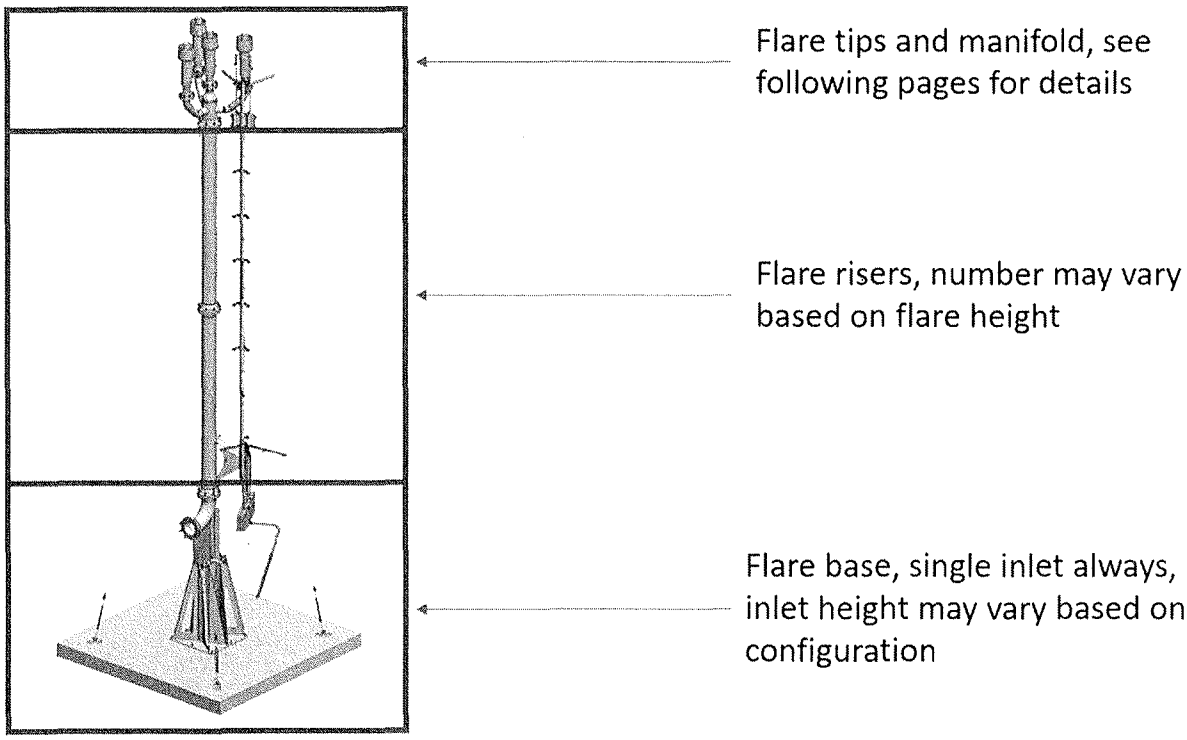
The flare tips approved for 99.0% DRE are configured as shown in the image below.



SHP-6 SHC-6 SVG-3B4

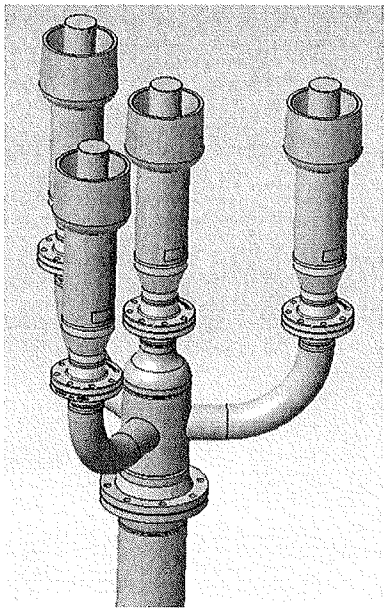
The following images document the flare configuration required for multi-tip flares (SHC-6 and SHP-6). Only the multi-tip configurations in the following images are allowed. The part numbers included in the following images are the only part numbers that may be used in the multi-tip flare configurations.

Flare Configuration Overview



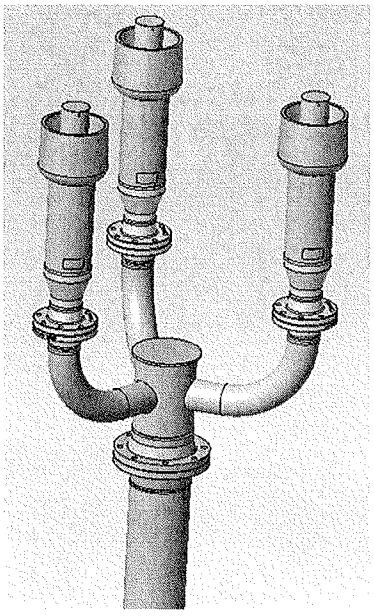
Note: The figures in Appendix A show various multi-tip configurations with the model SHC-6 tip. These configurations can also utilize model SHP-6.

