DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION
ACTIVITY REPORT: On-site Inspection

N566359262

FACILITY: NITREX METAL TECHNOLOGIES INC		**SRN / ID:** N5663
LOCATION: 822 KIM DR, MASON		**DISTRICT:** Lansing
CITY: MASON		**COUNTY:** INGHAM
CONTACT: Rick Lucas , Facility Manager		**ACTIVITY DATE:** 08/11/2021
STAFF: Michelle Luplow	**COMPLIANCE STATUS:** Compliance	**SOURCE CLASS:** MINOR
SUBJECT: Scheduled, announced onsite inspection to determine compliance with PTI 357-95 and 30-19B		
RESOLVED COMPLAINTS:		

Inspected by: Michelle Luplow

Nitrex Personnel Present: **Rick Lucas, Facility Manager (rick.lucas@nitrex.com)**

Scott Frank, Project Manager

Purpose

Conduct an announced, scheduled onsite compliance inspection of Nitrex Inc to determine compliance with PTI No's 357-95 (supplemental revision) and 30-19B for an ammonia nitriding processes. This facility was last inspected in January 2019.

Facility Background

Nitrex heat treats steel using an ammonia nitriding process. This process lengthens the life of the part. Ammonia, which supplies the nitrogen for this process, comes into contact with heated steel, which causes the ammonia to dissociate into nitrogen and hydrogen. The nitrogen diffuses into the steel, creating a nitride layer. Nitrided products typically include those for the automotive, aerospace, defense, and heavy machinery (John Deere, CAT, etc) industries.

The exhaust gases from the nitriding furnaces are sent to neutralizers/afterburners, prior to exhausting to ambient air. It was explained to me that the furnace exhaust gas gets heated up to "crack" the ammonia – which burns off the hydrogen and allows the remaining nitrogen to be exhausted.

Rick Lucas, Facility Manager, said that Nitrex operates two 8-hr shifts 5 days per week and one 8-hr shift on the 6th day of the week, depending on industry fluctuations. Shifts are from 6 a.m. – 3 p.m. and 3 p.m. – 11 p.m.

Inspection

I arrived at Nitrex at approximately 11:30 a.m. August 11, 2021 and met with Rick Lucas, and later, Scott Frank, to conduct an inspection of the facility.

Prior to conducting an inspection of the facility, R. Lucas and I discussed the equipment onsite, and verified that the equipment in Table is present. Table 1 contains an up-to-date list of all permitted and exempt equipment which were identified during the inspection.

Table 1. Equipment located onsite

Unit	Description	PTI/ Exemption	Federal Regulation	Compliance Status
3 Nitriding Furnaces (M1-M3)	Furnaces utilizing anhydrous ammonia to nitride the steel	PTI 357-95	NA	Compliance
EU-N36 & EU-N37 Nitriding Furnaces	2 Electrically-heated ammonia nitriding furnaces. Emissions controlled by natural gas-fired neutralizing units (afterburners).	PTI 30-19B	NA	Compliance
EU-N40	Not Installed.	PTI 30-19B	NA	NA
4 Gas-neutralizing units (afterburners)	Natural gas-fired units used to combust the residual NH3 from the nitriding furnaces, prior to exhausting the gas stream to ambient air.	PTI 357-95	NA	Compliance
Anhydrous Ammonia Tank	500-gallon NH3 storage tank used as a process gas in the nitriding furnaces	PTI 357-95	NA	Compliance
6 Nitriding Furnaces (M4, M7-M11)	Furnaces utilizing anhydrous ammonia to nitride steel. These furnaces were installed after the 18-month window for construction, post issuance of PTI 357-95 (see Table 2). Equipment can be considered exempt under pre-December 20, 2016 exemption Rules. (post 2016 exempt rules do not allow installation of heat treating equipment that uses anhydrous ammonia)	Rule 282(a)(i) (pre-12/20/16)	NA	Compliance
1 Emergency Generator	80 hp Kohler natural gas-fired generator used in emergencies (power loss) used to run their computer operating systems. Unit is much less than 10 MMBtu/hr and therefore exempt. Installed in 2008. Manufactured before 2008.	Rule 285(2)(g)	NSPS Subpart JJJJ	Compliance

3 Wash Stations	1 dip tank – currently disconnected for a rebuild (the plumbing is rotted) 2 automated washers w/ natural gas-fired dryer: 1) belt-fed spray wash (used mostly for dirty or large parts) 2) dump system – dunks parts into tank & agitates (used mostly for small parts) Units are used to clean off grease, dirt, oils from the parts prior to treatment in the nitriding furnaces Vented to outside atmosphere.	Rule 281(2)(e)	NA	Compliance

PTI 30-19B: FG-NITRIDE (EU-N36, EU-N37, EU-N40)

PTI 30-19 was issued in May 2019 to permit an under-construction nitriding furnace (EU-N36). PTI 30-19A was issued in April 2019 to permit an additional nitriding furnace, EU-N37. PTI 30-19B was issued in January 2020, combining EU-N36 and EU-N37 conditions in addition to requirements for an additional nitriding furnace, EU-N40 under FGNITRIDE. EU-N36 and EU-N37 were installed in October 2019. During the inspection I confirmed with Rick Lucas that EU-N40 has not been installed, and no construction has started to install this emission unit. R. Lucas said that the project for EU-N40 was put on hold due to COVID-19. I made him aware of the requirement that emission units must begin construction within 18 months of permit issuance. If construction does not occur within that 18-month window, the facility will need to apply for a new permit for that emission unit. EU-N40 will need to be repermitted because it has been more than 18 months since permit issuance and construction has not started. R. Lucas is aware of this requirement.

There are no Emission Limits, Design/Equipment Parameters, or Testing/Sampling requirement for FGNITRIDE at this time.

Material Limits

Natural gas is the only fuel permitted to be burned in the afterburners of FG-NITRIDE. I confirmed with R. Lucas that EU-N36 and EU-N37 only burn natural gas to fuel the afterburners.

Process/Operational Restrictions

The natural gas afterburners are required to be installed, maintained and operated in a satisfactory manner, which includes operating the afterburners in accordance with manufacturer's recommendations. R. Lucas provided me with the Nitrex Neutralizer Installation and Maintenance manual (attached) as well as Nitrex's own internal maintenance criteria for the afterburners and a log of Preventative Maintenance conducted on the units. The manual states that maintenance includes ensuring a clean supply of gas, unobstructed air flow to the air blower, verification of thermocouple integrity, and the condition of the flame (which on its own can indicate whether there is any soot or other buildup on the burner). The manual also states that the neutralizer halves should be separated and the insulation inspected on an annual basis to ensure its integrity is being maintained. Reviewing Nitrex's internal SOP/maintenance procedure confirmed that their maintenance procedures includes all requirements from the manual in addition to their own determinations for what should be checked on the neutralizer units and how often. This program is acceptable to AQD.

The N37 neutralizer was operating at 570°C. The alarm temperature set point is 300°C. S. Frank said they aim to run all neutralizers for all furnaces (permitted and unpermitted) at 500-600°C. The temperature controller has 1 monitor for the fire burner and 1 for the overtemp control. The overtemp setpoint was established at 1100°C. If the system reaches this overtemp temperature, the system shuts down and an alarm sounds.

Monitoring/Recordkeeping

Records of the date, duration and description of any malfunction or leak occurring from any emission unit in FG-NITRIDE, including the estimated amount of ammonia released into the atmosphere, are required to be kept, as well as records for the date and description of the corrective action performed to address the malfunction/leak.

R. Lucas said there have been no recorded leaks. He said they conduct daily Preventative Maintenance walk arounds to check for damage and leaks. He also said that in the event there were leaks, the computer-controlled neutralizing systems would shut down the furnace if there were any leaks.

Reporting

Nitrex is required to notify AQD upon completion of the installation. EU-N36 and EU-N37 notifications were submitted in 2019. This no longer applies to EU-N40 because it will need to be repermitted prior to installation.

PTI 357-95 (supplemental revision)

This PTI applies to the anhydrous ammonia tank and nitriding furnaces M1-M3.

Furnaces

PTI 35-95 encompasses the anhydrous ammonia tank and nitriding processes (nitriding furnaces and gas neutralization after burners).

Under the Permit Exemption Rules promulgated prior to December 20, 2016, metal heat treating furnaces rated at less than 10 MMBtu/hr, that fire sweet natural gas, and that treat metals that are not coated with oil are eligible for exemption under Rule 282(a)(i). Table 2 lists all nitriding furnaces installed before December 20, 2016. All are under 10 MMBtu/hr, all are fired with sweet natural gas, and all treat parts that are clean (not oil-coated). Parts are washed in one of 3 parts washers prior to being treated in a nitriding furnace. The 3 furnaces (M1, M2, and M3) were likely installed under PTI 357-95. The remaining furnaces would be allowed to be installed under exemption Rule 282(a)(i). All heat-treating furnaces that utilize ammonia and were installed after December 20, 2016 require a permit prior to installation.

Table 2. List of pre-December 20, 2016 furnaces

Nitriding Furnace ID	Btu/hr	Installation Date
M1	853,035	1997

M2	214,965	1997
M3	818,914	1997
M4	511,821	1998
M7	81,891	2005
M8	1,719,719	2005
M9	511,821	2006
M10	784,793	2004
M11	783,087	2012

Nitrex is required to implement an inspection and maintenance plan for the facility (nitriding furnaces, gas neutralization afterburners, anhydrous ammonia tank).

Nitrex's "Predictive/Preventative Maintenance Daily Walk Through" sheet (see attached). The sheet includes verifying that the neutralizer panel (for gas neutralization afterburners) is operating and to check the alarms and the proper heat settings), checking of the furnace filters, and the processes that allow the furnaces to operate (such as fuel flows, etc). They have checks for the anhydrous ammonia tank (leaks, rust, line checks, smell check, etc) well.

