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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 (Zeeco)
For Upstream Production Facilities

DATE : January 13, 2022

The North Dakota Department of Environmental Quality – Division of Air Quality (Department) has completed a detailed review of the March 2017 and August 2020 test reports prepared by Air Hygiene, Inc. to document carbon monoxide (CO) emission factors and total hydrocarbons (THC) destruction and removal efficiency (DRE) on the Zeeco gas-assisted multi-point flare burner tip models MJAG-3 and MJ-3. Emissions testing followed Environmental Protection Agency (EPA) Reference Methods (RMs) 3A, 7E, and 25A. Flue gas was collected using an eductor hood, which was positioned over the flame.

Two sets of emissions testing were conducted during the March 2017 testing and nine sets of emissions testing were conducted during the August 2020 testing. Each set of emissions testing was conducted at varying flowrates and pressures. In addition, the testing varied the heating value of the gas by using either 100% natural gas or 100% propane. Each set of emissions testing appeared to achieve at least 99.0% average DRE.

Testing was also conducted to document CO emission factors for both the MJAG-3 flare burner tip (with assist gas) and the MJ-3 flare burner tip without assist gas. Based on the results of the testing, it appears that both flare burner tips (MJAG-3 and MJ-3) are able to achieve a CO emission factor of 0.25 lb/MMBtu and 0.10 lb/MMBtu, respectively. The evaluation reports filed by the Department are enclosed.

The Department is confident in its detailed review of the testing and is approving the Zeeco MJAG-3 and MJ-3 flare burner tips for the following reasons:

- Testing was conducted using appropriate EPA testing methods and the report submitted to the Department was substantial and has undergone complete review.
- The Department's observations during upstream inspections have documented that Zeeco flares appear to be capable of operating effectively and within the expectations 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

criteria when using Zeeco multi-point flare burner tip models MJ-3 and MJAG-3 as part of the Department's High Efficiency Program:

- Use of 99.0% DRE and a CO emission factor of 0.25 lb/MMBtu with assist gas
- Use of 99.0% DRE and a CO emission factor of 0.10 lb/MMBtu without assist gas

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 Zeeco, must be met by each company to be approved for and remain in the Department's High Efficiency Program when using Zeeco flares and burner tips:

1. Flares must be installed and maintained per Zeeco's requirements.

2. Operating pressure at the flare and flare tip must be less than or equal to 50 pounds per square inch gauge (psig), per the testing conditions.

3. Smokeless operations must be confirmed per EPA 40 CFR §60.18.

4. The lower heating value of the flared gas must remain above 931.5 Btu/scf.

5. When multiple burner tips are present on the same flare stack, the flame length from each tip must be equivalent.

6. The flare flame should have the following qualities:

   a. The flame should be visible.
   b. The flame color should be yellow to dark orange.
   c. The flame motion should be rolling and fluid. The flame should not flicker or be erratic.

In addition, the Department requires that the following conditions also be met for approval into and to remain in the High Efficiency Program:

7. Liquid knockout systems must be properly designed and maintained in order to prevent liquid from building up in the piping or being sent through the flare.

8. 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 are requested to be 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.

9. 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 for the designated flare type
- 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.

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

11. Following the installation or maintenance of any approved flare tip, an EPA Reference Method 22 observation shall be conducted for two hours for installation or fifteen minutes for maintenance. 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.

12. 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.

13. 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 by Zeeco. Examples are shown in Appendix A.

14. 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.

15. 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.

16. The tip pressure of the pressure assisted Zeeco flares must remain within the restrictions listed in Table 1:

Table 1: Zeeco Flare Tip Maximum Allowable Operating Pressures

Zeeco Flare Tip Model	Maximum Allowable Tip Pressure (psig)
MJ-3	50
MJAG-3	50

If multiple flare stacks are located at a High Efficiency approved facility, a common pressure indicator must be used before all flare stacks because pressure is not expected to increase downstream of the common pressure indicator. As an alternative, a separate pressure indicator may be installed to measure the operating pressure at each individual flare stack. Any pressure indicators must be located downstream of all shut-off valves.

17. 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 tip pressure specified in Table 1 above.
- Corrective action that was taken to resolve the deviation in tip pressure.
- 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 pressures.
- 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 of the flare.
- 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.

18. 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.

19. 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, removal, or denial from the High Efficiency Program and/or enforcement action initiated by the Department.

Important Considerations and Requirements:

A company's installation of an approved Zeeco flare burner tip and compliance with the conditions enumerated above satisfies the company's obligation to comply with the control requirements of 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 re-approved to utilize 99.0% DRE, and/or a CO emission factor of 0.25 lb/MMBtu with assist gas and 0.10 lb/MMBtu without assist gas within the High Efficiency Program following the suspension.

If you have any questions concerning the above, I encourage you to contact Russell Martin of my staff at (701)328-4639 or rsmartin@nd.gov for further assistance.

JLS/RM:saj
Attach:

North Dakota Department of Environmental Quality
Test Review

Test Point #	TP1	Test Company:	Air Hygiene, Inc.
Assist Gas Only		Date Tested:	8/5/2020
propane (%)	0.3202	High Heating Value (BTU/SCF):	1016
propane (ppm)	3202	No Flow	

Calibration Span (High Gas)	
CO	THC
96.4	85.6

Pre-Test Calibration Error

Gas	Range	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference (+/- 2%)*	Status
O_2	Zero	0.00	0.07	0.33	Pass
	Mid	12.00	12.07	0.33	Pass
	High	21.10	21.10	0.00	Pass
CO_2	Zero	0.00	0.00	0.00	Pass
	Mid	8.95	9.09	0.75	Pass
	High	18.70	18.72	0.11	Pass
CO	Zero	0.00	0.32	0.33	Pass
	Mid	49.30	48.04	-1.31	Pass
	High	96.40	96.16	-0.25	Pass
THC	Zero	0.00	0.04	0.05	Pass
	Low	25.60	25.05	-2.26	Pass
	Mid	45.60	45.05	-1.25	Pass
	High	85.60	85.60	0.00	Pass

* The VOC calibration gas difference is calculated based on the respective gas concentration value and applicable difference is +/- 5%.

