

# GEOSCIENCES AND ENGINEERING DIVISION NONCONFORMANCE REPORT

Project No. 14002.01.171

NCR No. 2007-40

## PART 1: DESCRIPTION OF NONCONFORMANCE

In some corrosion tests ultra high purity nitrogen gas is required to purge through the solution to maintain an oxygen-free environment because a small amount of oxygen interferes with corrosion current measurement. On 12/13/2007 one nitrogen gas cylinder supplied by Airgas® that purged nitrogen gas through four on-going test cells was found to be empty. This discontinuity of gas delivery condition deviated from the experimental procedure.

Initiated by: Don Bannon

Date: 21Dec07

Action Required by: Xihua He

Response Due Date: 11Jan08

## PART 2: PROPOSED DISPOSITION AND CORRECTIVE ACTION

**Disposition:** Discard the open circuit potential data monitored on 12/12/2007 and 12/13/2007 for the four on-going tests and accept the impedance data from the four tests as is. The tests were kept on-going.

The four on-going tests have the following test IDs: Ti29EIS01 (Scientific Notebook 794, page 24), Ti29EIS02 (Scientific Notebook 794, page 26), Ti7EIS01 (Scientific Notebook 794, page 28), Ti7EIS01 (Scientific Notebook 794, page 30),

**Basis of Disposition:** The main objective of these four tests is to measure the impedance of the titanium Grades 7 and 29 electrodes at elevated temperatures. At each temperature, the electrode was left in test solution for a week to allow the system to stabilize for impedance measurement. During that one-week period, the electrodes were monitored for open circuit potential. When the cylinder was found to be empty, only open circuit potential monitoring was running. The monitored open circuit potential during the course of the experiment is likely to be altered by the ingress of oxygen from air. The lab technician checked the cylinder the day before it was found to be empty and reported that nitrogen gas was still running. It is reasonable to discard the open circuit potential data monitored on 12/12/2007 and 12/13/2007. After the cylinder was found to be empty, it was replaced with a full cylinder and the ultra high purity nitrogen gas was purged through the test solution for another day before running the impedance measurement. The impedance data measured is unlikely to be affected by this deviation condition. According to the attached purity specification of ultra high pure nitrogen gas supplied by Airgas®, the oxygen and water content in the gas are below 1 ppm by volume. The purity of the test solution is unlikely to be compromised by the residual gas delivered from the gas cylinder.

**Action to Correct Nonconformance:** The empty gas cylinder was replaced with a full cylinder. In the future the gas cylinder will be monitored more frequently and replaced before it becomes empty.

Target date for completion: 1/9/2008

Proposed by: Xihua He

Date: 1/9/2008

## PART 3: APPROVAL

Manager: K. Ahlen

Date: 1-9-2008

Director of QA: [Signature]

Date: 1/9/2008

Comments/Instructions:

**PART 4: CLOSE OUT**

Comments: *Corrective action completed prior to approval. Verification is concurrent.*

**Distribution:**

Original-CENTER QA Records  
ORIGINATOR *BANNON*  
PRINCIPAL INVESTIGATOR *HE*  
MANAGER *AXLER*  
ASSISTANT DIRECTOR *MOHANTY*

Verified by:



Date:

*1/10/08*

## Nitrogen (N<sub>2</sub>)

A colorless, odorless, nonflammable gas or a colorless, odorless, nonflammable cryogenic liquid.

Purity Specifications	Minimum Purity	O <sub>2</sub>	H <sub>2</sub> O	THC	CO	CO <sub>2</sub>	H <sub>2</sub>	NO <sub>x</sub>	SO <sub>2</sub>
BIP® Technology	99.9999%	< 10 ppb	< 20 ppb	< 100 ppb					
Research Plus	99.9999%	< 0.2	< 0.2	< 0.1	< 0.5	< 0.1	< 0.5		
Research	99.9997%	< 0.5	< 0.5	< 0.2	< 0.5	< 0.5	< 2		
Continuous Emissions Monitoring	99.9995%	< 0.5	< 1	< 0.1	< 0.5	< 1		< 0.1	< 0.1
Ultra Pure Carrier	99.9993%	< 1	< 1	< 0.5	* < 0.5	* < 0.5			
Ultra High Purity	99.999%	< 1	< 1	< 0.5					
Zero	99.998%	< 4	< 3	< 0.5					
High Purity	99.998%	< 5	< 3						
High Pressure / High Purity	99.998%	< 5	< 3						

Concentrations given are ppm by volume unless otherwise specified.

