Consumers Energy

Count on Us

40 CFR 63, Subpart HHH
Compliance Test Report

for

EUGLYCDEHY

Consumers Energy Company
Muskegon River Compressor Station
State Registration Number (SRN) N2901
8613 Pine Road
Marion, Michigan 49665

Test Date: March 25, 2015

Report Date:
May 12, 2015

Work Order No. 23531215

Report Revision 0

Test Performed by:
Consumers Energy Company
Laboratory Services Department, Regulatory Compliance Testing Section and
Enthalpy Analytical, Inc.

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT
REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: Consumers Energy Company – Muskegon River Compressor Station County: Clare

Source Address: 8613 Pine Road City: Marion

AQD Source ID (SRN): N2901 ROP No.: MI-ROP-N2901-2014 ROP Section No.:

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From _____ To _____

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

40 CFR 63 Subpart HHH Compliance Test Report

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

Ocie Gregory, Jr.	Ex. Mgr. Natural Gas Compression & Storage	(586) 784-2091
Name of Responsible Official (print or type)	Title	Phone Number

Ocie Gregory Jr 5/12/15

Signature of Responsible Official Date

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

1.0 INTRODUCTION

Identification, location and dates of tests

This report summarizes the results of testing conducted on March 25, 2015 at Consumers Energy Company's (CEC) Muskegon River Compressor Station. CEC's Regulatory Compliance Testing Section (RCTS), along with Enthalpy Analytical, Inc., conducted performance tests at the exhaust location of the thermal oxidizer serving the glycol dehydration system, identified as EUGLYCDEHY. The glycol dehydration system is located and operating at the Muskegon River Compressor Station in Marion, Michigan. The system is controlled with a thermal oxidizer.

Purpose of testing

The purpose of the testing was to determine compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) from Natural Gas Transmission and Storage Facilities, 40 CFR Part 63, Subpart HHH §63.1275(b)(1)(iii). Initial testing was performed on December 18, 2014 and demonstrated compliance. However, during the December 2014 test event, the minimum combustion zone temperature was higher than anticipated. The purpose of this test event was to re-establish the minimum thermal oxidizer combustion zone temperature required to continuously achieve the required BTEX emission limit calculated pursuant to §63.1275(b)(1)(iii).

Unit	Parameters to be Tested	Underlying Regulation
EUGLYCDEHY	BTEX mass at the outlet of the control device	40 CFR 63, Subpart HHH

Brief description of source

The Muskegon River Compressor Station is a natural gas compressor station. The purpose of the facility is to maintain pressure of natural gas in order to move it in and out of storage reservoirs and along the pipeline system. When natural gas is removed from the storage reservoirs, a dehydration unit is used to remove water in order to meet pipeline gas quality specifications.

Names, addresses, and telephone numbers of the contacts for information regarding test and the test report, and names/affiliation of all personnel involved in conducting testing

A Test Protocol, dated February 6, 2015 was submitted and subsequently approved by the MDEQ in their letter dated March 10, 2015 (Attachment 1). In addition, an email request, dated February 9, 2015, was submitted to US EPA for an adjustment to the time period required for providing notification of a performance test. 40 CFR 63.9(e) requires the owner or operator of an affected source to give notice to EPA (the Administrator) in writing at least 60 calendar days before the performance test is scheduled. However, in order to ensure that

the re-test could take place before the glycol dehydration unit ceased operation for the season, CEC requested that EPA allow for a 30-day notification. EPA granted our request for an adjustment to the time period for performance test notification in their letter dated February 17, 2015. (Attachment 2)

BTEX performance tests were performed on March 25, 2015 by Mr. Justin Guenzler of Enthalpy Analytical, Inc., with auxiliary test support from RCTS Technical Analysts Brian Glendening and Gregg Koteskey. CEC Senior Engineer Ms. Amy Kapuga was onsite to coordinate the collection of process data in conjunction with each BTEX sample collection time. Muskegon River Compressor Station facility manager Mr. Parish Geers coordinated plant operations. MDEQ representatives were unable to witness the test program. The following table contains the test program participant contact information:

40 CFR Part 63 Subpart HHH Test Program Participants
Muskegon River Compressor Station

Responsible Party	Address	Contact
Test Facility	Muskegon River Compressor Station 6913 Pine Road Marion, Michigan 49665	Mr. Parish Geers Compression Field Leader 231-743-4101 parish.geers@cmsenergy.com
CEC Corporate Air Quality Contact	Consumers Energy Company Environmental Services Department 1945 West Parnall Road Jackson, Michigan 49201	Ms. Amy Kapuga 517-788-2201 amy.kapuga@cmsenergy.com
RCTS Test Representative	Consumers Energy Company Regulatory Compliance Testing Section 17010 Croswell Street West Olive, Michigan 49460	Mr. Brian Glendening Technical Analyst 616-738-3234 brian.glendening@cmsenergy.com
Enthalpy Analytical Test Representative	Enthalpy Analytical, Inc. 800-1 Capitola Drive Durham, NC 27713-4385	Mr. Justin Guenzler 919-850-4392 Justin.Guenzler@enthalpy.com
State Representative	Michigan Department of Environmental Quality Air Quality Division 120 West Chapin Street Cadillac, MI 49601	Mr. Robert Dickman 231-876-4412 dickmanr@michigan.gov
	Michigan Department of Environmental Quality Air Quality Division Saginaw Bay District Office 401 Ketchum Street, Suite B Bay City, Michigan 48708	Mr. Ben Witkopp 989-894-6219 witkoppb@michigan.gov

Please note that reproducing portions of this test report may omit critical substantiating documentation or cause information to be taken out of context. If any portion of this report is reproduced, please exercise due care in this regard.

2.0 SUMMARY OF RESULTS

Operating Data

Operating data collected during each test run included the natural gas flow rate and thermal oxidizer combustion zone temperature.

Applicable Permit Number

The Muskegon River Compressor Station is currently operating pursuant to the terms and conditions of Renewable Operating Permit (ROP) No. MI-ROP-N2901-2014. A performance test was conducted, as required, at the exhaust location of the thermal oxidizer serving the glycol dehydration system (EUGLYCDEHY).

Results

Comprehensive Glycol Dehydration System Process Data, Test Data Summary, BTEX Gas Chromatograph (GC) Analyses, Sample Calculations and Quality Assurance data are shown in Attachments 3 - 7. The following summary table illustrates the average BTEX emission rate based on performance test data obtained at the exhaust location of the thermal oxidizer serving the glycol dehydration system.

Summary of BTEX Concentrations and Emissions
EUGLYCDEHY
Muskegon River Compressor Station

Source Name	BTEX Compound Concentrations, (ppmv) [1]	BTEX Emission Rate, Mg/year [1]	BTEX Emission Limit, Mg/year[2]	Combustion Chamber Temperature, °F
EUGLYCDEHY	34.82	3.20	6.7	1167

[1] The average sum of BTEX concentrations shown above incorporate Run 1 values that were either non-detect (*ND*), below the minimum detection limit (*MDL*), or between the *MDL* and the Limit of Quantification (*LOQ*), as flagged by a *J* qualifier, and as such are to be considered an estimated value. Additional information on this topic is contained in the Enthalpy report found in Attachment 5 of this report.

[2] The BTEX emission limit was calculated as required by §63.1275(b)(1)(iii), Equation 1 – refer to Attachment 6

Based on the Muskegon River Compressor Station test data, BTEX emissions at the glycol dehydration system control device outlet meets the NESHAP unit specific megagrams per year BTEX emission limit for existing small glycol dehydration units as described in 40 CFR Part 63, Subpart HHH, §63.1275(b)(1)(iii), Equation 1.