Additionally, all the furnaces have alarm systems (audio and visual) that are connected to the interface on a computer for instances where the afterburner flames go out. The alarm system will shut the anhydrous ammonia gas flow off. A nitrogen purge is used in the furnaces in these cases, displacing the residual ammonia, and exhausting the ammonia out through the stack. The furnace does not shut down during these instances.

See "Process/Operational Restrictions" under the PTI 30-19B discussion of this report for additional information on what Nitrex does to conduct preventative maintenance on the neutralizer units.

Anhydrous Ammonia

The anhydrous ammonia tank has a capacity of 500 gallons, according to R. Lucas. There were no transfer operations being conducted during the inspection. R. Lucas said the tank is refilled every 3 weeks.

Ammonia emission rates from the nitriding process post-control are limited to 0.53 lb/hr. Testing to verify this emission rate is required if requested by the AQD. Based on the evaluation discussed above for maintenance and operations, Nitrex appears to be operating and maintaining the afterburner/neutralizer control equipment according the manufacturer's recommendations and therefore it is my professional judgment at this time that testing is not required to verify ammonia emission rates.

Nitrex is limited to 345,000 lbs of ammonia per 12-month rolling period for M1, M2, and M3 furnaces. Nitrex provided me with records of ammonia usage for calendar years 2019 – August 2021 in each furnace individually, but calculated 12-month rolling based on ammonia usage in all furnaces combined. I explained to R. Lucas that overestimating material usage based on amounts used in all furnaces is acceptable, as long as this does not result in exceeding the material limits. I explained that if they start to see their 12-month rolling emissions getting near the material limit, they should start to record material usage on a monthly and 12-month rolling basis for M1 – M3 furnaces only, in order to ensure compliance with the material limit.

Review of the 12-month rolling ammonia usage records indicates that the 12-month rolling highest usage rate was September 2020 – August 202 at 205,709 lbs ammonia usage across all furnaces. Nitrex is meeting their material limit at this time.

Nitrex is required to operate the anhydrous ammonia tank with a remotely operated internal or external positive shut-off valve for emergency shut-off situations. R. Lucas, along with Airgas, explained that there is an internal excess flow valve that will stop excess flow to the plant, but also stop excess flow outside the plant in the event of a catastrophic failure. R. Lucas also said that there is a mechanical shutoff inside the plant that will stop any excess flow from entering the furnaces and overwhelming the system. A computer system is installed to detect nitriding furnace excess ammonia as well.

A bulkhead, anchorage, or equivalent system is required to be used at the transfer area to ensure any breaks results from a pull will occur at a predictable location, while retaining intact the valves and piping on the plant side of the transfer area. The transfer hookups are situated on a small steel beams structure that I would consider to be an anchorage point, however during the inspection I noted that the pipes were not anchored to the steel beams. After the inspection, R. Lucas provided me a photo of the work that was done to ensure compliance with this condition (attached), which shows that the transfer hookups are now bolted down to the steel beam structure.

All transfer operations are required to be performed by a reliable person properly trained and made responsible for proper compliance with all applicable procedures and there should also be a person that is trained in the proper use of equipment. Airgas is contracted to fill the anhydrous ammonia tank. According to Airgas' website, all technicians who perform the transfers follow PSM/RMP/OSHA safety guidelines and would therefore be qualified as people properly trained in this practice.

Hoses used for transferring the liquid and/or vapor to and from the storage tanks are required to not be more than 25' in length. There were no hoses onsite during the inspection. All hoses used in transfer operations are owned by Airgas. Airgas stated that their transfer hoses are on a 100' reel. Internal discussions will be had on the feasibility of this requirement with regard to how the anhydrous ammonia delivery industry operates.

An internal discussion will also be had with regard to replacement of the hoses ever 5 years after date of manufacture (or more often if there is evidence of damage or deterioration). The current version of AQD's General PTI for anhydrous ammonia tanks also includes this requirement. Airgas, on the other hand, conducts monthly

checks on their hoses to ensure the integrity of the hoses are maintained (see attached records). According to Airgas records it appears that the hoses are used for a minimum of 9 years before the hoses are retired, and monthly checks are conducted in order to ensure there is no damage or deterioration prior to their hose "retirement" date.

Lastly, internal discussion will ensue concerning the requirement to vent any vapor or liquid lines (exclusive of couplings) to a water trap. R. Lucas and Airgas explained that venting the vapor and liquid lines to a water trap may inadvertently cause water to backwash into the tank and degrade the 99% purity that is required to heat treat Nitrex's parts. Additionally, R. Lucas explained that bleeding Airgas liquid and vapor lines into a water trap would also create the potential for water to affect the purity of the product that they deliver to other customers as well. Currently, Airgas said that they bleed 10" of their lines to atmosphere. Based on industry practices and the need to maintain a specific purity in the product, this requirement may not be applicable at an industry level (versus on an agricultural level).

Emergency Generator

The emergency generator, which is only used for power back-up to run their IT equipment, including computers during power outages, is subject to the New Source Performance Standards Subpart JJJJ; however, because the engine was ordered after June 12, 2006 (installed in 2008), but manufactured before January 1, 2009, there are no requirements currently in place with the NSPS for this type of unit.

Parts Washers

All parts washer listed in Table 1 are vented to atmosphere. I reviewed the SDS for the two cleaning agents used, ChemQuest Power Soak 1022 and ChemQuest PowerClean HDS 1022, to verify that they did not contain VOC's. The two main components of both are KOH (potassium hydroxide) and "wetting agents" listed under CAS #37251-67-5.

The waste cleaning solution is captured into a reservoir that Heritage Crystal Kleen will pump out and remove from site. None of their waste cleaning solutions/wastewater is sent to the wastewater treatment plant.

All parts washers can be considered exempt under Rule 281(2)(e) because they are used to wash and/or dry materials, where the material itself cannot become an air contaminant, there are no VOC's, and only natural gas is burned in the dryers on the automatic washers.

Compliance Statement

Nitrex appears to be in compliance with PTI No 357-95 and PTI 30-19B, pending the internal discussions on several of the anhydrous ammonia tank requirements.

Image 1(Anhydrous Ammonia) : Tank for anhydrous ammonia

Image 2(Bulkhead) : Bulk head for anhydrous ammonia transfer lines. Note gap between pipe and metal support structure (not secured to support structure).

Image 3(Supported transfer) : Support transfer lines. Note Nitrex installed bolted "straps" to ensure the transfer lines were secured to the support structure to ensure a predictable breakpoint.

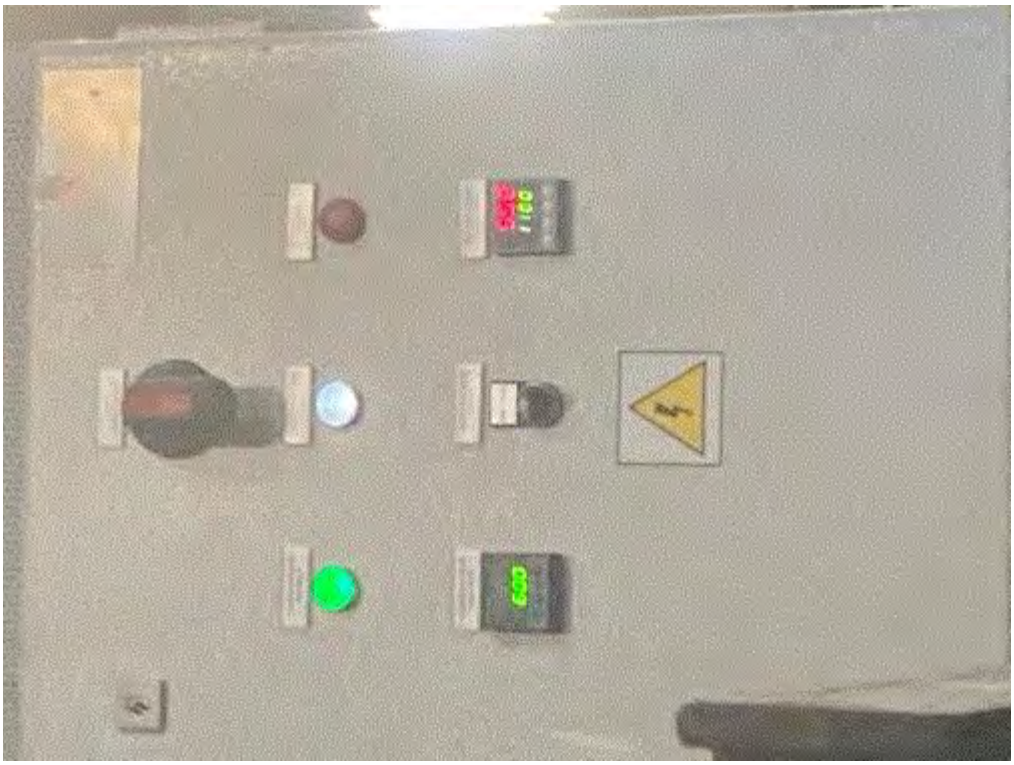


Image 4(N37) : N37 Neutralizer control panel with monitors for the burner temperature and the overtemp temperature.

NAME Michelle Luplow DATE 9/14/21 SUPERVISOR B.M.

Airgas Specialty Products
Certification of Inspection and Test

PMI Inspection: Hose was inspected according to Airgas SOP H-01. Hose Test: Hose was tested according to Airgas Hydrostatic Test SOP. New Hose Manufactured: Hose was tested according to Lewis Goetz WI 8.2.4.7.

