

April 20, 2018

Mr. William F. Durham  
Director  
WVDEP, Division of Air Quality  
601 – 57<sup>th</sup> Street SE  
Charleston, West Virginia 25304

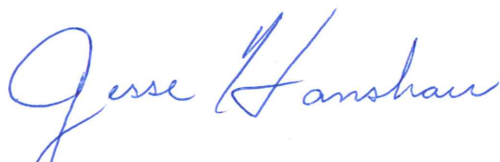
**Re: CONE Gathering LLC, Rule 13 Permit Class I Administrative Update – Majorsville Station – Facility ID (051-00143)**

Dear Mr. Durham,

CONE Gathering LLC, (CONE) and SLR International Corporation (SLR) have prepared the attached Rule 13 Permit Class I Administrative Update for the Majorsville Station (R13-3081E) to reflect the removal and replacement of the 2,370 hp Caterpillar G3608TALE Compressor Engine (E-4). The engine will be replaced with a 4,500 hp electric reciprocating compressor. This change will result in an overall decrease in emissions and allow the site to be represented with all electric sales gas compression. The applicable emission unit data sheets have been amended and are included within the application.

If any additional information is needed, please feel free to contact me by telephone at (304) 545-8563 or by e-mail at [jhanshaw@slrconsulting.com](mailto:jhanshaw@slrconsulting.com)

Sincerely,  
**SLR International Corporation**

  
Jesse Hanshaw, P.E.  
Principal Engineer



CONE Gathering LLC

Majorsville Station

Dallas, West Virginia

**Class I Administrative Update**

SLR Ref: 116.00894.00108

April 2018



**Class I Administrative Update**  
**Majorsville Station**  
**Dallas, West Virginia**

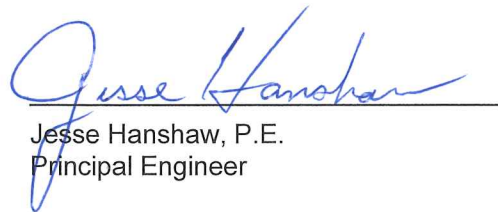
Prepared for:

**CONE Gathering LLC**  
1000 Consol Energy Drive  
Canonsburg, PA 15317

This document has been prepared by SLR International Corporation. The material and data in this permit application were prepared under the supervision and direction of the undersigned.



Travis Asbury  
Staff Engineer



Jesse Hanshaw, P.E.  
Principal Engineer

# CONTENTS

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## **Class I Administrative Update**

### **ATTACHMENTS**

APPLICATION FOR CLASS I ADMINISTRATIVE UPDATE  
ATTACHMENT A AMENDED PERMIT ATTACHMENTS  
ATTACHMENT B SUPPORTING DOCUMENTS

**APPLICATION FOR  
CLASS I ADMINISTRATIVE UPDATE**



WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION  
**DIVISION OF AIR QUALITY**

601 57<sup>th</sup> Street, SE  
Charleston, WV 25304  
(304) 926-0475  
[www.dep.wv.gov/daq](http://www.dep.wv.gov/daq)

**APPLICATION FOR NSR PERMIT  
AND  
TITLE V PERMIT REVISION  
(OPTIONAL)**

PLEASE CHECK ALL THAT APPLY TO **NSR (45CSR13)** (IF KNOWN):

- CONSTRUCTION     MODIFICATION     RELOCATION  
 CLASS I ADMINISTRATIVE UPDATE     TEMPORARY  
 CLASS II ADMINISTRATIVE UPDATE     AFTER-THE-FACT

PLEASE CHECK TYPE OF **45CSR30 (TITLE V)** REVISION (IF ANY):

- ADMINISTRATIVE AMENDMENT     MINOR MODIFICATION  
 SIGNIFICANT MODIFICATION

IF ANY BOX ABOVE IS CHECKED, INCLUDE TITLE V REVISION INFORMATION AS **ATTACHMENT S** TO THIS APPLICATION

**FOR TITLE V FACILITIES ONLY:** Please refer to "Title V Revision Guidance" in order to determine your Title V Revision options (Appendix A, "Title V Permit Revision Flowchart") and ability to operate with the changes requested in this Permit Application.