3.0 SOURCE DESCRIPTION

Description of Process

The Muskegon River Compressor Station maintains the pressure of natural gas in order to transport in and out of storage reservoirs and along the pipeline system. The glycol dehydration unit installed at Muskegon River Compressor Station is used to remove water from the natural gas obtained from storage reservoirs in order to meet pipeline gas quality specifications. The water removal process involves feeding lean, water-free triethylene glycol (TEG) into the top of a contact tower. As the TEG flows downward, it contacts wet natural gas flowing upward, thereby removing water through physical absorption. The dry natural gas exits the top of the absorption column and is fed to the pipeline. The water-rich TEG exiting via the bottom of the column is fed to a flash vessel for removal of any hydrocarbon vapors and the skimming of liquid hydrocarbons. After leaving the flash vessel, the rich glycol is heated and directed to a reboiler for thermal regeneration, which removes excess water, thereby returning the TEG to its original purity. Remaining hydrocarbon vapors in the flash vessel and reboiler/regenerator are consumed in the forced-draft natural gas-fired thermal oxidizer.

Process Flow Sheet or Diagram

NA

Type and Quantity of Raw Material Processed During the Tests

NA

Maximum and Normal Rated Capacity of the Process

The Muskegon River Compressor Station utilizes a glycol dehydration system to remove water from natural gas withdrawn from underground storage reservoirs. The maximum rated capacity of the system is 400 million standard cubic feet per day (MMscfd). The average flow rate is 220 MMscfd.

Process Instrumentation Monitored During Test

Dehydration system process data collected during each test run included natural gas flow rate (quantity of gas processed) and thermal oxidizer combustion zone temperature. The preceding data was logged at least once every 15 minutes and then averaged to determine the per-test run values.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

Description of sampling train(s) and field procedures

Triplicate BTEX test runs, approximately one hour in duration, were performed at the thermal oxidizer exhaust stack associated with the applicable glycol dehydration system as specified in Part 63 Subpart HHH, §63.1282, in accordance with reference test methods described in the United States Environmental Protection Agency (U.S. EPA), 40 CFR Part 60, Attachment A, Method 18. Auxiliary tests for exhaust gas velocity, molecular weight and moisture were also performed.

Traverse Points

The traverse points employed at each thermal oxidizer exhaust were selected using U.S. EPA Reference Method 1, *Sample and Velocity Traverses for Stationary Sources*. The cross - sectional inside diameter of the stack was measured and traverse points selected based on upstream and downstream duct disturbances. Attachment 2 contains the traverse point location data for the exhaust stack.

Velocity and Temperature

The exhaust gas velocity and temperature was determined using U.S. EPA Reference Method 2, *Determination of Stack Gas Temperature and Velocity (Type S Pitot Tube)*. The exhaust gas velocity was measured using an "S Type" Pitot tube connected to an appropriately sized magnehelic or oil manometer and exhaust gas temperatures were measured using K-type thermocouples and digital temperature display devices.

Molecular Weight

The exhaust gas composition was determined using U.S. EPA Reference Method 3, *Gas Analysis for Determination of Molecular Weight*. Grab samples were collected during each BTEX run and directly analyzed on site with a Fyrite combustion gas analyzer. The stack gas molecular weight was used in conjunction with exhaust gas velocity calculations.

Moisture

The exhaust gas moisture content was determined using U.S. EPA Reference Method 4, *Determination of Moisture in Stack Gases*. The method requires effluent gas to be drawn through a series of four impingers; the first two containing water, the third empty and the fourth containing indicating silica gel. To ensure condensation of exhaust gas moisture, the impingers are immersed in an ice bath during the test. Upon completion, collected water vapor is determined gravimetrically to calculate exhaust gas percent moisture.

Benzene, Toluene, Ethyl benzene, Xylenes (BTEX)

BTEX concentrations were determined by Enthalpy Analytical, Inc. using guidelines detailed in U.S. EPA Method 18, *Measurement of Gaseous Organic Compound Emissions by Gas Chromatography (GC).* Specifically, the *Direct Interface and Analysis Procedure*, described in Method 18, §8.2.2 was used.

Source samples were delivered to the GC using a heated sample line. Approximately 5 liters per minute of sample was pulled from the source into the heated line by a heated stainless steel and Teflon sample pump. A slipstream of approximately 50 mL/min was delivered to the GC using a peristaltic pump pulled through a sample loop. The sample was passed through the GC continuously with a sample injected at approximately 14 minute intervals.