EXARO Hose Management

Customer Details

Serial Number:	063-00273-20	Test Date:	08/16/21
Customer:	Owosso	Monthly Inspection:	09/16/21
Address:	2271 W. Dewey Rd	Annual Test:	Monthly Inspection
Contact:	Mike Jones	Hose Retirement:	03/10/30
Customer Ref No.:	21898	Order Number:	

Hose Details

Hose Type:	N1446/Goodall	Assembly Working Pressure:	350.00 PSI
Overall Length :	25 ft 0 in	Nominal Bore (in):	2.000
Date of Manufacture:	03/10/20	Location:	N95

Fitting Details - End A		Fitting Details - End B	
Description:	MNPT	Description:	MNPT
Size (in):	2	Size (in):	2
Material:	Steel	Material:	Steel
Retention:	Swage	Retention:	Swage

Test Details		Test Specification:	Monthly Visual Inspection
Test Method:	Visual	Result:	Pass
Test Pressure (PSI):	N/A		

Elongation Test (Composite Hose Only)

Test Length :	N/A	Result: (No greater than N/A% of Overall Length)	N/A
Final Length):	N/A	Result: (Between N/A% and N/A% of Overall Length)	N/A

Continuity and Electrical Resistance Test

Continuity:	N/A	Result:	N/A
Resistance (ohms):	N/A	Result:	N/A

Summary

Test Reason:	PMI Inspection	Final Result:	Pass

Repair Details:

Comments: Hose is in good working order with no notable defects.

Recommendations:

Authorization

Tested By:	Rodney Shaydik	Entered By:	Mike Jones

Airgas Specialty Products
Certification of Inspection and Test

PMI Inspection: Hose was inspected according to Airgas SOP H-01. Hose Test: Hose was tested according to Airgas Hydrostatic Test SOP. New Hose Manufactured: Hose was tested according to Lewis Goetz WI 8.2.4.7.

Customer Details

Serial Number:	063-00274-20	Test Date:	08/16/21
Customer:	Owosso	Monthly Inspection:	09/16/21
Address:	2271 W. Dewey Rd	Annual Test:	Monthly Inspection
Contact:	Mike Jones	Hose Retirement:	03/10/30
Customer Ref No.:	21898	Order Number:	

Hose Details

Hose Type:	N1446/Goodall	Assembly Working Pressure:	350.00 PSI
Overall Length :	100 ft 0 in	Nominal Bore (in):	1.000
Date of Manufacture:	03/10/20	Location:	N95

Fitting Details - End A

Description:	MNPT
Size (in):	1
Material:	Steel
Retention:	Swage

Fitting Details - End B

Description:	MNPT
Size (in):	1
Material:	Steel
Retention:	Swage

Test Details

Test Specification: Monthly Visual Inspection

Test Method:	Visual	Result:	Pass
Test Pressure (PSI):	N/A		

Elongation Test (Composite Hose Only)

Test Length :	N/A	Result: (No greater than N/A% of Overall Length)	N/A
Final Length):	N/A	Result: (Between N/A% and N/A% of Overall Length)	N/A

Continuity and Electrical Resistance Test

Continuity:	N/A	Result:	N/A
Resistance (ohms):	N/A	Result:	N/A

Summary

Test Reason:	PMI Inspection	Final Result:	Pass

Repair Details:

Comments: Hose is in good working order with no notable defects.

Recommendations:

Authorization

Tested By:	Rodney Shaydik	Entered By:	Mike Jones

Airgas Specialty Products
Certification of Inspection and Test

PMI Inspection: Hose was inspected according to Airgas SOP H-01. Hose Test: Hose was tested according to Airgas Hydrostatic Test SOP. New Hose Manufactured: Hose was tested according to Lewis Goetz WI 8.2.4.7.

Customer Details

Serial Number:	063-02185-19	Test Date:	08/16/21
Customer:	Owosso	Monthly Inspection:	09/16/21
Address:	2271 W. Dewey Rd	Annual Test:	Monthly Inspection
Contact:	Mike Jones	Hose Retirement:	12/11/29
Customer Ref No.:	WFA10414502BO	Order Number:	

Hose Details

Hose Type:	N1446/Goodall	Assembly Working Pressure:	350.00 PSI
Overall Length :	25 ft 0 in	Nominal Bore (in):	1.000
Date of Manufacture:	12/11/19	Location:	N95

Fitting Details - End A		Fitting Details - End B	
Description:	MNPT	Description:	MNPT
Size (in):	1	Size (in):	1
Material:	Steel	Material:	Steel
Retention:	Swage	Retention:	Swage

Test Details		Test Specification:	Monthly Visual Inspection
Test Method:	Visual	Result:	Pass
Test Pressure (PSI):	N/A		

Elongation Test (Composite Hose Only)

Test Length :	N/A	Result: (No greater than N/A% of Overall Length)	N/A
Final Length):	N/A	Result: (Between N/A% and N/A% of Overall Length)	N/A

Continuity and Electrical Resistance Test

Continuity:	N/A	Result:	N/A
Resistance (ohms):	N/A	Result:	N/A

Summary

Test Reason:	PMI Inspection	Final Result:	Pass

Repair Details:

Comments: Hose is in good working order with no notable defects.

Recommendations:

Authorization

Tested By:	Rodney Shaydik	Entered By:	Mike Jones

1.0 Purpose

This work instruction describes how to effectively perform preventive maintenance on IN Incinerator.

2.0 References & Documentation

- QMP 012 – Preventive Maintenance
- Form F017 – Preventive Maintenance Schedule
- WI 016 – Time Schedule Tolerances for Maintenance Activities
- Manual Installation Guide for Model: IN-750-1/0/0AG/120 Incinerator
- Manual for the Eclipse Burner Manual

3.0 Resources

- Shop Tools

4.0 Definitions

Eliminates residual ammonia and/or other pollutant gasses and other NOx emissions to meet compliance with environmental regulations.

5.0 Responsibility & Authority

- Maintenance Manager
- Production Manager

6.0 Instructions

Note: *Timing tolerances for performance of preventive maintenance activities are defined in Work Instruction WI-016 and F017 forms of the Preventive Maintenance Schedule log.*

6.1 General visual inspection of each Incinerator shall be performed yearly as follows:

6.1.1 Leak test safety shut-off valves for tightness of closure

6.1.2 Examine wiring bundles, wires, hoses, tubes and piping, and ensure they are undamaged and properly secured including as follows:

- Burner nozzle
- Spark plugs
- Flame sensors
- Flame tube or combustion block

6.1.3 Verify that there is no debris of any kind, indicating possible Incinerator damage, in the area surrounding the Incinerator. Examine the Incinerator for external damage.

6.1.4 Check the air pressure switch settings by checking switch movements against the pressure setting comparing with actual impulse schedule

6.1.5 If applicable, remove and clean all the orifice plates.

6.1.6 Verify the condition of the flame

6.2. Yearly maintenance as follows:

6.2.1 Inspect the insulation visually to determine if it has maintained integrity

6.2.2 Test fire burner and soap test/combustion air piping

6.2.3 Test the Over Temp limit controller operation.

6.2.4 Check inlet gas pressure settings on the main and pilot lines and tighten all electrical terminations.

6.2.5 Check the alarm systems for proper signals

6.2.6 Test the interlock sequence of all safety equipment; manually make each interlock fail noting that related equipment closes or stops as specified by the manufacturer.

6.2.7 Test the monitoring control system by manually shutting off gas burner.

6.2.8 Clean and replace the combustion air blower filter.

7.0 Start -up

7.1.1 Once all components have been located and interconnections completed:

- the neutral gas can be turn on.
- place the selector switch to the manual position to verify then switch to automatic
- operate the Incinerator at low set-point (400 degrees Cor less) for a few hours to ensure that any humidity is removed from the insulation prior to introducing the gases to be generated.

Approved by:

_____ _____

Production Manager Date Maintenance Manager Date

Amendments and Reason for Amendment:

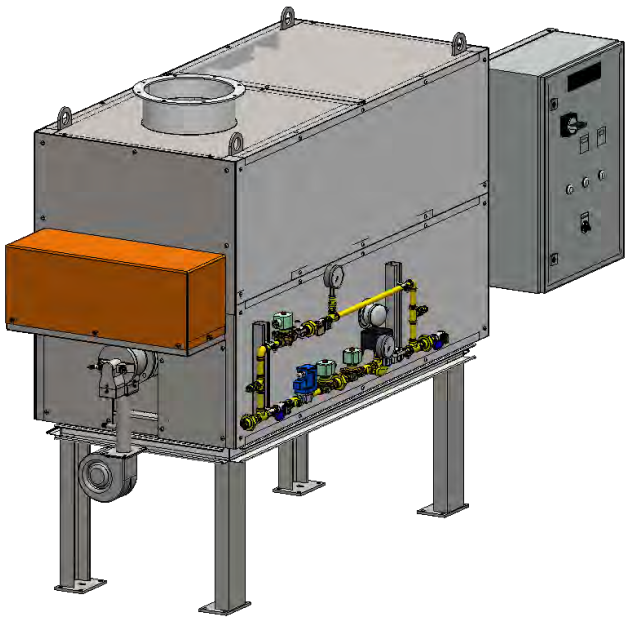
Rev.	Date	Page	Par.	Description
A	Set. 09, 21	All	All	Original Issue