Calibration Data

Gas	Time	Zero Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	0.07	0.16	0.43	0.09	Pass
	After Run	0.07	0.18	0.52		Pass
CO_2	Before Run	0.00	0.01	0.05	0.00	Pass
	After Run	0.00	0.01	0.05		Pass
CO	Before Run	0.32	0.11	-0.22	1.07	Pass
	After Run	0.32	1.14	0.85		Pass
THC	Before Run	0.04	0.04	N/A	0.04	Pass
	After Run	0.04	0.07			

Gas	Time	Upscale Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	12.07	12.13	0.28	0.52	Pass
	After Run	12.07	12.02	-0.24		Pass
CO_2	Before Run	9.09	8.94	-0.80	0.16	Pass
	After Run	9.09	8.97	-0.64		Pass
CO	Before Run	46.04	46.46	-1.64	0.22	Pass
	After Run	46.04	46.57	-1.42		Pass
THC	Before Run	25.05	25.05	N/A	0.60	Pass
	After Run	25.05	24.54			

Emission Test Results

Emission Unit	Units	CO	THC
		Measured	Measured
TP1	lb/MMBtu	0.22	--
	DRE (%)	--	99.54%

Reviewed By: Paige McDaniel Date Reviewed: 11/12/2021

North Dakota Department of Environmental Quality
Test Review

Test Point #	TP4	Test Company:	Air Hygiene, Inc.
100% Tulsa Natural Gas (Assist Gas On)		Date Tested:	8/5/2020
propane (%)	0.3202	High Heating Value (BTU/SCF):	1016
propane (ppm)	3202	High Pressure / Low BTU	

Calibration Span (High Gas)	
CO	THC
96.4	85.6

Pre-Test Calibration Error

Gas	Range	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference (+/- 2%)*	Status
O_2	Zero	0.00	0.07	0.33	Pass
	Mid	12.00	12.07	0.33	Pass
	High	21.10	21.10	0.00	Pass
CO_2	Zero	0.00	0.00	0.00	Pass
	Mid	8.95	9.09	0.75	Pass
	High	18.70	18.72	0.11	Pass
CO	Zero	0.00	0.32	0.33	Pass
	Mid	49.30	48.04	-1.31	Pass
	High	96.40	96.16	-0.25	Pass
THC	Zero	0.00	0.04	0.05	Pass
	Low	25.60	25.05	-2.26	Pass
	Mid	45.60	45.05	-1.25	Pass
	High	85.60	85.60	0.00	Pass

* The VOC calibration gas difference is calculated based on the respective gas concentration value and applicable difference is +/- 5%.

Calibration Data

Gas	Time	Zero Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	0.07	0.16	0.43	0.09	Pass
	After Run	0.07	0.16	0.52		Pass
CO_2	Before Run	0.00	0.01	0.05	0.00	Pass
	After Run	0.00	0.01	0.05		Pass
CO	Before Run	0.32	0.11	-0.22	1.07	Pass
	After Run	0.32	1.14	0.65		Pass
THC	Before Run	0.04	0.04	N/A	0.04	Pass
	After Run	0.04	0.07			

Gas	Time	Upscale Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	12.07	12.13	0.28	0.52	Pass
	After Run	12.07	12.02	-0.24		Pass
CO_2	Before Run	9.09	8.94	-0.80	0.16	Pass
	After Run	9.09	8.97	-0.64		Pass
CO	Before Run	48.04	46.46	-1.64	0.22	Pass
	After Run	48.04	46.67	-1.42		Pass
THC	Before Run	25.05	25.05	N/A	0.60	Pass
	After Run	25.05	24.54			

Emission Test Results

Emission Unit	Units	CO Measured	THC Measured
TP4	lb/MMBtu	0.03	--
	DRE (%)	--	99.95%

Reviewed By: Paige McDaniel Date Reviewed: 11/12/2021

North Dakota Department of Environmental Quality
Test Review

Test Point #	TP5	Test Company:	Air Hygiene, Inc.
100% Tulsa Natural Gas (Assist Gas Off)		Date Tested:	8/6/2020
propane (%)	0.3202	High Heating Value (BTU/SCF):	1016
propane (ppm)	3202	High Pressure / Low BTU	

Calibration Span (High Gas)	
CO	THC
96.4	85.6

Pre-Test Calibration Error

Gas	Range	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference (+/- 2%)*	Status
O_2	Zero	0.00	0.03	0.14	Pass
	Mid	12.00	12.08	0.38	Pass
	High	21.10	21.08	-0.09	Pass
CO_2	Zero	0.00	0.01	0.05	Pass
	Mid	8.95	9.07	0.64	Pass
	High	18.70	18.70	0.00	Pass
CO	Zero	0.00	0.14	0.15	Pass
	Mid	49.30	48.75	-0.57	Pass
	High	96.40	97.44	1.08	Pass
THC	Zero	0.00	0.43	0.50	Pass
	Low	25.60	26.07	0.05	Pass
	Mid	45.60	45.98	-0.21	Pass
	High	85.60	86.12	0.61	Pass

* The VOC calibration gas difference is calculated based on the respective gas concentration value and applicable difference is +/- 5%.

Calibration Data

Gas	Time	Zero Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	0.03	0.18	0.71	0.14	Pass
	After Run	0.03	0.15	0.57		Pass
CO_2	Before Run	0.01	0.03	0.11	0.11	Pass
	After Run	0.01	0.01	0.00		Pass
CO	Before Run	0.14	1.63	1.75	0.44	Pass
	After Run	0.14	1.41	1.32		Pass
THC	Before Run	0.43	0.43	N/A	0.02	Pass
	After Run	0.43	0.45			

Gas	Time	Upscale Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	12.08	12.12	0.19	0.33	Pass
	After Run	12.08	12.05	-0.14		Pass
CO_2	Before Run	9.07	8.95	-0.64	0.32	Pass
	After Run	9.07	9.01	-0.32		Pass
CO	Before Run	48.75	48.82	0.07	0.35	Pass
	After Run	48.75	48.48	-0.28		Pass
THC	Before Run	26.07	26.07	N/A	0.71	Pass
	After Run	26.07	25.46			

Emission Test Results

Emission Unit	Units	CO	THC
		Measured	Measured
TP5	lb/MMBtu	0.05	--
	DRE (%)	--	99.88%

Reviewed By: Paige McDaniel Date Reviewed: 11/12/2021

North Dakota Department of Environmental Quality
Test Review

Test Point #	TP8	Test Company:	Air Hygiene, Inc.
100% Tulsa Natural Gas (Assist Gas On)		Date Tested:	8/6/2020
propane (%)	0.3202	High Heating Value (BTU/SCF):	1016
propane (ppm)	3202	Low Pressure / Low BTU	

Calibration Span (High Gas)	
CO	THC
96.4	55.6

Pre-Test Calibration Error

Gas	Range	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference (+/- 2%)*	Status
O_2	Zero	0.00	0.03	0.14	Pass
	Mid	12.00	12.08	0.38	Pass
	High	21.10	21.08	-0.09	Pass
CO_2	Zero	0.00	0.01	0.05	Pass
	Mid	6.95	9.07	0.64	Pass
	High	18.70	18.70	0.00	Pass
CO	Zero	0.00	0.14	0.15	Pass
	Mid	49.30	48.75	-0.57	Pass
	High	96.40	97.44	1.08	Pass
THC	Zero	0.00	0.43	0.50	Pass
	Low	25.60	26.07	0.05	Pass
	Mid	45.60	45.98	-0.21	Pass
	High	85.60	86.12	0.61	Pass

* The VOC calibration gas difference is calculated based on the respective gas concentration value and applicable difference is +/- 5%.