BTEX analyses were performed using the Hewlett Packard Model 5890 Series II, Gas Chromatograph "Morticia" (S/N 3033A32176). Morticia was equipped with a Flame Ionization Detector and a Restek RTX-624 30 m x 0.32 mm x 1.8 µm capillary column on the front and a Restek RK-624 30 m x 0.32 mm x 1.8 µm capillary column on the rear. All analytes of interest were referenced to certified gas phase standards.

The calibration curves are located in the EPA Method 18 Direct Interface section of Enthalpy Report in Appendix 2 and referenced in the Analysis Method column on the Detailed Results page of the same document. For each calibration curve used, the first page of the curve contains all method specific parameters (i.e., curve type, origin, weight, etc.) used to quantify the samples. The calibration curve section also includes a table with the Retention Time (RetTime), Level (Lvl), Amount (corresponding units), Area, Response Factor (Amt/Area) and the analyte Name. The calibration table is used to identify (by retention time) and quantify each target compound.

Calibrations were performed by diluting the following certified cylinders: Linde CC-55804, exp 2/13/16 (containing benzene, toluene, ethylbenzene, p-xylene, and o-xylene) and Customgas CC-44380, exp 4/2/16 (containing benzene). Dilutions of the certified standards were performed using an Environics 4000 gas diluter.

An EPA Method 205 verification of the Environics 4000 gas dilution system was performed by calibrating the GC with a certified 892.4 ppm propane gas cylinder (Linde CC-114215, exp 9/24/22). Two calibration points were run in triplicate for each mass flow controller and a challenge gas (Linde CC-406589, exp 9/17/22) was analyzed in triplicate as well. All calibration points and the challenge gas sample met the method required 2% accuracy and precision criteria.

Quality Assurance Procedures

Each U.S. EPA reference method performed contains specific language stating that to obtain reliable results, persons using these methods should have a thorough knowledge of the techniques associated with each method. While CEC RCTS was involved only with the auxiliary support testing for BTEX, this role did not diminish efforts to minimize any potential sampling errors through observing a quality assurance (QA) test procedure for each field test component.

For each test run, initial and final moisture weights were measured within 0.1 grams. The velocity, molecular weight and moisture apparatus was leak-checked before and after each test run. Documented auxiliary sample data included time, barometric pressure, exhaust gas temperature, exhaust gas ΔP, total moisture sample volume per run, percent moisture and percent O_2/CO_2.

All manual test equipment was calibrated before and after the test program in accordance with the procedures outlined in the *Quality Assurance handbook for Air Pollution Measurement Systems, Volume III, EPA-600/R-94/038C.* Pitot tubes and thermocouples used to measure the exhaust gas were calibrated following the handbook requirements outlined in *Stationary Source-Specific Methods,* Method 2, *Type S Pitot Tube Inspection*, and in ALT – 011, *Alternative Method 2 Thermocouple Calibration Procedure Calibration Procedure.* Dry test meters used for moisture determination incorporated a calibration method entitled ALT – 009, *Alternative Method 5 Post – Test Calibration techniques,* a field calibration technique that incorporates pre-test leak check procedures in Method 5. The ALT – 009 calibration results are shown at the end of each source spreadsheet.

Dimensioned sketch showing all sampling ports in relation to breeching and to upstream and downstream disturbances or obstructions of gas flow and a sketch of cross-sectional view of stack indicating traverse point locations and exact stack dimensions

The exhaust stack configuration for EUGLYCDEHY is shown in Figure 1.

5.0 TEST RESULTS AND DISCUSSION

Detailed tabulation of results, including process operating conditions and flue gas conditions

The BTEX concentrations in the Enthalpy report, as measured by GC, are on a wet basis. These were converted to a dry basis, using the moisture content obtained in conjunction with each BTEX GC run, as well as dry volumetric flow rates at the thermal oxidizer exhaust, to calculate the BTEX megagram emissions.

Please note that the toluene result for the first gas chromatograph injection during Run 2 was slightly above the calibrated range and is E-flagged. The result is considered an estimate; however, instrument linearity may still be assumed since the value is very close to the calibrated range.

Also note that the m- and p- xylene isomers are inseparable and indistinguishable with the equipment and conditions used for this project and have virtually identical responses. Therefore, the instrument was calibrated using p-xylene. Any xylene results shown are therefore accurate representations of the total m-xylene and p-xylene present in the sample, although specifics about the two individual isomers cannot be given.