	Sep-19			Oct-19			Nov-19			Dec-19			Jan-20			Feb-20			Mar-20			Apr-20			May-20
Equipment			Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace	
M-1	184.76	5%	544.38	77.52	2%	334.72	125.19	4%	404.13	143.91	4%	591.54	146.95	4%	405.38	146.72	4%	729.84	138.48	4%	641.75	206.3	7%	710.23	117.48
M-2	343.25	10%	1011.36	367.93	10%	1588.67	315.88	9%	1019.69	388.4	11%	1596.52	387.05	10%	1067.72	295.87	7%	1471.76	323.22	8%	1497.89	374.11	13%	1287.95	297.64
M-3	470.66	14%	1386.76	416.07	11%	1796.53	466.56	13%	1506.11	464.18	13%	1908.02	529.56	14%	1460.85	467.64	12%	2326.21	457.81	12%	2121.61	377.87	13%	1300.89	368.21
M-4	520.69	15%	1534.17	535.87	14%	2313.82	273.81	8%	883.89	364.47	10%	1498.16	498.09	13%	1374.03	513.43	13%	2553.99	404.23	11%	1873.31	447.57	15%	1540.85	442.15
M-7	145.23	4%	427.91	84.87	2%	366.46	213.27	6%	688.46	124.09	4%	510.07	157.44	4%	434.31	227.52	6%	1131.77	172.71	5%	800.38	160.28	6%	551.79	204.34
M-8	308.48	9%	908.91	338	9%	1459.44	61.46	2%	198.40	55.51	2%	228.17	198.53	5%	547.67	163.34	4%	812.51	61.23	2%	283.76	0	0%	0.00	60.1
M-9	370.23	11%	1090.85	391.8	10%	1691.74	604.08	17%	1950.04	563.9	16%	2317.92	531.65	14%	1466.61	455.81	11%	2267.36	515.15	13%	2387.34	472.07	16%	1625.19	447.87
M-10	230.29	7%	678.53	463.93	12%	2003.19	447.11	13%	1443.32	356.07	10%	1463.63	188.02	5%	518.67	381.37	10%	1897.07	325.36	8%	1507.80	137.72	5%	474.13	243.2
M-11	539.64	16%	1590.01	427.2	11%	1844.59	462.03	13%	1491.48	338.17	10%	1390.05	388.72	10%	1072.32	343.5	9%	1708.69	431.44	11%	1999.41	253.11	9%	871.38	274.97
N-36	294.63	9%	868.10	418.8	11%	1808.32	260.83	7%	841.99	289.61	8%	1190.44	354.81	9%	978.78	513.991	13%	2556.78	560.68	15%	2598.34	247.45	9%	851.89	330.27
N-37	0	0%	0.00	348.44	9%	1504.52	329.45	9%	1063.50	423.42	12%	1740.47	510.28	13%	1407.66	487.1	12%	2423.01	445.68	12%	2065.40	213.12	7%	733.71	269.68
Total hours used	3407.86			3870.43			3559.67			3511.73			3891.1			3996.291			3835.99			2889.6			3055.91
Total ammonia used	10041			16712			11491			14435			10734			19879			17777			9948			7279
Monthly usage all furnaces			10041.00			16712			11491			14435			10734			19879			17777.00			9948.00	
Rolling 12 month usage			10041.00			26753.00			38244.00			52679.00			63413.00			83292.00			101069.00			111017.00	

		Jun-20			Jul-20			Aug-20			Sep-20			Oct-20			Nov-20			Dec-20			Jan-21			Feb-21
	Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace			
4%	279.83	174.46	5%	710.83	123.92	4%	661.87	418.02	11%	1686.38	279.43	8%	1143.78	0	0%	0.00	0	0%	0.00	73.97	2%	403.68	189.88	6%	947.67	238.66
10%	708.96	246.49	7%	1004.32	269.95	8%	1441.82	310.91	8%	1254.27	323.25	9%	1323.14	303.8	8%	1044.39	152.883	6%	943.68	309.85	10%	1690.94	260.49	8%	1300.08	197.23
12%	877.05	380.64	12%	1550.91	442.79	13%	2364.98	406.69	11%	1640.67	411.1	12%	1682.74	438.97	12%	1509.07	325.42	12%	2008.68	373.73	12%	2039.55	387.61	12%	1934.52	431.5
14%	1053.18	274.26	8%	1117.46	266.03	8%	1420.89	308	8%	1242.53	260.88	7%	1067.85	290.84	8%	999.84	262.78	10%	1622.03	251.59	8%	1373.00	294.6	9%	1470.32	270.52
7%	486.73	93.24	3%	379.90	191.79	6%	1024.37	32.4	1%	130.71	150.82	4%	617.34	159.05	4%	546.78	61.71	2%	380.91	125.6	4%	685.44	118.16	4%	589.72	41.55
2%	143.15	148.42	5%	604.73	241	7%	1287.20	249.94	7%	1008.31	247.42	7%	1012.75	308.29	8%	1059.83	152.94	6%	944.03	363.34	11%	1982.85	221.06	7%	1103.29	0
15%	1066.80	366.02	11%	1491.34	341.86	10%	1825.90	310.42	8%	1252.30	380.8	11%	1558.71	474.36	13%	1630.74	344.07	13%	2123.80	222.51	7%	1214.30	398.45	13%	1988.62	429.08
8%	579.29	429.91	13%	1751.66	201.09	6%	1074.04	372.93	10%	1504.48	347.5	10%	1422.41	410.29	11%	1410.48	165.83	6%	1023.60	178.76	6%	975.55	129.89	4%	648.27	0
9%	654.96	386.61	12%	1575.23	364.94	11%	1949.17	347.37	9%	1401.36	414.24	12%	1695.59	458.22	12%	1575.25	378.78	14%	2338.05	356.01	11%	1942.85	334.84	11%	1671.15	359.69
11%	786.68	466.26	14%	1899.76	443.11	13%	2366.69	472.88	13%	1907.69	376.42	11%	1540.78	450.28	12%	1547.95	472.56	18%	2916.91	496.25	16%	2708.18	428.12	14%	2136.70	416
9%	642.36	328.35	10%	1337.85	452.92	14%	2419.08	433.12	12%	1747.29	354.22	10%	1449.91	408.31	11%	1403.67	345.45	13%	2132.32	432.57	14%	2360.66	374.61	12%	1869.64	318.35
		3294.66			3339.4			3662.68			3546.08			3702.41			2662.423			3184.18			3137.71			2702.58
		13424			17836			14776			14515			12728			16434			17377			15660			16080
	7279.00			13424.00			17836.00			14776.00			14515.00			12728.00			16434.00			17377.00			15660.00	
	118296.00			131720.00			149556.00			164332.00			168806.00			164822.00			169765.00			172707.00			177633.00	

		Mar-21			Apr-21			May-21			Jun-21			Jul-21			Aug-21			In Pounds			
	Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace			Pounds per furnace			2019	2020	2021	Last 12 months
9%	1420.00	352.76	10%	1627.53	287.25	9%	1275.70	181.9	5%	1111.06	181.95	4%	958.99	257.78	7%	1555.22	338.75	8%	1430.54	1,874.77	7,373.56	10,326.70	11,874.15
7%	1173.49	196.3	6%	905.67	403.95	12%	1793.98	343.17	10%	2096.11	329.4	8%	1736.14	0	0%	0.00	0	0%	0.00	5,216.25	14,736.85	9,005.47	14,007.62
16%	2567.37	483.04	14%	2228.60	427.23	13%	1897.37	428.27	13%	2615.90	504.95	12%	2661.40	580.23	15%	3500.60	674.62	16%	2848.92	6,597.42	20,883.21	20,254.67	27,494.71
10%	1609.56	375.62	11%	1733.00	220.12	7%	977.57	283.52	8%	1731.76	458.75	11%	2417.89	401.17	11%	2420.31	421.24	10%	1778.89	6,230.03	17,238.95	14,139.30	19,202.02
2%	247.22	268.38	8%	1238.22	243.44	7%	1081.14	250.72	7%	1531.42	162.59	4%	856.95	32.02	1%	193.18	257.49	6%	1087.38	1,992.90	7,170.43	6,825.23	9,055.69
0%	0.00	48.06	1%	221.73	45.13	1%	200.43	0	0%	0.00	0	0%	0.00	0	0%	0.00	0	0%	0.00	2,794.93	9,686.80	1,525.45	6,524.91
16%	2552.97	412.35	12%	1902.46	335.71	10%	1490.92	326.44	10%	1993.92	420.75	10%	2217.61	417.46	11%	2518.59	456.22	11%	1926.62	7,050.55	19,910.39	16,591.70	23,119.25
0%	0.00	12.47	0%	57.53	253.29	8%	1124.88	350.33	10%	2139.84	461.98	11%	2434.92	352.69	9%	2127.82	413.18	10%	1744.86	5,588.67	14,139.16	10,278.12	15,110.15
13%	2140.11	428	13%	1974.66	357.84	11%	1589.20	348.61	10%	2129.33	428.16	11%	2256.67	507.18	13%	3059.88	315.31	8%	1331.55	6,316.13	18,784.27	16,152.55	23,704.29
15%	2475.15	479.41	14%	2211.85	409.53	12%	1818.76	509.18	15%	3110.11	594.71	15%	3134.49	658.49	17%	3972.75	637.95	16%	2694.06	4,708.86	22,660.45	21,553.86	30,267.69
12%	1894.14	362.78	11%	1673.76	328.31	10%	1458.05	383.846	11%	2344.56	501.26	12%	2641.95	604.11	16%	3644.67	586.12	14%	2475.18	4,308.49	20,122.93	18,001.95	25,348.51
		3419.17			3311.8			3405.986			4044.5			3811.13			4100.88						
		15775			14708			20804			21317			22993			17318						
																						Total for 12 months	205,709.00
	16080.00			15775.00			14708.00			20804.00			21317.00			22993.00			17318.00				
	173834.00			171832.00			176592.00			190117.00			198010.00			203167.00			205709.00				

MODEL : IN NEUTRALIZER



FEATURES

- Eliminates residual ammonia and/ or other pollutant gases and minimizes NOx emissions
- High efficiency
- Low operating costs
- Compliance with environmental regulations
- Improved furnace and process reliability
- Connectivity to furnace controls

Always follow local rules and regulations when instructions differ from this manual.

Nitrex Metal Inc. reserves the right to modify this document without prior notice.

TABLE OF CONTENTS

1 SAFETY INFORMATION

This manual contains important information relating to the Nitrex Metal Inc. Neutralizer and associated Control System. This manual has been written for trained personnel and is intended for the understanding of the Neutralizers installation and operation. Before installation and operation, be sure to read this manual and fully understand the contents. To safeguard against the possibility of personal injury or property damage, follow the recommendations and instructions of the manuals provided with the Nitrex equipment.

Careless operation will result in a serious injury or death. Operator and maintenance personnel should read and fully understand this manual and component manuals before operation, inspection and or maintenance.

- Keep this manual near the Nitrex equipment so that all trained personnel can have access to it.
- Fully understand this manual for an effective troubleshooting of the generated alarms.

The following symbols will be used to illustrate potential dangers while operating this equipment. The unit may contain one if not all of the following hazards.