Calibration Data

Gas	Time	Zero Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	0.03	0.18	0.71	0.14	Pass
	After Run	0.03	0.15	0.57		Pass
CO_2	Before Run	0.01	0.03	0.11	0.11	Pass
	After Run	0.01	0.01	0.00		Pass
CO	Before Run	0.14	1.63	1.75	0.44	Pass
	After Run	0.14	1.41	1.32		Pass
THC	Before Run	0.43	0.43	N/A	0.02	Pass
	After Run	0.43	0.45			

Gas	Time	Upscale Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	12.08	12.12	0.19	0.33	Pass
	After Run	12.08	12.05	-0.14		Pass
CO_2	Before Run	9.07	8.95	-0.64	0.32	Pass
	After Run	9.07	9.01	-0.32		Pass
CO	Before Run	48.75	48.82	0.07	0.35	Pass
	After Run	48.75	48.48	-0.28		Pass
THC	Before Run	26.07	26.07	N/A	0.71	Pass
	After Run	26.07	25.46			

Emission Test Results

Emission Unit	Units	CO Measured	THC Measured
TP8	lb/MMBtu	0.01	--
	DRE (%)	--	99.99%

Reviewed By: Paige McDaniel Date Reviewed: 11/12/2021

North Dakota Department of Environmental Quality
Test Review

Test Point #	TP9	Test Company:	Air Hygiene, Inc.
100% Tulsa Natural Gas (Assist Gas Off)		Date Tested:	8/6/2020
propane (%)	0.3202	High Heating Value (BTU/SCF):	1016
propane (ppm)	3202	Low Pressure / Low BTU	

Calibration Span (High Gas)	
CO	THC
96.4	85.6

Pre-Test Calibration Error

Gas	Range	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference (+/- 2%)*	Status
O_2	Zero	0.00	0.03	0.14	Pass
	Mid	12.00	12.08	0.38	Pass
	High	21.10	21.08	-0.09	Pass
CO_2	Zero	0.00	0.01	0.05	Pass
	Mid	8.95	9.07	0.64	Pass
	High	18.70	18.70	0.00	Pass
CO	Zero	0.00	0.14	0.15	Pass
	Mid	49.30	48.75	-0.57	Pass
	High	96.40	97.44	1.08	Pass
THC	Zero	0.00	0.43	0.50	Pass
	Low	25.60	26.07	0.05	Pass
	Mid	45.60	45.98	-0.21	Pass
	High	85.60	86.12	0.61	Pass

* The VOC calibration gas difference is calculated based on the respective gas concentration value and applicable difference is +/- 5%.

Calibration Data

Gas	Time	Zero Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	0.03	0.18	0.71	0.14	Pass
	After Run	0.03	0.15	0.57		Pass
CO_2	Before Run	0.01	0.03	0.11	0.11	Pass
	After Run	0.01	0.01	0.00		Pass
CO	Before Run	0.14	1.83	1.75	0.44	Pass
	After Run	0.14	1.41	1.32		Pass
THC	Before Run	0.43	0.43	N/A	0.02	Pass
	After Run	0.43	0.45			

Gas	Time	Upscale Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	12.08	12.12	0.19	0.33	Pass
	After Run	12.08	12.05	-0.14		Pass
CO_2	Before Run	9.07	8.95	-0.64	0.32	Pass
	After Run	9.07	9.01	-0.32		Pass
CO	Before Run	48.75	48.82	0.07	0.35	Pass
	After Run	48.75	48.48	-0.28		Pass
THC	Before Run	26.07	26.07	N/A	0.71	Pass
	After Run	26.07	25.46			

Emission Test Results

Emission Unit	Units	CO Measured	THC Measured
TP9	lb/MMBtu	0.01	--
	DRE (%)	--	99.99%

Reviewed By: Paige McDaniel Date Reviewed: 11/12/2021

North Dakota Department of Environmental Quality
Test Review

Test Point #:	TP10	Test Company:	Air Hygiene, Inc.
100% Propane (Assist Gas On)		Date Tested:	8/6/2020
propane (%)	95.4	High Heating Value (BTU/SCF):	2478
propane (ppm)	954000	High Pressure / High BTU	

Calibration Span (High Gas)	
CO	THC
96.4	85.6

Pre-Test Calibration Error

Gas	Range	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference (+/- 2%)*	Status
O_2	Zero	0.00	0.03	0.14	Pass
	Mid	12.00	12.08	0.38	Pass
	High	21.10	21.08	-0.09	Pass
CO_2	Zero	0.00	0.01	0.05	Pass
	Mid	8.95	9.07	0.64	Pass
	High	18.70	18.70	0.00	Pass
CO	Zero	0.00	0.14	0.15	Pass
	Mid	49.30	48.75	-0.57	Pass
	High	96.40	97.44	1.08	Pass
THC	Zero	0.00	0.43	0.50	Pass
	Low	25.60	26.07	0.05	Pass
	Mid	45.60	45.98	-0.21	Pass
	High	85.60	86.12	0.61	Pass

* The VOC calibration gas difference is calculated based on the respective gas concentration value and applicable difference is +/- 5%.

Calibration Data

Gas	Time	Zero Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	0.03	0.18	0.71	0.14	Pass
	After Run	0.03	0.15	0.57		Pass
CO_2	Before Run	0.01	0.03	0.11	0.11	Pass
	After Run	0.01	0.01	0.00		Pass
CO	Before Run	0.14	1.83	1.75	0.44	Pass
	After Run	0.14	1.41	1.32		Pass
THC	Before Run	0.43	0.43	N/A	0.02	Pass
	After Run	0.43	0.45			

Gas	Time	Upscale Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	12.08	12.12	0.19	0.33	Pass
	After Run	12.08	12.05	-0.14		Pass
CO_2	Before Run	9.07	8.95	-0.64	0.32	Pass
	After Run	9.07	9.01	-0.32		Pass
CO	Before Run	48.75	48.82	0.07	0.35	Pass
	After Run	48.75	48.48	-0.28		Pass
THC	Before Run	26.07	26.07	N/A	0.71	Pass
	After Run	26.07	25.46			

Emission Test Results

Emission Unit	Units	CO	THC
		Measured	Measured
TP10	lb/MMBtu	0.04	--
	DRE (%)	--	99.99%

Reviewed By: Paige McDaniel Date Reviewed: 11/12/2021

North Dakota Department of Environmental Quality
Test Review

Test Point #	TP11	Test Company:	Air Hygiene, Inc.
100% Propane (Assist Gas Off)		Date Tested:	8/6/2020
propane (%)	95.4	High Heating Value (BTU/SCF):	2478
propane (ppm)	954000	High Pressure / High BTU	

Calibration Span (High Gas)	
CO	THC
96.4	85.6

Pre-Test Calibration Error

Gas	Range	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference (+/- 2%)*	Status
O_2	Zero	0.00	0.03	0.14	Pass
	Mid	12.00	12.08	0.38	Pass
	High	21.10	21.08	-0.09	Pass
CO_2	Zero	0.00	0.01	0.05	Pass
	Mid	8.95	9.07	0.64	Pass
	High	18.70	18.70	0.00	Pass
CO	Zero	0.00	0.14	0.15	Pass
	Mid	49.30	48.75	-0.57	Pass
	High	96.40	97.44	1.08	Pass
THC	Zero	0.00	0.43	0.50	Pass
	Low	25.60	26.07	0.05	Pass
	Mid	45.60	45.98	-0.21	Pass
	High	85.60	86.12	0.61	Pass

* The VOC calibration gas difference is calculated based on the respective gas concentration value and applicable difference is +/- 5%.