Discussion of significance of results relative to operating parameters and emission regulations

Based on the Muskegon River Compressor Station test data, BTEX emissions at the glycol dehydration system control device outlet meets the NESHAP unit specific megagrams per year BTEX emission limit for existing small glycol dehydration units as described in 40 CFR Part 63, Subpart HHH, §63.1275(b)(1)(iii), Equation 1.

Discussion of any variations from normal sampling procedures or operating conditions, which could have affected the results

NA

Documentation of any process or control equipment upset condition which occurred during the testing

NA

Description of any major maintenance performed on the air pollution control device(s) during the three month period prior to testing

NA

In the event of a re-test, a description of any changes made to the process or air pollution control device(s)

NA

Results of any quality assurance audit sample analyses required by the reference method
NA

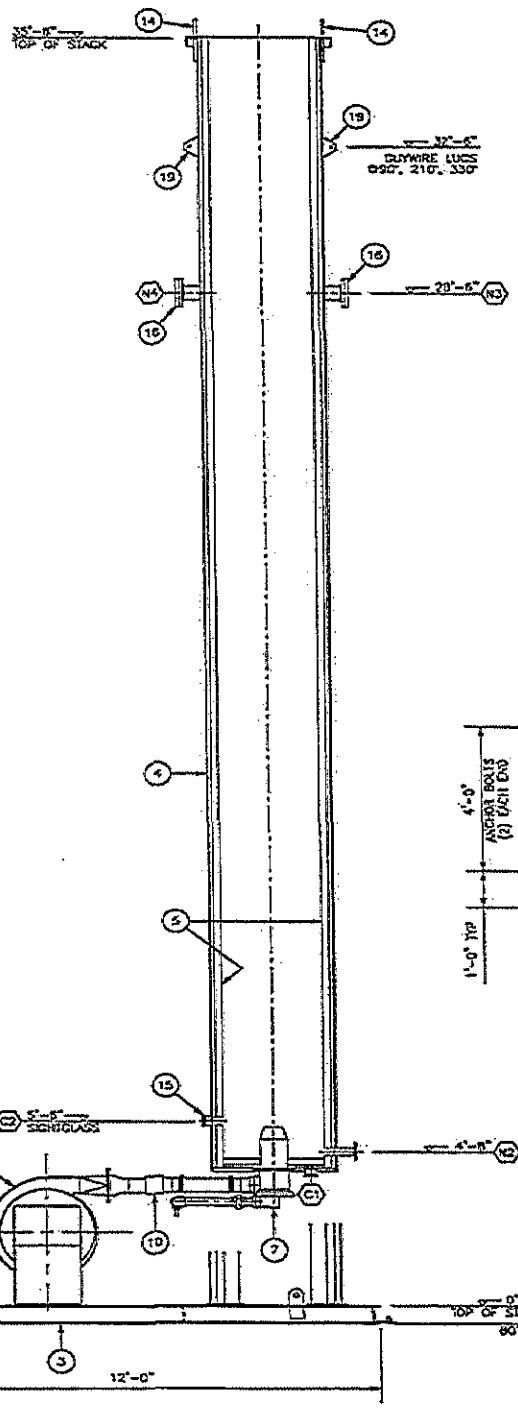
Calibration sheets for the dry gas meter, orifice meter, pitot tube, and any other equipment or analytical procedures which require calibration
Attachment 7 contains the moisture instrumentation calibration log and pitot tube inspection and certification sheets.

Sample calculations of all the formulas used to calculate the results
Sample calculations for all formulas used in the test report are contained in Attachment 6.

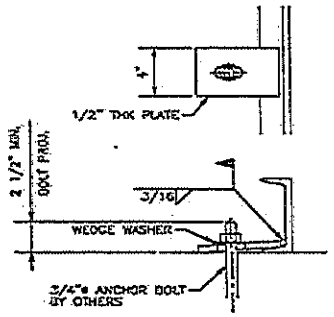
Copies of all field data sheets, including any pre-testing, aborted tests, and/or repeat attempts
Please refer to Attachment 3 for process data collected during the test runs; Attachment 4 for calculation spreadsheets for each of the test runs; and Attachment 5 for laboratory data sheets with the measured concentrations for each test run.