This Neutralizer operates with flammable gases if these gases are not supplied at the correct pressure and flow rate the neutralizer will not function correctly. Furthermore this will increase the risk of complete combustion in the chamber and can result in Carbon Monoxide.

Primarily this unit neutralizer effluent gases such as Ammonia, Hydrogen and Nitrogen.

Familiarize yourself with the hazards of the gases as well as any harmful byproducts created in the neutralizing process.

Carbon monoxide is a colorless, odorless, and tasteless gas that is slightly lighter than air. It is toxic to humans and animals when encountered in higher concentrations, although it is also produced

This unit contains electrical components that operate at high voltages. Before attempting any maintenance or servicing, be sure to power off the unit.

2 CODES AND STANDARDS

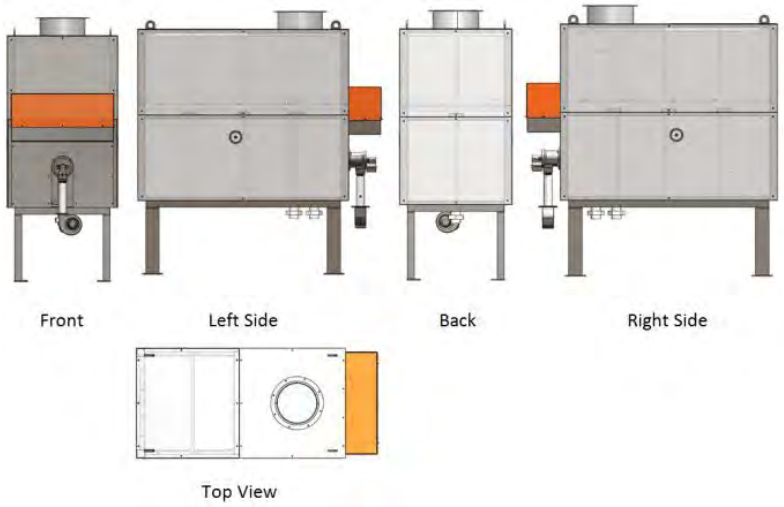
Installer/Servicers are responsible for compliance with all applicable codes and standards. This means that their installation must conform to local codes or, in the absence of local codes please refer to the following: CAN/CGA- B149 for Canadian Gas Codes and NFPA-70 for National Electrical Codes.

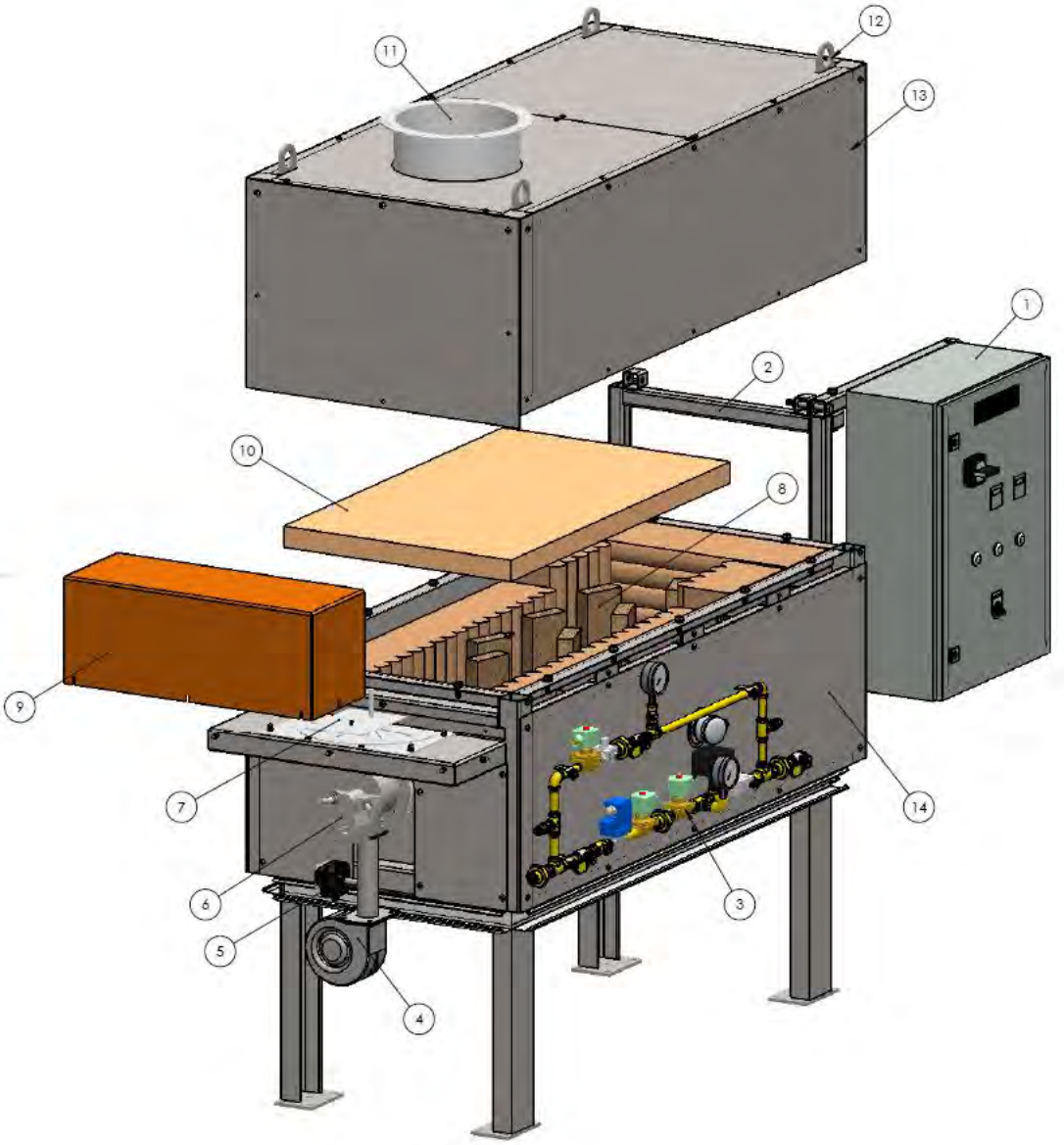
3 OPERATION INTRODUCTION

The Nitrex exhaust gas Neutralizers are designed to eliminate the residual ammonia and other pollutant gases from process fumes released to the environment without generating excessive amounts of NOX. Depending on the composition of the effluent gas, the reaction may be either endothermic or exothermic. The amount of air (oxygen) supplied to the flame must be sufficient to react with all the natural and effluent gases. When the content of exothermally reacting gases (e.g. H2) in the effluent atmosphere is low (e.g. in nitriding atmospheres diluted by N2,) natural gas is usually added to help maintain adequate reaction temperature, typically in the 900ºC-1100ºC (1652ºF-2012ºF) range.

In the case of effluent gases containing higher amounts of H2, a vigorous reaction releasing large amounts of heat is generated and the temperature of combustion rises. However, excessively high temperature is conducive to the generation of increased amounts of NOx in the gas released by the Neutralizer. To compensate for this effect, the amounts of air and natural gas are automatically adjusted by the process controller.

The control system is equipped with an automatic flame monitoring system. Any malfunction of the Neutralizer, like overheating or extinguishing of the flame automatically triggers an alarm signal which is relayed to the control system of the equipment generating the effluent gases.





1) Control Panel
2) Control Panel Mounting frame
3) Gas Manifold
4) Blower Fan
5) Air Pressure Switch
6) Burner Assembly
7) Air Gate
8) Control Panel Mounting frame
9) Air Gate Screen
10) Combustion Chamber Divider
11) Chimney
12) Lifting Hooks
13) Upper Chamber Assembly
14) Lower Chamber Assembly

3.1 COMBUSTION CHAMBER

The combustion chamber assembly consists of 2 integrated chambers, namely:

- **Combustion chamber**

- **Cool-down chamber**

The combustion chamber has a modular design that can be easily accessed for service.
For maximum efficiency, all Neutralizer models contain a central burner, a flame detector, a flame igniter and inlet tubes for the process gas. The inlet tubes are positioned around the burner. The tubes can be accessed for service or replacement.

The Combustion Chamber Assembly is fitted with a DUAL thermocouple (protected with silicon carbide shielding) for control, over-temperature and monitoring. If data logging is requires a triple thermocouple can be purchased separately.

The fuel gas/air mixture is fed to the Eclipse burner at a rate controlled by the Control System (see Control System).

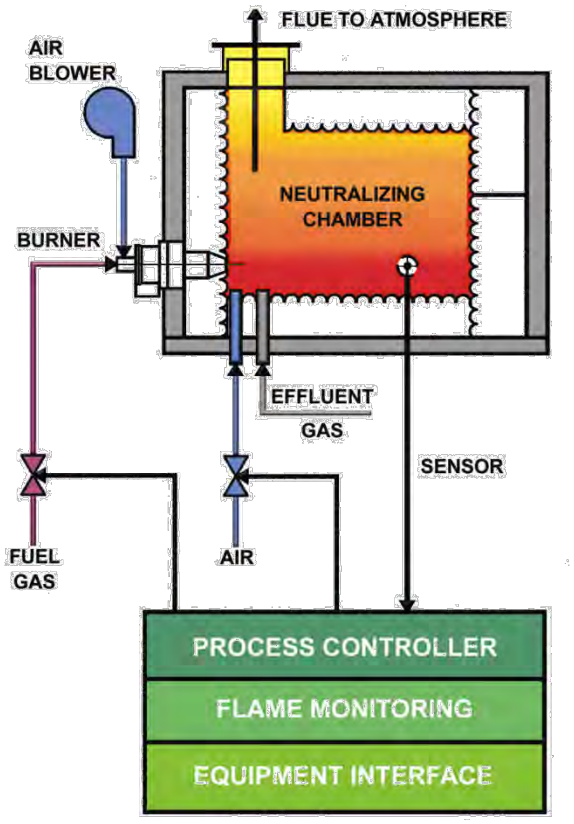
3.2 CONTROL SYSTEM

The control system supplied for the above combustion chamber assembly has been engineered to maintain at all times the temperature required for a complete incineration of the process atmosphere.