Calibration Data

Gas	Time	Zero Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	0.03	0.18	0.71	0.14	Pass
	After Run	0.03	0.15	0.57		Pass
CO_2	Before Run	0.01	0.03	0.11	0.11	Pass
	After Run	0.01	0.01	0.00		Pass
CO	Before Run	0.14	1.83	1.75	0.44	Pass
	After Run	0.14	1.41	1.32		Pass
THC	Before Run	0.43	0.43	N/A	0.02	Pass
	After Run	0.43	0.45			

Gas	Time	Upscale Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	12.08	12.12	0.19	0.33	Pass
	After Run	12.08	12.05	-0.14		Pass
CO_2	Before Run	9.07	8.95	-0.64	0.32	Pass
	After Run	9.07	9.01	-0.32		Pass
CO	Before Run	48.75	48.82	0.07	0.35	Pass
	After Run	48.75	48.48	-0.28		Pass
THC	Before Run	26.07	26.07	N/A	0.71	Pass
	After Run	26.07	25.46			

Emission Test Results

Emission Unit	Units	CO Measured	THC Measured
TP11	lb/MMBtu	0.02	--
	DRE (%)	--	100.00%

Reviewed By: Paige McDaniel Date Reviewed: 11/12/2021

North Dakota Department of Environmental Quality
Test Review

Test Point #	TP16	Test Company:	Air Hygiene, Inc.
100% Propane (Assist Gas On)		Date Tested:	8/7/2020
propane (%)	95.4	High Heating Value (BTU/SCF):	2478
propane (ppm)	954000	Low Pressure / High BTU	

Calibration Span (High Gas)	
CO	THC
96.4	85.6

Pre-Test Calibration Error

Gas	Range	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference (+/- 2%)*	Status
O_2	Zero	0.00	0.00	0.00	Pass
	Mid	12.00	12.04	0.19	Pass
	High	21.10	21.07	-0.14	Pass
CO_2	Zero	0.00	-0.03	-0.16	Pass
	Mid	6.95	9.07	0.64	Pass
	High	18.70	18.76	0.32	Pass
CO	Zero	0.00	0.06	0.06	Pass
	Mid	49.30	47.67	-1.69	Pass
	High	96.40	97.23	0.86	Pass
THC	Zero	0.00	0.21	0.25	Pass
	Low	25.60	25.30	-1.44	Pass
	Mid	45.60	45.14	-0.92	Pass
	High	85.60	85.34	-0.30	Pass

* The VOC calibration gas difference is calculated based on the respective gas concentration value and applicable difference is +/- 5%.

Calibration Data

Gas	Time	Zero Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	0.00	0.13	0.62	0.05	Pass
	After Run	0.00	0.14	0.66		Pass
CO_2	Before Run	-0.03	0.00	0.16	0.16	Pass
	After Run	-0.03	-0.03	0.00		Pass
CO	Before Run	0.06	0.69	0.86	0.20	Pass
	After Run	0.06	1.08	1.06		Pass
THC	Before Run	0.21	0.21	N/A	0.32	Pass
	After Run	0.21	0.48			

Gas	Time	Upscale Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	12.04	12.08	0.19	0.05	Pass
	After Run	12.04	12.07	0.14		Pass
CO_2	Before Run	9.07	8.88	-1.02	0.64	Pass
	After Run	9.07	9.00	-0.37		Pass
CO	Before Run	47.67	47.63	-0.04	1.30	Pass
	After Run	47.67	46.38	-1.34		Pass
THC	Before Run	25.30	25.30	N/A	2.37	Pass
	After Run	25.30	23.27			

Emission Test Results

Emission Unit	Units	CO Measured	THC Measured
TP16	lb/MMBtu	0.13	--
	DRE (%)	--	99.99%

Reviewed By: Paige McDaniel Date Reviewed: 11/12/2021

North Dakota Department of Environmental Quality
Test Review

Test Point #:	TP17	Test Company:	Air Hygiene, Inc.
100% Propane (Assist Gas Off)		Date Tested:	8/7/2020
propane (%)	95.4	High Heating Value (BTU/SCF):	2476
propane (ppm)	954000	Low Pressure / High BTU	

Calibration Span (High Gas)	
CO	THC
96.4	85.6

Pre-Test Calibration Error

Gas	Range	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference (+/- 2%)*	Status
O_2	Zero	0.00	0.00	0.00	Pass
	Mid	12.00	12.04	0.19	Pass
	High	21.10	21.07	-0.14	Pass
CO_2	Zero	0.00	-0.03	-0.16	Pass
	Mid	8.95	9.07	0.64	Pass
	High	18.70	18.76	0.32	Pass
CO	Zero	0.00	0.06	0.06	Pass
	Mid	49.30	47.67	-1.69	Pass
	High	96.40	97.23	0.86	Pass
THC	Zero	0.00	0.21	0.25	Pass
	Low	25.60	25.30	-1.44	Pass
	Mid	45.60	45.14	-0.92	Pass
	High	85.60	85.34	-0.30	Pass

* The VOC calibration gas difference is calculated based on the respective gas concentration value and applicable difference is +/- 5%.