\* CO + CO<sub>2</sub> < 1 ppm

Pure Gases

PRODUCT	Ordering Information					Equipment Recommendations		Page Number
	Cylinder Size	Contents ft <sup>3</sup>	Standard Valve Outlet (CGA)	Product Number	Cylinder Pressure at 70°F (psig)	Description Product Number	Delivery Pressure Range (psig)	
<b>BIP® Technology</b>	300	304	580	NI BIP300	2,640			
	Certificate of Conformance included.							
<b>Research Plus</b>	300	304	580	NI RP300	2,640	<b>Two-Stage Regulators</b> Y12-GC244 * 580 Y12-SR145 * 580 Y12-N145 * 580  <b>Single-Stage Regulators</b> Y12-N145 * 580 Y11-244 * 580	<b>A = 0-25</b> <b>B = 0-50</b> <b>D = 0-100</b>	
	200	235	580	NI RP200	2,200			
	80	93	580	NI RP80	2,200			
	35	36	580	NI RP35	2,200			
Total impurities guaranteed < 1 ppm. Individual Certificate of Analysis included.								
<b>Research</b>	300	304	580	NI R300	2,640	<b>Tee Purge</b> Y99-TP1A580		
	200	235	580	NI R200	2,200			
	80	93	580	NI R80	2,200			
	35	36	580	NI R35	2,200			
Total impurities guaranteed < 3 ppm. Individual Certificate of Analysis included.								
<b>Continuous Emissions Monitoring (CEM)</b>	300	304	580	NI CZ300	2,640			
	200	235	580	NI CZ200	2,200			
	150A	144	580	NI CZ15A	2,000			
	80	93	580	NI CZ80	2,200			
	35	36	580	NI CZ35	2,200			
Batch Certificate of Analysis included.								
<b>Ultra Pure Carrier (UPC)</b>	300	304	580	NI UPC300	2,640	<b>Two-Stage Regulators</b> Y12-N145 * 580 Y12-244 * 580	<b>A = 0-25</b> <b>B = 0-50</b> <b>D = 0-100</b>	
	200	235	580	NI UPC200	2,200			
	80	93	580	NI UPC80	2,200			
	35	36	580	NI UPC35	2,200			
Total Impurities < 3 ppm. An individual or batch analysis is available upon request at a nominal charge. Certificate of Conformance provided upon request.								
<b>Ultra High Purity (UHP)</b>	300	304	580	NI UHP300	2,640	<b>Single-Stage Regulators</b> Y11-N145 * 580 Y11-244 * 580	<b>E = 0-150</b> <b>F = 0-250</b> <b>G = 0-500**</b>	
	200	235	580	NI UHP200	2,200			
	80	93	580	NI UHP80	2,200			
	35	36	580	NI UHP35	2,200			
An individual or batch analysis is available upon request at a nominal charge. Certificate of Conformance provided upon request.								
<b>Zero</b>	300	304	580	NI Z300	2,640			
	200	235	580	NI Z200	2,200			
	80	93	580	NI Z80	2,200			
	35	36	580	NI Z35	2,200			
An individual or batch analysis is available upon request at a nominal charge. Certificate of Conformance provided upon request.								

\* Insert Delivery Pressure Range Code

\* Insert Delivery Pressure Range Code  
\*\* Single Stage Only

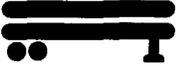
BIP® purifier technology is an **AIR PRODUCTS** innovation.  
 BIP® is a registered trademark of Air Products and Chemicals, Inc.  
 (US Trademark 2,521,752).  
 BIP® purifier technology is protected by US patent no. 0591840.

# Pure Gases

## Nitrogen (N<sub>2</sub>)

A colorless, odorless, inert compressed gas at high pressure.

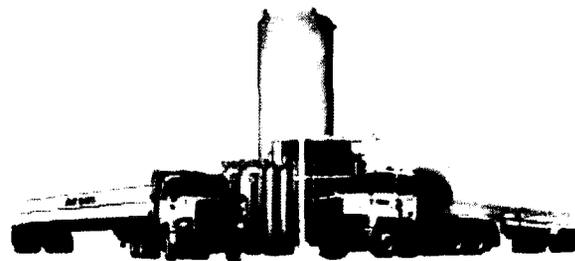
Pure Gases

PRODUCT	Ordering Information					Equipment Recommendations		
	Cylinder Size	Contents ft <sup>3</sup>	Standard Valve Outlet (CGA)	Product Number	Cylinder Pressure at 70°F (psig)	Description Product Number	Delivery Pressure Range (psig)	Page Number
<b>High Purity (HP)</b> 	300	304	580	NI HP300	2,640	<b>Two-Stage Regulators</b> Y12-N145 * 580 Y12-244 * 580  <b>Single-Stage Regulators</b> Y11-N145 * 580 Y11-244 * 580  <b>Tee Purge</b> Y99-TP1A580	A = 0-25 B = 0-50 D = 0-100 E = 0-150 F = 0-250 G = 0-500**	E26 E11
	200	235	580	NI HP200	2,200			
	80	93	580	NI HP80	2,200			
	35	36	580	NI HP35	2,200			
	An individual or batch analysis is available upon request at a nominal charge. Certificate of Conformance provided upon request.							
<b>High Pressure / High Purity</b>	6K	482	677	NI HP6K	6,000	<b>Single-Stage Regulators</b> Y11-N115H580 Y11-N198J (CGA)† Y11-N198K (CGA)†	0-2,000 0-4,000 0-6,000	E57 E57 E57
	4K	337	680	NI HP3K	3,500			
	3K							
An individual or batch analysis is available upon request at a nominal charge. Certificate of Conformance provided upon request.						† Insert CGA Valve Number		
<b>Liquid</b>	Various sizes and volumes available upon request.							

For Laser Grade, see Special Applications Section

Technical Data & Shipping Information		For Laser Grade, see Special Applications Section.
Molecular Weight	28.01	
Specific Volume	13.8 cf/lb @70° F	
Flammability Limits in Air	Nonflammable	
U.S. DOT Name	Nitrogen, Compressed	
ID Number	UN 1066	
U.S. DOT Hazard Class	2.2	
U.S. DOT Label	Nonflammable Gas	
CAS Registry	7727-37-9	

Airgas offers unique *BIP*<sup>®</sup> technology gases in argon, helium and nitrogen. *BIP* technology (an Air Products innovation) provides premium-grade purity at costs you would expect to pay for zero-grade gas using a purifier built into the cylinder. For details, see Special Applications section.



Airgas offers a wide range of gas supply modes, including high-pressure cylinders, liquid cylinders (or dewars), MicroBulk and bulk. Your Airgas specialty gas representative can help you decide which option is best for your operation. Be sure to ask about our unique line of specialty gas equipment, including automatic changeover systems for uninterrupted gas supply.