The fuel gas/air mixture is controlled according to the temperature inside the combustion chamber. Analogue control of a modulating valve insures a proportional flow control of fuel gas and air delivered by an industrial air blower.

The system includes a temperature controller, over-temperature controller and a flame monitoring system. The temperature inside the combustion chamber is always displayed by the controller.

For environmental monitoring purposes, the system generates a low temperature alarm, and may be equipped with an analogue output for data recording of temperature.



4 DIMENSIONS

Operating Characteristics	IN-75	IN-150	IN-300	IN-500	IN-750	IN-1000
Maximum process gas flow	75 l/min	150 l/min	300 l/min	500 l/min	750 l/min	1000 l/min
Maximum thermal output	22 kW	45 kW	82 kW	132 kW	198 kW	264 kW
Fuel gas rated input	16 kW	26 kW	42 kW	50 kW	85 kW	110 kW
- idle input (average)	12 kW	16 kW	26 kW	30 kW	50 kW	65 kW
- minimum input	4 kW	6 kW	10 kW	12 kW	18 kW	24 kW
Maximum air draw	37 m^3/h	72 m^3/h	122 m^3/h	245 m^3/h	365 m^3/h	500 m^3/h
Operating temperature	900-1100°C	900-1100°C	900-1100°C	900-1100°C	900-1100°C	900-1100°C
Maximum temperature	1300°C	1300 °C	1300 °C	1300 °C	1300 °C	1300 °C

Operating Characteristics	IN-75	IN-150	IN-300	IN-500	IN-750	IN-1000
Control voltage/frequency	110/220 VAC/50Hz	110/220 VAC/50Hz	110/220 VAC/50Hz	110/220 VAC/50Hz	110/220 VAC/50Hz	110/220 VAC/50Hz
Control power	500 VA	500 VA	750 VA	750 VA	1000 VA	1000 VA
Overall dimension (L x H x W) [mm]	1513 x 1328 x 752	1763 x 1328 x 752	1814 x 1632 x 852	2032 x 1632 x 1052	2180 x 1842 x 1052	2470 x 1842 x 1152

5 PURGE CALCULATIONS

Purge Time Calculations	IN-75	IN-150	IN-300	IN-500	IN-750	IN-1000
Blower Capacity [CFH] @ 1" W.C.	3600	3600	3600	9600	9600	9600
Air Orifice Capacity [CFH] @ 1" W.C.	1070.86	1702.35	2770.86	3570.86	4662.81	6574.84
Chamber Volume [CF]	5.6	7.2	15.8	20.3	29.1	41.2
Min Purge Time [sec]	94	76	103	102	112	113
Set Value [sec]	120	120	120	120	120	120

6 INSTALLATION AND START-UP

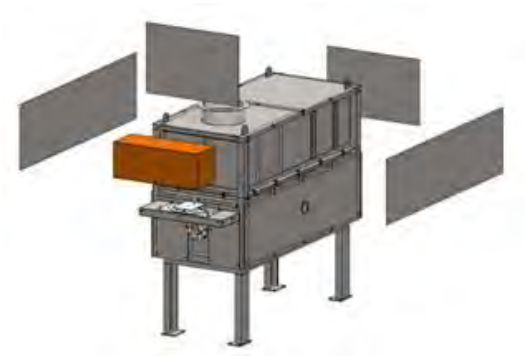
The basic equipment location and connection will be outlined in this chapter. So as to guide the installer, piping, electrical wiring for supply and control will also be discussed in this section. If any safety precautions listed in this manual are less stringent than applicable local codes, then all local codes will prevail. It is the customer's responsibility to adhere to all state and national codes that are relevant to this type of equipment installation and operation.

6.1 Shipping and Uncrating

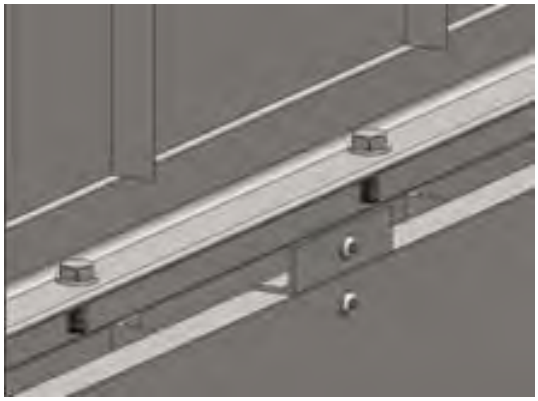
The Nitrex IN Neutralizer system is shipped in a few parts. These parts may be packaged within or around the Neutralizer.

Typically the Neutralizer is shipped with its bricks under the neutralizer. These bricks are fragile and should be handled with care. One of the first tasks before placing the unit should be to remove the upper chamber and install the bricks. Please consider this operation when locating the unit in your facility. It is possible that the bricks may need replacing in the future and if the upper chamber is blocked by surrounding equipment it can be problematic.

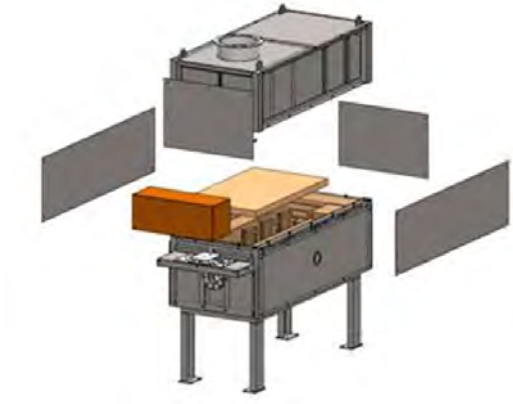
First Remove the Air gate screen (seen in orange), followed by upper (Side, Front and Back) screens to expose a bolted flange that runs all around the unit.

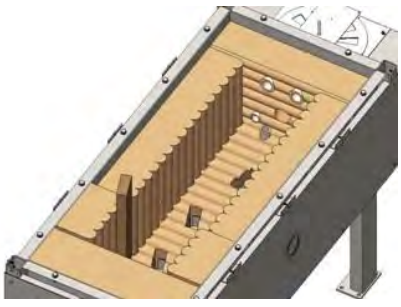


Remove all bolts from this flange. Using the 4 eye hooks on the top of the unit carefully lift off the upper half.



Once the Upper half has been removed, remove Ceraboard Divider.





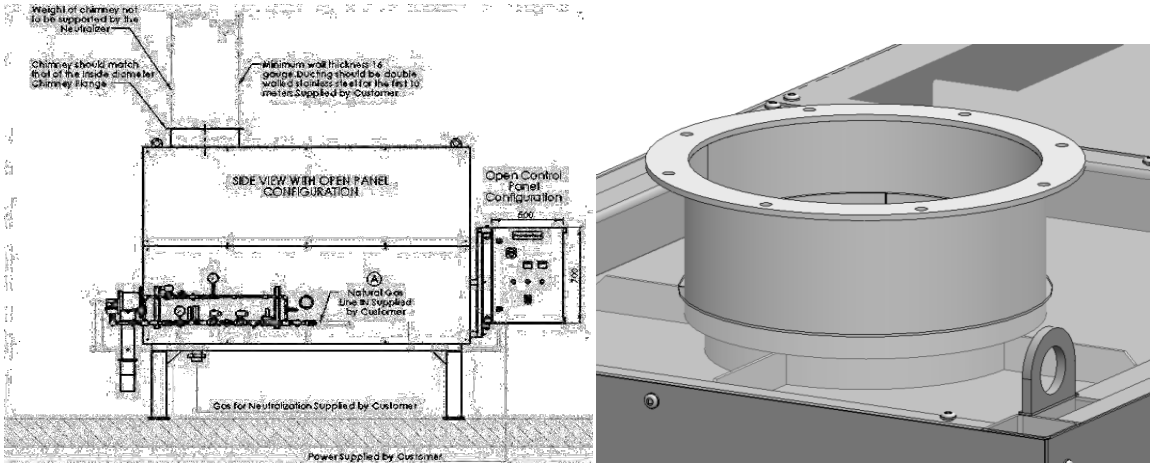
CAUTION
HANDLE CERABOARD WITH CARE

This material handles like a very weak particle board and can break easily.

Once the board is removed, place the brick in the Slotted cut out located at the bottom of the unit. Ensure that bricks are all at the same level and re-install the Ceraboard and close up the unit.

6.2 Chimney Ducting

The Chimney duct is used to expel content-trace residuals form the burning of exhaust gases. Ducting should be provided with double walled stainless steel for the first 10 Feet or 3 Meters. This prevents any burn hazards to the operator. A minimum wall thickness of 16, gauge is recommended. Afterwards a single walled duct and chimney cap should be sufficient. Please refer to local code for any further requirements. The weight of the chimney is not to be supported by the neutralizer and the chimney flange should match that of the unit for easy installation. At no time should the chimney run horizontally; an incline to the vertical stack of at least 30 deg is recommended.



Connect the chimney to the flange located on the top of the Neutralizer. The flange is adjustable and should be set in the upper most position when the chimney is attached. Setting the flange to the uppermost position facilitates future removal of the Neutralizer, if it is necessary to do so, without the need to dismantle the chimney.

WARNING
It is important that the Neutralizer is placed in a location where there is positive pressure otherwise it will not function properly.

6.3 Furnace Connection

Connect furnace exhaust pipes to the inlet ports located underneath the Neutralizer. All piping should be manufactured from high quality rigid piping and be purged/flushed of all cutting fluids and residue, prior to the operation of the equipment. All piping with ammonia supply gas or exhaust gases should be fabricated by black steel or stainless steel (preferable). Black steel is acceptable for all other piping; galvanized or similar material should not be used. It is always recommended to size the piping (inner diameters) larger than the end connections to reduce any pressure drops along the lengths.