8” Quad Tip



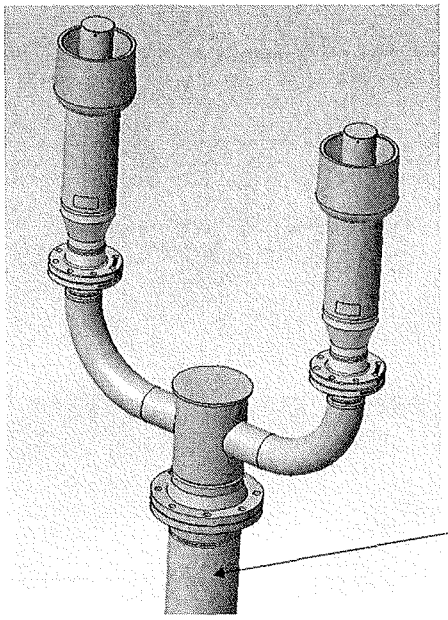
- Manifold
  - Part Number: 5462400
- Crate
  - Part Number: 5468255

8” Tri Tip



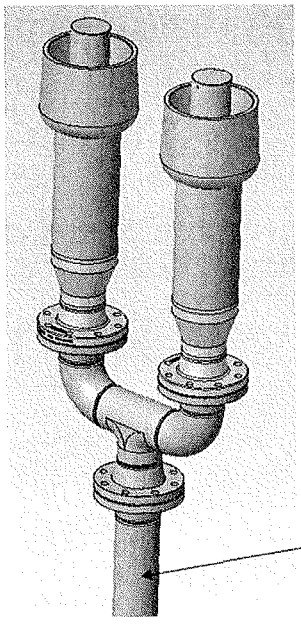
- Manifold
  - Part Number: 5468269
- Crate
  - Part Number: 5468272

8” Dual Tip



- Manifold
  - Part Number: 5468274
- Crate
  - Part Number: 5468271

4” Dual Tip



- Manifold
  - Part Number: 5462185
- Crate
  - Part Number: 5962010

Appendix B

The following are required inspections, as per the manual provided by Steffes. These Steffes requirements shall be followed to maintain the agreement to utilize 99.0% DRE and/or a CO emission factor other than that provided by the EPA. Any modification to Steffes's inspection requirements will be incorporated into an amended version of this memo.

The following are potential issues with the flare tips that should be remedied immediately or as soon as is practicable. If the issue cannot be remedied immediately, the Department should be contacted immediately.

1. A smoking flare, which could indicate the following:
    - Buildup of debris
    - A problem with the flare
    - Very wet gas
2. An unequal flame size, which could indicate a problem with one of the flare tips.

As is indicated in Condition 9 of this memo, an EPA Reference Method 22 observation must be conducted any time a flare tip is replaced or maintenance is conducted on the flare tip. A visual inspection should be conducted monthly, or any time a flare tip is replaced or maintenance is performed. A visual inspection should include:

1. A check for visible smoke
2. A check to verify the size of the flame from all flare tips is equal

REQUIRED INSPECTIONS

	Installation	Monthly	As Needed Per Inspection	Initial & Date
Purge pilot supply line with 3/8" pilot line not connected	X			
Regular visual flame inspection, checking for: • No smoke • Equal flame sizes on flare stack with multiple same model flare tips.	X	X		
Check pilot for spark and/or listen for audible "snap"	X	X		
Thermocouple line is properly secured with hose clamps or zip ties provided.	X			
Data logger, if used, is connected and running properly. (Green light blinks every ten seconds).	X	X		
Verify thermocouple is reading properly. Look at thermoworks file and/ or plug thermocouple into thermocouple reader.	X	X		
Check ignition line from controller to connection on pilot. All connections must be tight. Cannot touch any metal surfaces during windy conditions.	X		X	
Thermocouple probe is inserted completely into thermo well	X			
Top of pilot is 1 to 1.5 inches below top of flare tip barrel.	X			
No copper wire or plastic in the flare pit except ground rod.	X			
First stand max of 6 FT from the flare	X			
Max distance between stands is 8' and stands are in a straight line	X			
All connections are tight: Flange bolts, compression fittings, pipe connections	X			
Check ground line from pilot tip to ground rod and fencer to ground rod. All connections must be tight	X		X	
No cracked insulators on igniter wire	X		X	
Monitor pilot temperature to ensure it is lit and operating within normal temperature ranges.	X	X		

*Depending on the operating conditions of the flare will determine the frequency of required inspection and maintenance shutdown.

Appendix C

The following are recommended troubleshooting steps, as per the manual provided by Steffes. Any modification to Steffes's troubleshooting will be incorporated into an amended version of this memo.

TROUBLESHOOTING

SYMPTOM	POTENTIAL SITUATIONS	RECOMMENDED ACTION
Pilot will not spark	Fencer/Controller not turned on or bad connection	Turn fencer/controller on, should hear a snap. Make sure to hear clicking internally. Check for bad connections. Make sure all connections are tight and free of corrosion.
	Improper spark gap	Adjust gap. Check spark on ground post.
Have spark, not lighting	Orifice plugged	Clean with tip cleaner.
	No gas at pilot	Check all appropriate valves and regulators to ensure they are open and set to correct pressure to send gas to pilot. Check for air or liquid in the line. If so, purge line with gas
	Improper gas pressure	Set pilot line pressure to 6-10 psi (Natural gas)
Poor flame quality	Flare tip is not seated properly or can't move freely	Shut well in and move tip. Clean out debris. May use steel wire brush to clean off flare tip and ball. If tip is still stuck, call factory.
	Liquid in line	Drain and clean lines
	Springs are not operating properly or there is contamination in the gas	Call factory or replace