Calibration Data

Gas	Time	Zero Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	0.00	0.13	0.62	0.05	Pass
	After Run	0.00	0.14	0.66		Pass
CO_2	Before Run	-0.03	0.00	0.16	0.16	Pass
	After Run	-0.03	-0.03	0.00		Pass
CO	Before Run	0.06	0.89	0.86	0.20	Pass
	After Run	0.06	1.08	1.05		Pass
THC	Before Run	0.21	0.21	N/A	0.32	Pass
	After Run	0.21	0.48			

Gas	Time	Upscale Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	12.04	12.08	0.19	0.05	Pass
	After Run	12.04	12.07	0.14		Pass
CO_2	Before Run	9.07	8.88	-1.02	0.64	Pass
	After Run	9.07	9.00	-0.37		Pass
CO	Before Run	47.67	47.63	-0.04	1.30	Pass
	After Run	47.67	46.38	-1.34		Pass
THC	Before Run	25.30	25.30	N/A	2.37	Pass
	After Run	25.30	23.27			

Emission Test Results

Emission Unit	Units	CO	THC
		Measured	Measured
TP17	lb/MMBtu	0.05	--
	DRE (%)	--	99.99%

Reviewed By: Paige McDaniel Date Reviewed: 11/12/2021

North Dakota Department of Environmental Quality
Test Review

Test Point #:	TP12-1	Test Company:	Air Hygiene, Inc.
100% Ethylene		Date Tested:	3/31/2017
propane (%)	0	High Heating Value (BTU/SCF):	1050
propane (ppm)	0	Maximum (Staging) Pressure	

Calibration Span (High Gas)	
CO	THC
160.0	304.0

Pre-Test Calibration Error

Gas	Range	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference (+/- 2%)*	Status
O_2	Zero	0.00	0.02	0.10	Pass
	Mid	12.14	11.99	-0.72	Pass
	High	20.93	20.95	0.10	Pass
CO_2	Zero	0.00	0.03	0.16	Pass
	Mid	8.86	9.16	1.59	Pass
	High	18.82	18.91	0.48	Pass
CO	Zero	0.00	0.15	0.08	Pass
	Mid	98.10	96.10	-1.11	Pass
	High	160.00	179.26	-0.40	Pass
THC	Zero	0.00	0.18	0.06	Pass
	Low	85.70	87.38	1.79	Pass
	Mid	159.00	162.11	1.88	Pass
	High	304.00	304.06	0.02	Pass

* The VOC calibration gas difference is calculated based on the respective gas concentration value and applicable difference is +/- 5%.

Calibration Data

Gas	Time	Zero Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	0.02	0.00	-0.10	0.10	Pass
	After Run	0.02	0.02	0.00		Pass
CO_2	Before Run	0.03	0.04	0.05	0.11	Pass
	After Run	0.03	0.06	0.16		Pass
CO	Before Run	0.15	0.20	0.03	0.06	Pass
	After Run	0.15	0.10	-0.03		Pass
THC	Before Run	0.18	0.51	N/A	0.03	Pass
	After Run	0.18	0.43			

Gas	Time	Upscale Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	11.99	12.13	0.67	0.10	Pass
	After Run	11.99	12.15	0.76		Pass
CO_2	Before Run	9.16	8.92	-1.28	0.32	Pass
	After Run	9.16	8.86	-1.59		Pass
CO	Before Run	96.10	98.46	1.31	0.17	Pass
	After Run	96.10	98.16	1.14		Pass
THC	Before Run	87.38	86.00	N/A	0.11	Pass
	After Run	87.38	86.33			

Emission Test Results

Emission Unit	Units	CO Measured	THC Measured
TP12-1	lb/MMBtu	0.01	--
	DRE (%)	--	100.00%

Reviewed By: Paige McDaniel Date Reviewed: 11/12/2021

North Dakota Department of Environmental Quality
Test Review

Test Point #	TP13-1	Test Company:	Air Hygiene, Inc.
100% Propane		Date Tested:	3/31/2017
propane (%)	100	High Heating Value (BTU/SCF):	1050
propane (ppm)	1000000	Maximum (Staging) Pressure	

Calibration Span (High Gas)	
CO	THC
180.0	304.0

Pre-Test Calibration Error

Gas	Range	Gas Concentration (ppm)	Analyzer Response (ppm)	Difference (+/- 2%)*	Status
O_2	Zero	0.00	0.02	0.10	Pass
	Mid	12.14	11.99	-0.72	Pass
	High	20.93	20.95	0.10	Pass
CO_2	Zero	0.00	0.03	0.16	Pass
	Mid	8.86	9.16	1.59	Pass
	High	18.82	18.91	0.48	Pass
CO	Zero	0.00	0.15	0.08	Pass
	Mid	98.10	96.10	-1.11	Pass
	High	180.00	179.28	-0.40	Pass
THC	Zero	0.00	0.18	0.06	Pass
	Low	85.70	87.38	1.79	Pass
	Mid	159.00	162.11	1.88	Pass
	High	304.00	304.06	0.02	Pass

* The VOC calibration gas difference is calculated based on the respective gas concentration value and applicable difference is +/- 5%.

Calibration Data

Gas	Time	Zero Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	0.02	0.00	-0.10	0.10	Pass
	After Run	0.02	0.02	0.00		Pass
CO_2	Before Run	0.03	0.04	0.05	0.11	Pass
	After Run	0.03	0.06	0.16		Pass
CO	Before Run	0.15	0.20	0.03	0.06	Pass
	After Run	0.15	0.10	-0.03		Pass
THC	Before Run	0.18	0.51	N/A	0.03	Pass
	After Run	0.18	0.43			

Gas	Time	Upscale Gas				Status
		Analyzer Response	System Response	System Bias (+/- 5%)	System Drift (+/- 3%)	
O_2	Before Run	11.99	12.13	0.67	0.10	Pass
	After Run	11.99	12.15	0.76		Pass
CO_2	Before Run	9.16	8.92	-1.28	0.32	Pass
	After Run	9.16	8.86	-1.59		Pass
CO	Before Run	96.10	98.46	1.31	0.17	Pass
	After Run	96.10	98.16	1.14		Pass
THC	Before Run	87.38	86.00	N/A	0.11	Pass
	After Run	87.38	86.33			

Emission Test Results

Emission Unit	Units	CO Measured	THC Measured
TP13-1	lb/MMBtu	0.08	--
	DRE (%)	--	100.00%

Reviewed By: Paige McDaniel Date Reviewed: 11/12/2021

Appendix A

The base flare tips approved for 99.0% DRE and a CO emission factor of 0.25 lb/MMBtu with assist gas and 0.10 lb/MMBtu without assist gas are configured as shown in the images below.