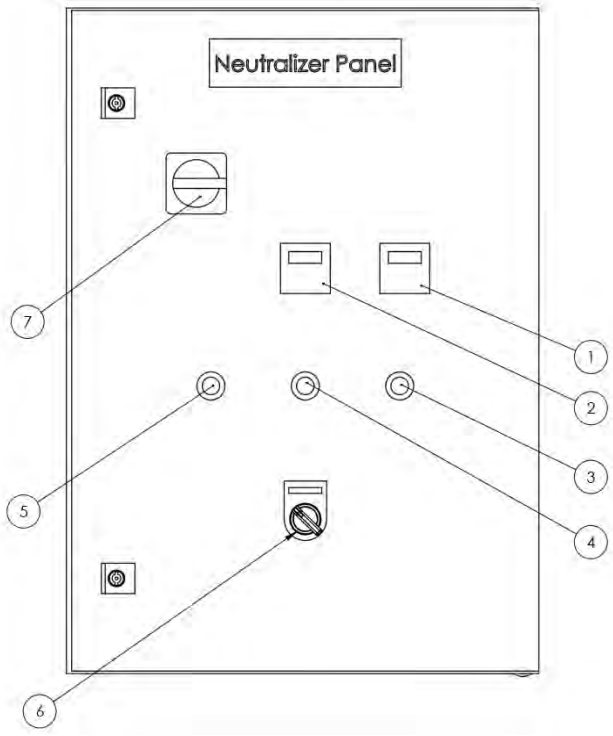
6.4 First Start-Up

Once all components have been located and interconnections completed the natural gas can be turned on. The next step will be to place the selector switch to the manual position (described in the latter section of this manual). This will initiate the start sequence and subsequent operation of the Neutralizer in the manual position. Once this operation has been verified, then the required furnaces can be connected so that an automatic operation can be possible.

Please operate the Neutralizer at a low set-point (400°C or less) for a few hours to ensure that any humidity is removed from the insulation prior to introducing the gases to be incinerated.

7 ELECTRICAL CONNECTIONS

7.1 Neutralizer Control Panel



1) Overheat Protection
2) Temperature Controller
3) Power ON (LED)
4) Ready (LED)
5) Fault (LED)
6) Main-OFF-AUTO (Switch)
7) Main Disconnect to Neutralizer

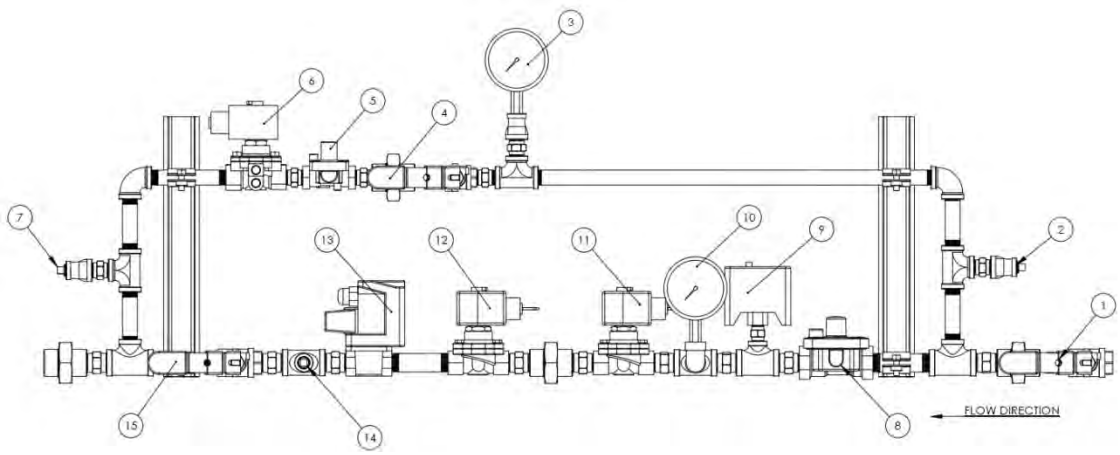
The operation selection switch allows the operator to select between the three control functions of the Neutralizer control - MANUAL – OFF – AUTOMATIC.

- **MANUAL**: The Neutralizer will function continuously while the switch is in this position. If the Neutralizer was off when the operator selected MANUAL mode, the Neutralizer controller will proceed with the ignition and fire sequence.
- **OFF**: The Neutralizer will not function in this mode
- **AUTOMATIC**: The Neutralizer will function whenever a signal is sent to the logic circuits of the Neutralizer control box. If the control circuitry receives a signal at any time when the Neutralizer is in the AUTOMATIC position, the Neutralizer controller will proceed with the ignition and fire sequence.

7.2 Neutralizer Gas Manifold

This manifold is an assembly of all manual and electronic valves, regulators and gauges used for the supply of natural gas to the burner unit. The schematic of the assembly is shown in the “Burner Fluids Control Diagram” and the part identification and manufacturer information is located in the Drawings / Parts List Manual and the component manuals included with the documentation for the system.

When connecting the natural gas supply to the gas train respecting all local codes and safety procedures.



1) Master Manual Shut-off valve
2) Sample Port
3) Main Pressure Gauge
4) Pilot Line Manual Shut-off valve
5) Pilot Pressure Regulator
6) Pilot Line Solenoid Valve
7) Secondary Sample Port
8) Main Pressure Regulator
9) Low Limit Pressure Switch
10) Main Pressure Gauge
11) Main Solenoid Valve
12) Secondary Main Solenoid Valve
13) Modulating Valve.
14) Main Line Sample Port
15) Isolating Shut Off

Master Manual Shut-off valve

Master Manual Shut-off Ball valve is used to positively shut-off the flow of natural gas from the source.

Main Manual Shut-off valve

Main Manual Shut-off Ball Valve is used to positively shut-off the flow of natural gas from the main line to the burner.

Pilot Line Manual Shut-off valve

The Pilot Line Manual Shut-off Ball Valve is used to positively shut-off the flow of natural gas from the pilot line to the burner.

Main Pressure Regulator

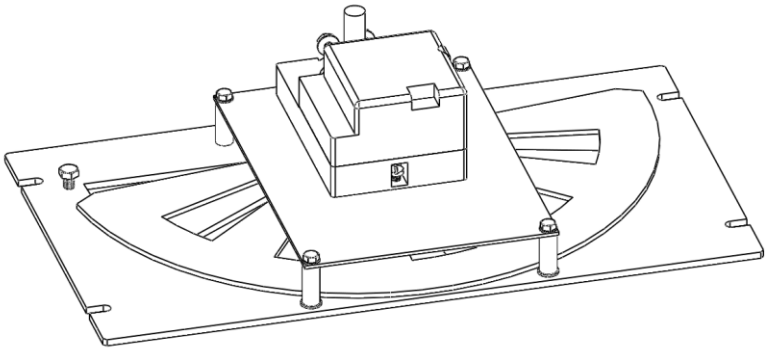
The Main Pressure Regulator takes input supply pressure from and regulates it down (3-6” of W.C.) for process consumption. The regulator could also contain a relief valve for overpressure situations (depending upon Neutralizer model).

Pilot Pressure Regulator
The Pilot Pressure Regulator takes input supply pressure and regulates down (2.8-5.2” W.C.) for process consumption.

Main Solenoid Valve
The Main Solenoid shut-off valve is used to electrically shut off the flow of natural gas through the main line to the burner. The main line solenoid is operated directly by the burner controller (2.4.12).

Pilot Line Solenoid Valve
The Pilot Line Solenoid Shut-off Valve is used to shut-off the flow of natural gas through the pilot line to the burner. The Pilot line solenoid is operated directly by the burner controller (2.4.12)

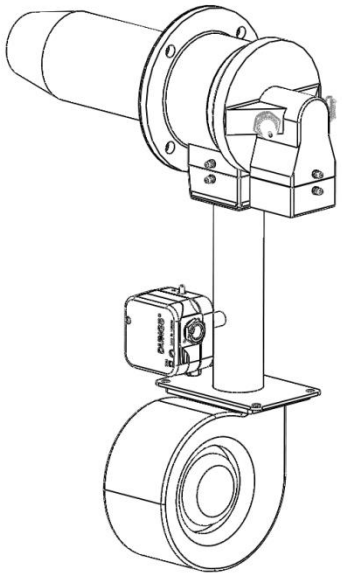
Air Intake Manifold
The Air gate is located on the Neutralizer and is used to cool down the atmosphere inside the neutralizer. The Air gate is controlled by the process controller



7.3 Burner Assembly

The burner assembly are the only components directly exposed to the flame and high temperatures.

Burner
The Burner is supplied with combustion gas and combustion air. The burner consists of a mixing chamber (nozzle and combustor) for the gases, a spark igniter (Right), and a flame rod (Left). The flame exits the burner through the conical orifice of the combustor.



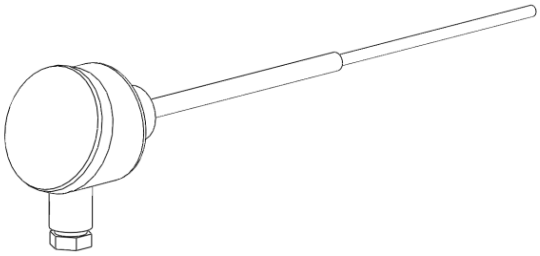
Air Blower
A high capacity blower supplies air to the burner unit.

Air Pressure Switch
The air pressure switch reads the pressure prior to entry into the burner assembly confirming that there is adequate air supply. The signal from the air pressure switch is sent to the burner controller (see 2.4.12). Additional information is found in the Eclipse User Manual.

Flame Rod
The Flame Rod screws into the Eclipse Burner (2.3.2) and includes a probe that extends into the potential flame path. The probe detects whether there is a flame available thus ensuring that the burner operation can proceed by sending the signal to the Veriflame Controller (2.4.11). A more detailed description is found in the Eclipse documentation.