Copies of all laboratory data including QA/QC
The analytical test reports for the BTEX analysis, in Attachment 5, include Quality Control/Quality Assurance Reports which document the acceptability of the test results.

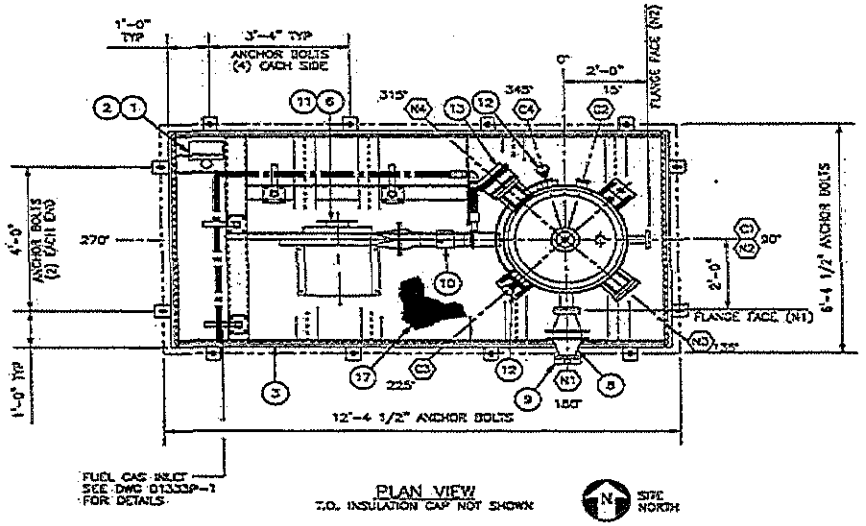
FIGURES



ELEVATION



SKID MOUNTING DETAIL — TYPICAL
SCALE: N.T.S.
(FIELD WELD REQUIRED) TYPICAL 12-PLCS



PLAN VIEW
T.O. INSULATION CAP NOT SHOWN

SITE NORTH

NOZZ

ITEM	TYPE	SERVICE
N1	RFSO	WASTE GAS INLET W/VAL
N2	RFSO	AUXILIARY INLET
N3	RFSO	SAMPLE PORT
N4	RFSO	SAMPLE PORT
C1	FNPT	DRAIN
C2	FNPT	SIGHTGLASS
C3	FNPT	THERMOCOUPLE
C4	FNPT	THERMOCOUPLE

BILL

ITEM NO.	QTY.	DE
1	1	JUNCTION BOX PIPE STA
2	1	TERMINAL JUNCTION BOX
3	1	EQUIPMENT SKID, STRUC
4	1	THERMAL OXIDIZER BODY
5	1	CERAMIC BLANKET, 2-LA
6	1	COMBUSTION AIR BLOWER
7	1	THERMJET BURNER ASSE
8	1	3" — 150# ECCENTRIC
9	2	3" — 150# PNEUMATIC
10	1	4" DND BUTTERFLY TRIM
11	1	COMBUSTION AIR DIFF. P
12	2	THERMOCOUPLE, TYPE-K
13	1	IGNITION TRANSFORMER
14	2	LIFTING LUGS
15	1	2" DND SIGHTGLASS
16	2	4" SAMPLE PORT, 150#
17	1	1" SERRATED BAR GRAT
18	1	3" — STD PIPE x 25'-0
		TRACE AND INSULATION
19	3	GUYWIRE LUG, 3/8" THK

NOTES:

1. SEE PLAN VIEW FOR TRUE ORIENT
2. FLANGE BOLT HOLES SHALL STRAD
3. ALL NOZZLES AND COUPLINGS SH
4. SKID SHALL BE HOT DIP GALVANIZ
5. ITEM 18 PROVIDED BY FLARE IND.
6. ADDITIONAL CONTROL VALVE (ITEM
7. WEIGHT OF SKID: APP. 7,400 LBS. WEIGHT OF STACK: APP. 2,500 LB. TOTAL OPERATING WEIGHT: APP.
8. PURGE/COOLING AIR LINE REQUIRE AND SIGHTGLASS (NOT SHOWN).
9. THERMAL OXIDIZER LIFTING LUGS (AT 90° AND 270° (NOT SHOWN IN
10. BLOWER INLET FLANGE IS A PLAT ANSI BOLT PATTERN FOR 5"-150,
11. (ITEM 18): A SECTION OF PIPE, WITH HEAT TRACING AND INSULAT INSTALLED AS NEEDED BY CUSTO

AS	09/21/01	AS
△	DATE	REVIS

COATING SPECIFICATION	UNLESS OTHERWISE SPECIFIED	ANCHORAGE INFORMATION
SSPC-SP6		
GASOLINE 02-11 2-3 MILS D.F.T.		

MICHIGAN GAS STORAGE
MUSKEGON RIVER COMPRESSOR STA

MODEL 736 THERMAL OXIDIZER

FIGURE 2

BTEX Gas Chromatograph Sample Apparatus Schematic

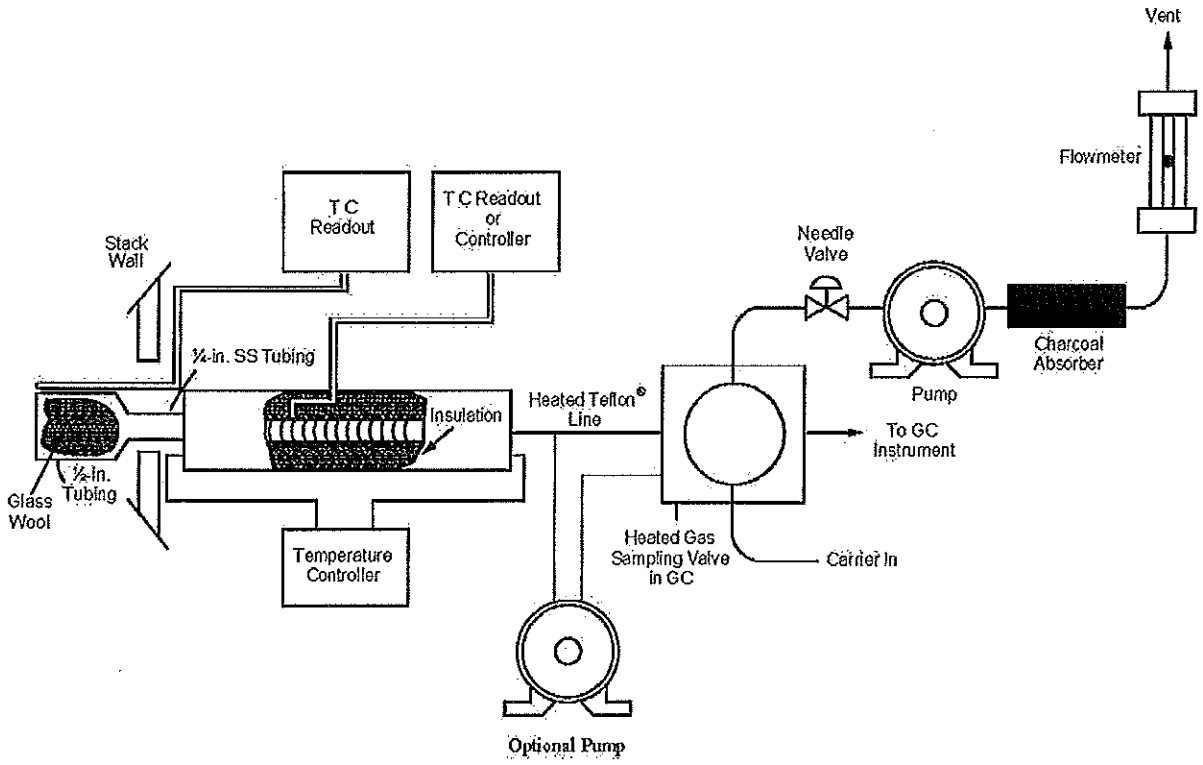


FIGURE 3