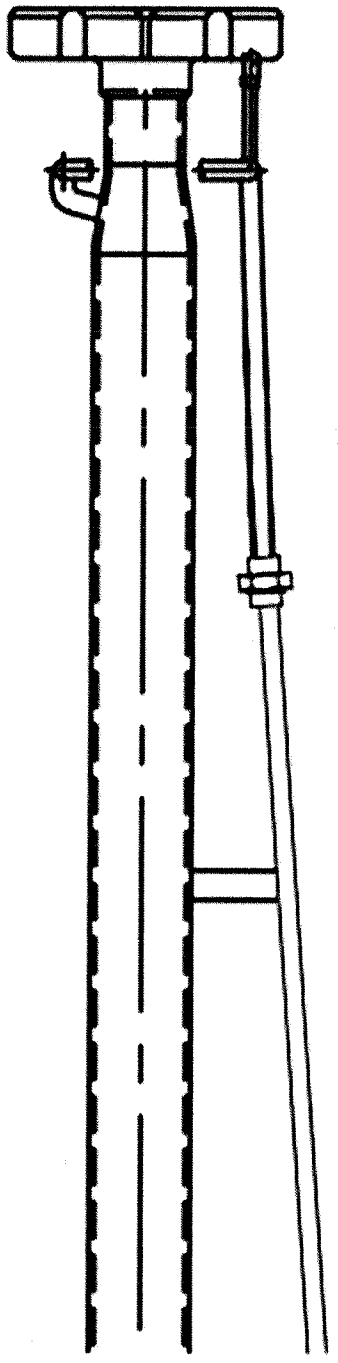


Figure 1: MJAG-3 Flare Tip

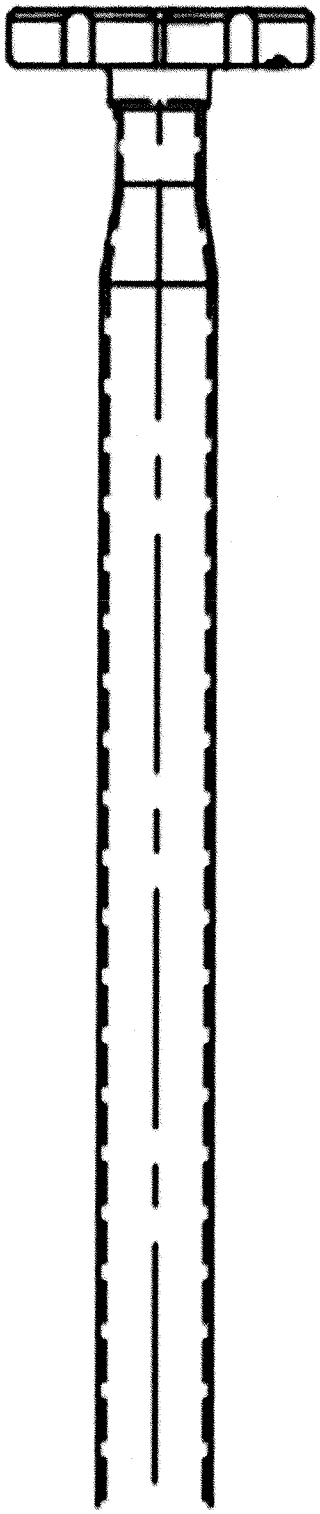


Figure 2: MJ-3 Flare Tip

The base flare tips may be manifolded together into a common flare tip by Zeeco to meet the flow performance requirements for a given application. Some general examples of these are shown below for reference only. The number of flare tips is not limited by the figures depicted below. However, only flare tips that have been manifolded together by Zeeco will be accepted into the High Efficiency Program.