Spark Plug
The Spark Plug receives a high-tension signal from the Ignition transformer (2.3.5). It is the only means used to ignite the pilot gas and start the required initial flame. The spark plug wire should be Nitrex Metal Inc. approved.

CAUTION
HANDLE THERMOCOUPLE WITH CARD



Carefully insert the thermocouple into the port located on the same side as the gas manifold.

This thermocouple is a DUAL TYPE-S thermocouple and in the conduit, which can be found next to the port there, are two (2) T/C extension wires. Please note that the positive lead is the orange wire

8 TROUBLESHOOTING

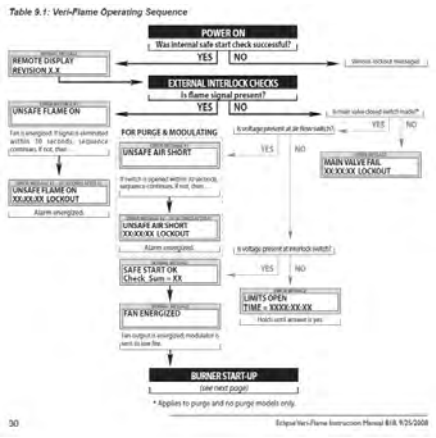
The Neutralizer and control system operates on a basic feedback control loop. The burner controller sends signals to various components. The flame sensor and temperature sensors monitor and provide the information. The operator can adjust the incineration temperature if desired (operating temperature 1650-2000ºF).

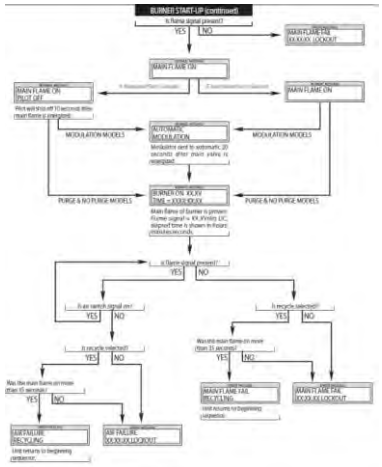
Additional operating information and troubleshooting is included with the Eclipse burner manual. The Eclipse manual is integral to the understanding of the burner and controller operation, thus it should be read thoroughly.
Sequence of Operation

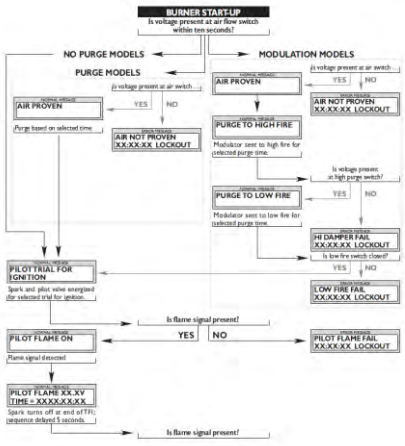
System is ready for operation when: Main Power is ON (-S7) and all breakers are ON.
If there is no overheat alarm (=1712-A1), process controller makes contact COM to NO.
In case of: overheat (overheat set point = 1350 °C (2462°F), thermocouple failure, controller failure or =1712-F1 breaker is OFF – internal =1712-A1 controller relay is de-energized, red “Overheat alarm” =1718-H1 pilot light is ON and process is disabled.

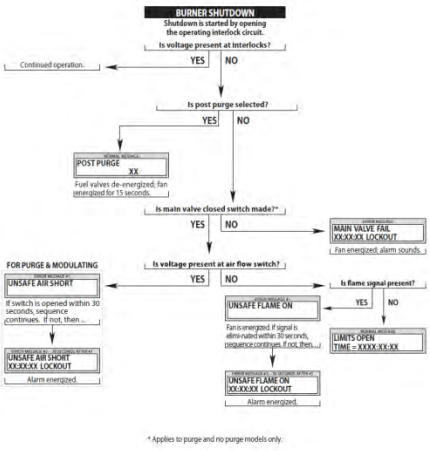
Operation sequence starts when 120 V is supplied to =1010-S1 (Selector Switch –- is in MAN position or in AUTO position and =K1719-KA1 relay is activated from a furnace control). When there is no overheat alarm =1714-A1 burner controller receives the signal to start the operation sequence. Controller performs internal checking and starts purging procedure if no error is detected. Contactor =1714-K1 is energized which activates blower =1715-M1 which supplies the purging air to the neutralization (combustion) chamber. The Normally open contact of =1714-K2 then activates =1718-KA1 “Purge Relay”. Signal from this relay is transferred to the furnaces control systems and cuts off the process gas flow. Blower pressure switch is activated and controller internal purge timer starts counting purging time. Purge time is set at 45 sec. to assure five exchanges of chamber volume.

After purging, Controller =1714-A1 starts the ignition sequence. Pilot gas solenoid valve =1714-Y1 is activated and a spark is generated at the igniter. When the flame is detected by the Flame rod, main gas valves are energized from terminal 5 of the =1714-A1 burner controller.









Temperature Control

The temperature inside the Neutralizer is controlled by the =1713-A2 process controller. If the temperature reading from the thermocouple is below the set-point (eg. 900 °C (1652°F)), the controller sends a signal through the signal conditioner to the modulating gas valve –VM30 (=1713-Y1) to increase natural gas flow. If the temperature is above the set-point the process controller sends a signal to the Air actuator =1713-A3 to open the orifice to increase the airflow into the Neutralizer which in turn cools it down.

9 MAINTENANCE

The maintenance of the Neutralizer is very minimal. The most important points to observe are: a clean supply gas, unobstructed air flow to the air blower, verification of thermocouple integrity. The condition of the flame, as viewed through the sight port and also indicated by the flame signal on the Veriflame controller, will point out if there is any soot or other buildup within the burner.

Additional maintenance information along with monthly and yearly checklists is included with the Eclipse burner manual. It is important to follow the manufacturers' suggestions for the operation of each respective component.

Once yearly the Neutralizer halves should be separated and the insulation inspected to visually determine if it has maintained its integrity.

Control Set Points

1713-A1 Temp.P6100 (Burner control)		
Configuration mode	ULoc	20
TC type S in Celsjus	inPt	SC
	ruL	1762
	rLL	0
	dPos	1
control type-dual (heat&cool)	CtyP	duAL
primary output-Reverse (heating)	Ctrl	rEu
	ALA1	P_Hi
	PhA1	870C
	ALA2	nonE
output1 - heating	USE1	Pri
output1 - 4-20mA	tYP1	4-20
output2 - cooling	USE2	SEc
output2 - 2-10V (or 4-20*)	tYP2	2-10 (4-20)
* depend on damper configuration		
output3 - Alarm 1, Direct	USE3	Al-d
Setup mode	ULoc	10
High Alarm 1 value	PhA1	870C
set point	SP	930 (950)C
Operator mode		
set point	SP	930 (950)C

1712-A1 Temp.P6100 (Burner control)		
Configuration mode	ULoc	20
TC type S in Celsjus	inPt	SC
	ruL	1762F
	rLL	0
	dPos	1
limit action	Ctrl	Hi
	ALA1	P_Hi
	ALA2	nonE
output2 - alarm	USE2	AI-d
Setup mode	ULoc	10
set point	SP	1100C
High Alarm value	PhA1	1100C

NITREX INC. – MICHIGAN OPERATIONS DATE 16 Aug 2021

Predictive/Preventive Maintenance Walk Through.

	CHECKED ON DAILY BASIS:	Checked	Initials
1	All over head cranes (visual inspection & functioning properly) on & down	X	JP
2	Water line control panels (proper readings & visual inspection)	X	
3	Chemical Room- Visual Inspection	J	
4	Power boxes in chemical room (tripped breakers for example)	X	
5	W-5 power panel inspection	X	
6	W-5/W-4 condition of wash tanks: Wash line log (is it done)	X	
7	Shipping / Receiving area (visual inspection of walls, floor etc)	X	
8	Fork truck paperwork (ensure daily checks were performed)	X	
9	M-8 water systems (pumps, water power panel)	22	
10	M-8 pit walk through (check for water on floor check gages)	X	
11	M-8 steam ONC boiler (gages)	X	
12	Neutralizer panel (it should be automatic/check alarms) 527,733	X	
13	H2 Smart Hydrogen sample box (gages)	X	
14	Flow meters on all furnaces	X	
15	Furnace Filters (check to see they have been changed)	X	
16	Alarms on all furnaces (make any corrections needed)	X	
17	Check processes on furnaces that are running (flows etc.)	X	
18	Liquid Nitrogen tanks (leaks, rust etc.) 100.4	X	
19	Ammonia tanks system (leaks, rust etc.) 101.1	6.0.7	
20	CO2 tank system (leaks, rust etc.) 2294	6001	
21	Closed loop water system (water levels, turbines)	X	
22	Generator back-up (self -diagnostic test)	X	
23	Control Room-Read shift notes fix problems noted	X	
24	Check processes on all furnaces (I.E. flows)	X	
25	Visually check actual computer-(Replace filters as needed)	X	
26	M-7 Electric panel	X	
27	Generator system-spot check transfer switch	98	
28	Water control system (temperature & alarms)	X	
29	All Control panels sample controls, gages)	X	
30	Electric control panels to furnaces	954	
31	2 Dissociator panels (temp. & alarms. Panel should be on Auto)	X	
32	All furnaces visual inspection (wires, etc.)	100	
33	Nitrogen Flow (100 psi in 60 psi main line)	X	
34	After burners on auto, check alarms, proper heat settings	X	
35	Main pit walk through (check for water on floor and water flow) Fault, 339/213	1	
36	Incinerators & incinerator control boxes	NA	
37	M-9 sampling box (proper flow)	X	
38	M-9 alarms (temperature control & dissociator)	110, 201	
39	Kaeser air compressor (check oil/lube etc.) Not down	X	
40	Kaeser air compressor tank (drain & check tank)	3.9	
41	W6 Titration (Wash)	—	
42	W6 Tritation (Rinse)	—	
43	W6 Conductivity (Wash)	—	X
44	W6 Conductivity (Rinse)		
	Comments:		