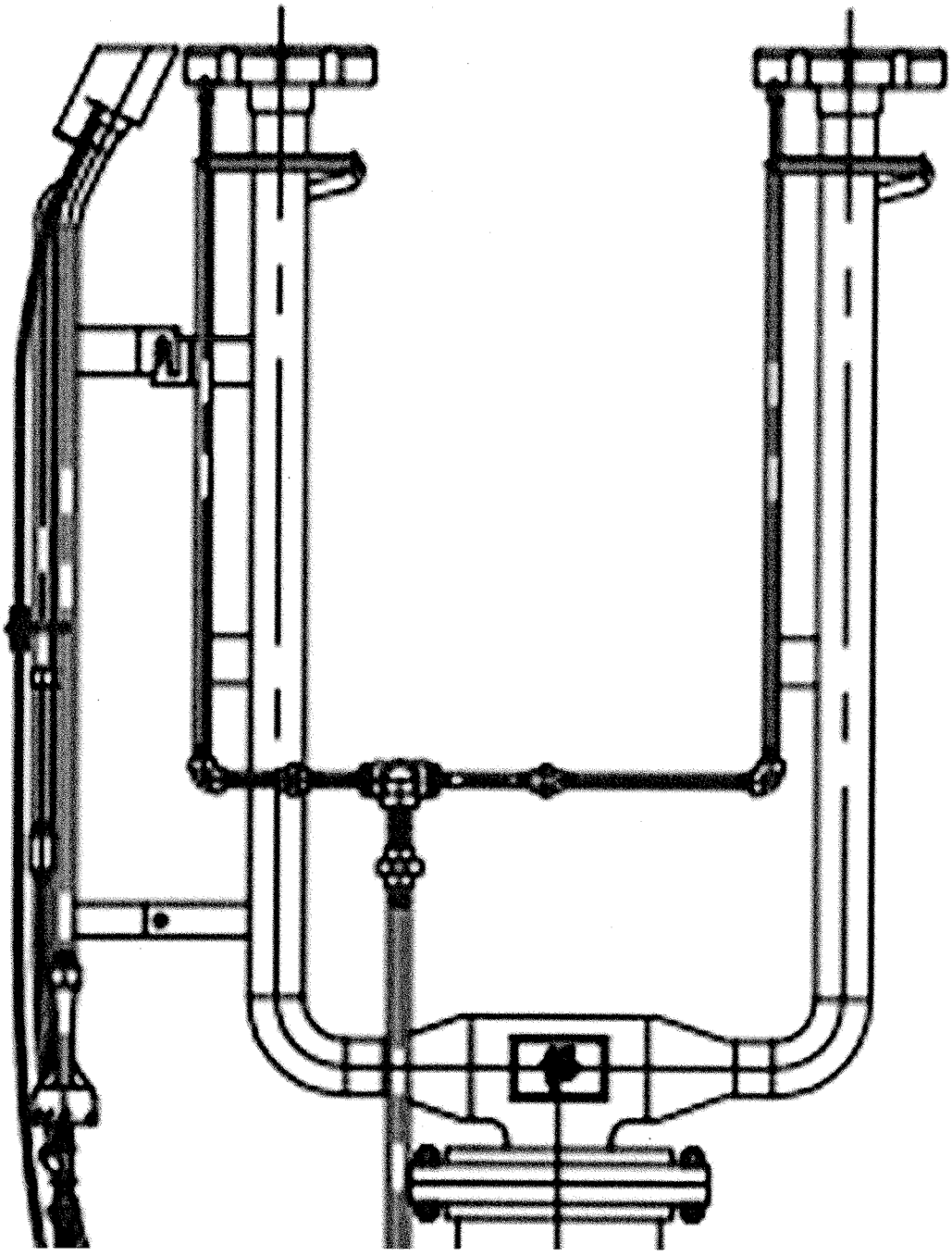


Figure 3. 2MJAG-3 Flare Tip

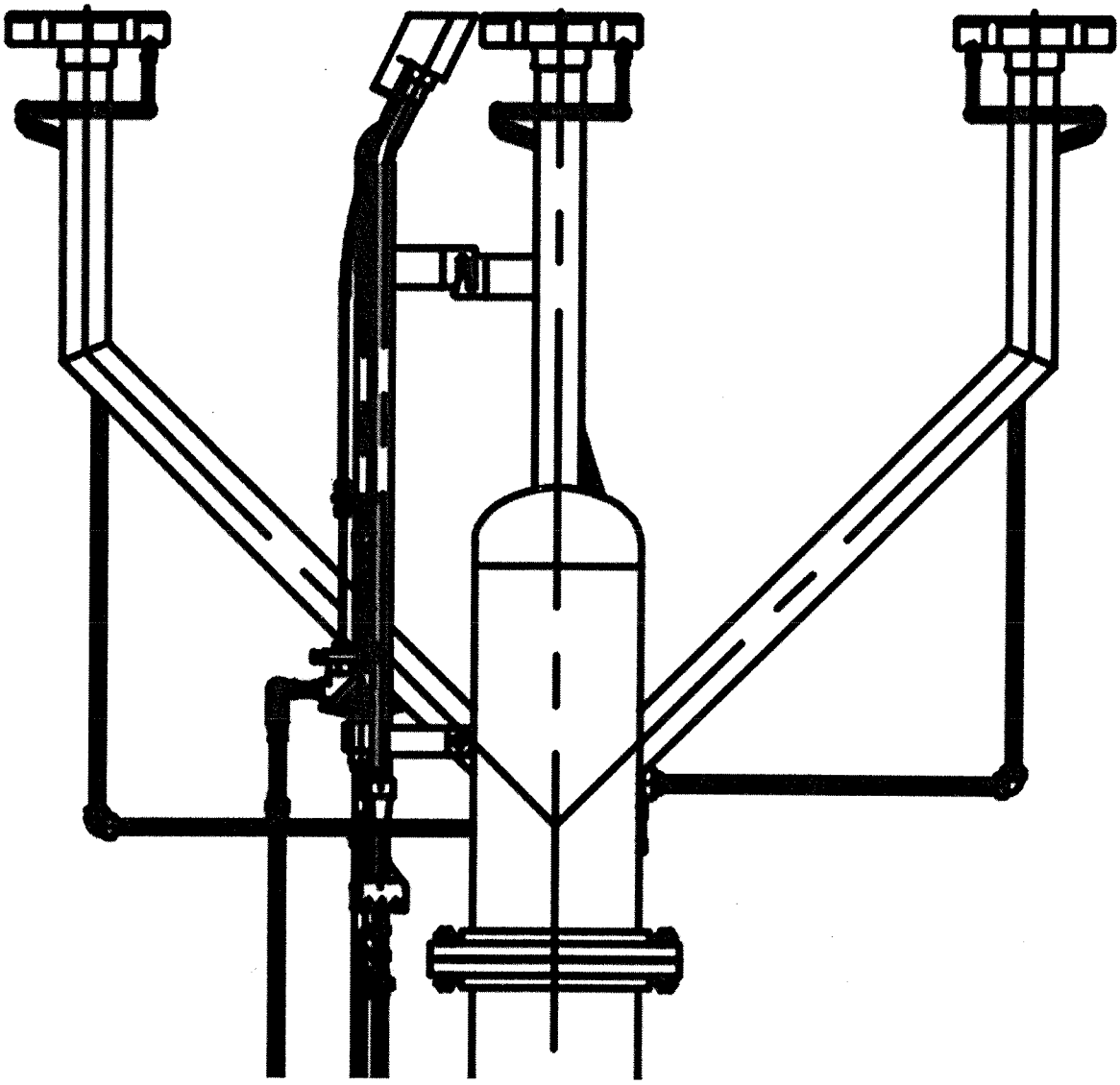


Figure 4. 3MJAG-3 Flare Tip.

Appendix B

The following are required inspections, as per the manual provided by Zeeco. These Zeeco 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 Zeeco'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
   - Improper use of assist media
2. If a tip configuration utilizes multiple tips, 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
3. A check for the quality of the flame
   a. The flame should be visible
   b. The flame color should be yellow to dark orange
   c. The flame motion should be rolling and fluid. The flame should not flicker or be erratic.

Inspections required by Zeeco are included below:

MJ Flare Tip w/ Assist Gas Ring (if applicable)

The Series MJ Flare Tip requires little or no maintenance. There are no moving parts to replace or lubricate. The flare tip shall be inspected at every shut down or a minimum of once every 3–5 years.

The tip is in the heat affected zone and as a result is subject to deterioration during operation. A visual inspection should be performed. The visual inspection should ensure that it is securely mounted and that no cracks or corrosion are visible either on the inside or outside surfaces of the tip. If cracks or corrosion are present, the tip must be replaced. The condition of the gas ports shall be assessed to ensure that there is no blockage in these ports. The ports may be cleaned using compressed air. Drilling of these ports is not recommended as it could enlarge the gas opening and compromise the proper operation of the "spider" tip.

NOTE: Any damage to the Series MJ Flare Tip may warrant Flare Tip replacement. Contact Zeeco if damage to the Series MJ Flare Tip is found.

HSLF Flare Pilot

To ensure proper pilot operation and longevity, the following system components must be inspected at every shut down and replaced if defective:

Tip – The pilot tip is in the heat affected zone and as a result is subject to deterioration during operation. This deterioration is dependent on the type of pilot gas used. A visual inspection shall be performed. The visual inspection should ensure that it is securely mounted and that no cracks or corrosion are visible either on the inside or outside surfaces of the tip. If cracks or corrosion are present, the tip must be replaced. The condition of the gas ports inside the pilot tip shall be assessed to ensure that there is no blockage in these ports. The ports may be cleaned using compressed air. Drilling of these ports is not recommended as it may enlarge the gas opening and compromise the proper operation of the pilot.

Mixer assembly – The mixer shall be visually inspected to determine that it is securely mounted and that no cracks or corrosion are visible. If cracks or corrosion are present, the mixer must be replaced. The mixer should also be clean and free of debris. The mixer may be cleaned with compressed air or wiped with a cloth. The gas spud mounted in the base of the mixer assembly shall be inspected to ensure that its gas port or ports are not blocked. If blockage is discovered, attempt to remove the blockage using compressed air. Drilling of these ports is not recommended as it may enlarge the gas opening and compromise the proper operation of the pilot.

Strainer(s) – Assure that the strainer is securely mounted and that no cracks or corrosion are visible. If cracks or corrosion are present, the strainer must be replaced. If the strainer is intact, clean debris from strainer mesh and reinstall.

Mounting brackets – Assure that the brackets are securely mounted and that no cracks or corrosion are visible. If cracks or corrosion are present, the bracket(s) must be replaced.

Weather-head(s) – Assure that all weather-heads are securely mounted and that no cracks or corrosion are visible. If cracks or corrosion are present, the weather-head must be replaced.

Thermocouples – Perform continuity check from grade. Damaged or malfunctioning thermocouples shall be replaced at the next shut down or immediately replaced from grade if retractable thermocouples or pilots are installed.

NOTE: All thermocouples used for pilot flame monitoring shall be replaced at every shut down.

Appendix C

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

Problem or observation	Potential causes	Action
A red glow of the pilot shield is visible at night	Pilot is operating properly	No action required.
Pilot will not light	Pilot is improperly installed	Refer to the pilot installation instructions to verify that the pilot is properly installed and wiring terminations are correctly made.
	Pilot mixer orifice is plugged	Refer to the maintenance section of the Zeeco manual for instructions on cleaning the mixer orifice.
	Pilot fuel gas is incorrect or compromised	Verify that the pilots are receiving a fuel gas supply that is regulated to the proper pressure as shown on the flare tip drawings and that the LHV of the fuel gas is greater than 300 Btu/scf (11,200 KJ/Nm^3). Note that the High Efficiency Program requires a minimum LHV of 931.5 Btu/scf for Zeeco flare tips. If your LHV is below 931.5 Btu/scf, 98% DRE must be used.
	HEI ignition probe is not sparking	Inspect, clean and test HEI ignition probe. Refer to the HEI Maintenance Section of the Zeeco manual for details.
	HEI ignition module has failed	Replace ignition module.
	HEI ignition wiring has failed	Inspect HEI ignition wiring and perform wiring continuity check for open circuit from grade.
Control system indicates that pilots are not burning	Pilot fuel gas supply does not meet operational requirements	Confirm pilot fuel gas composition and pressure are per job specific requirements as indicated on flare tip drawing.
	Pilots are damaged or pilot mixers are plugged	Inspect pilots for tip or pilot mixer damage or plugging of the mixer orifice. Refer to the Maintenance section of the Zeeco manual for instructions on cleaning the mixer orifice. Replace tip and/or mixer if damaged.
	Pilot fuel lines are plugged	Inspect pilot fuel gas lines, clean per site specific recommendations if required
	HEI spark probe is not sparking	Inspect and clean HEI spark probe
	HEI ignition module has failed	Replace ignition module

Problem or observation	Potential causes	Action
	HEI ignition wiring has failed	Inspect HEI ignition wiring and perform wiring continuity check for open circuit from grade.
	Pilot thermocouple has failed	Perform continuity check for open circuit on thermocouple from grade. If no open circuit condition is found, verify thermocouple output is near specified value at ambient temperature with no flame present. Output values range from 0.397 mV at 50 °F (10° C) to 1.521 mV at 100° F (37.8° C) for a Type K thermocouple. Replace thermocouple if defective.
	Pilot thermocouple wiring has failed	Inspect thermocouple wiring and perform wiring continuity check for open circuit from grade.
	Pilot temperature switch (if provided) has failed	Test pilot temperature switch and replace if defective.
	Flame verification temperature settings are incorrect	Contact Zeeco for proper temperature set points and instructions for adjusting these set points.
Explosions heard inside flare stack	Purge gas is not flowing or flow is too low	Confirm that the purge gas flow to the flare is at the rate as given in the Utility Requirements Appendix in Section 9 of the Zeeco manual or Zeeco Flare Tip drawing.
	Air is leaking in the flare header or stack	Inspect the flare gas header and flare stack for sources of air leakage. Seal any air leaks that are discovered.
	Flare gas contains oxygen	Check the flare gas composition to determine if oxygen is present. If it is present, adjust process conditions to eliminate oxygen from the flare gas.
Excessive corrosion at the flare stack base	Oxygen is entering the flare stack	Check for air leakage in the flare header and for oxygen in the flared gases. Seal air leaks and adjust process conditions to eliminate oxygen from the flare gas.
Utility piping is distorted at grade	Utility piping brackets are anchored in place	Ensure that utility piping guide brackets are NOT anchored to the flare stack.
Flare gas exiting the tip will not light	Pilots are not burning	Light the pilots per the pilot and ignition system operating instructions of the Zeeco manual. If pilots will not light per operating instructions refer to the troubleshooting section entitled "Pilot will not light" of the Zeeco manual.

Problem or observation	Potential causes	Action
	Flare gas heating value is too low	For stable combustion to take place at the flare tip, the flare gas must be above 300 Btu/scf (11,200 KJ/Nm^3) in heating value. Verify the flare gas heating value and if it is found to be below 300 Btu/scf (11,200 KJ/Nm^3) add assist gas until 300 Btu/scf (11,200 KJ/Nm^3) heating value is reached. WARNING: Before adding assist gas, it is important to confirm that the flare capacity will not be exceeded by the additional volume of assist gas. Note that the High Efficiency Program requires a minimum LHV of 931.5 Btu/scf for Zeeco flare tips. If your LHV is below 931.5 Btu/scf, 98% DRE must be used.
	Flare gas flow is too low	Increase the flare gas flow rate to the minimum purge rate. If detonation arrestors are in use, check to make sure they are not clogged. They need to be clear of any debris or flow could be reduced.
Flare is smoking	Flare gas flow rate exceeds smokeless capacity of the flare tip	Reduce flare gas flow rate if possible. Consult Zeeco for information on modifying or replacing the tip to accommodate larger flows.
	Flare gas composition has changed	Confirm that the flare gas is per the design composition. If the flare gas composition cannot be restored to the design conditions, consult Zeeco for information on modifying or replacing the tip to provide smokeless operation for the new gas composition.
	Air assist blower (if provided) is off or on low speed	Verify that the air assist blowers are operating properly and are running at the recommended speed.
	Flare gas flow rate exceeds smokeless capacity of the Air-Assist Blower.	Reduce flare gas flow rate if possible. Consult Zeeco for information on replacing the Air-Assist Blower to provide greater capacity.
	Insufficient Assist Gas Flow Rate	Increase Assist Gas flow rate
A red glow of the flare tip body is visible at night	Air is leaking into the flare tip body	Inspect the flare tip and flare gas header for sources of air leakage. Seal any air leaks that are discovered.
	Purge gas is not flowing or purge gas flow is too low	Confirm that the purge gas flow to the flare is at the rate as given in the Utility Requirements Appendix in Section 9 of the Zeeco manual and on the Flare Tip drawing.

Problem or observation	Potential causes	Action
Flare is producing excessive noise	Pulsating flame	If a Gas Seal purge reduction device is installed as part of the Flare System, the seal may have liquid accumulation. Check the seal drain lines for any obstructions and clear as required to allow water to drain from the seal.
	Pilot gas composition has changed	Confirm that the pilot gas composition is per the design pilot gas composition. If design pilot gas composition cannot be restored, consult Zeeco for information about adjustments that may be required to the pilot design.
Radiation readings are too high	Flare gas flow rate exceeds design capacity of the flare tip	Reduce flare gas flow rate if possible. Consult Zeeco for information on modifying or replacing the tip to accommodate larger flows.