**Section I. General**

1. Name of applicant (as registered with the WV Secretary of State's Office): CONE Gathering LLC		2. Federal Employer ID No. (FEIN): 47-1054194	
3. Name of facility (if different from above): Majorsville Station		4. The applicant is the: <input type="checkbox"/> OWNER <input type="checkbox"/> OPERATOR <input checked="" type="checkbox"/> BOTH	
5A. Applicant's mailing address: 1000 Consol Energy Drive Canonsburg, PA 15317		5B. Facility's present physical address: 3700 Number Two Ridge Road Dallas, WV 26036	
6. <b>West Virginia Business Registration.</b> Is the applicant a resident of the State of West Virginia? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO – If <b>YES</b> , provide a copy of the <b>Certificate of Incorporation/Organization/Limited Partnership</b> (one page) including any name change amendments or other Business Registration Certificate as <b>Attachment A</b> . – If <b>NO</b> , provide a copy of the <b>Certificate of Authority/Authority of L.L.C./Registration</b> (one page) including any name change amendments or other Business Certificate as <b>Attachment A</b> .			
7. If applicant is a subsidiary corporation, please provide the name of parent corporation:			
8. Does the applicant own, lease, have an option to buy or otherwise have control of the <i>proposed site</i> ? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO – If <b>YES</b> , please explain:    Owner  – If <b>NO</b> , you are not eligible for a permit for this source.			
9. Type of plant or facility (stationary source) to be <b>constructed, modified, relocated, administratively updated</b> or <b>temporarily permitted</b> (e.g., coal preparation plant, primary crusher, etc.): Natural Gas Compression and Dehydration Facility		10. North American Industry Classification System (NAICS) code for the facility:  486210	
11A. DAQ Plant ID No. (for existing facilities only): 051-00143		11B. List all current 45CSR13 and 45CSR30 (Title V) permit numbers associated with this process (for existing facilities only): R13-3081E	

*All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.*

12A.

- For **Modifications, Administrative Updates** or **Temporary permits** at an existing facility, please provide directions to the *present location* of the facility from the nearest state road;
- For **Construction** or **Relocation permits**, please provide directions to the *proposed new site location* from the nearest state road. Include a **MAP** as **Attachment B**.

From Wheeling: Travel East on I-70 for approximately 9.3 miles. Take Exit 11 onto Dallas Pike. Turn right onto Dallas Pike and travel approximately 1.7 miles. Take a slight left onto Middle Wheeling Creek Road (Old Co. 39) for 0.4 miles. Continue onto Dallas Pike and Travel 3.0 miles. Turn right onto Number 2 Ridge Road and travel 3.6 miles. Turn right and the facility will be 0.5 miles on the right.

12.B. New site address (if applicable):	12C. Nearest city or town: Majorsville	12D. County: Marshall
-----------------------------------------	-------------------------------------------	--------------------------

12.E. UTM Northing (KM): 4,424.302	12F. UTM Easting (KM): 539.827	12G. UTM Zone: 17
------------------------------------	--------------------------------	-------------------

13. Briefly describe the proposed change(s) at the facility:  
 CONE would like to update their permit to reflect the removal of the 2,370 HP Caterpillar G3608 LE Compressor Engine. This engine will be replaced with a 4,500 HP Electric Reciprocating Compressor.

14A. Provide the date of anticipated installation or change: - If this is an <b>After-The-Fact</b> permit application, provide the date upon which the proposed change did happen:	14B. Date of anticipated Start-Up if a permit is granted: / /
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------

14C. Provide a **Schedule** of the planned **Installation of/Change** to and **Start-Up** of each of the units proposed in this permit application as **Attachment C** (if more than one unit is involved).

15. Provide maximum projected **Operating Schedule** of activity/activities outlined in this application:  
 Hours Per Day 24      Days Per Week 7      Weeks Per Year 52

16. Is demolition or physical renovation at an existing facility involved?     **YES**       **NO**

17. **Risk Management Plans.** If this facility is subject to 112(r) of the 1990 CAAA, or will become subject due to proposed changes (for applicability help see [www.epa.gov/ceppo](http://www.epa.gov/ceppo)), submit your **Risk Management Plan (RMP)** to U. S. EPA Region III.

18. **Regulatory Discussion.** List all Federal and State air pollution control regulations that you believe are applicable to the proposed process (*if known*). A list of possible applicable requirements is also included in Attachment S of this application (Title V Permit Revision Information). Discuss applicability and proposed demonstration(s) of compliance (*if known*). Provide this information as **Attachment D**.

**Section II. Additional attachments and supporting documents.**

19. Include a check payable to WVDEP – Division of Air Quality with the appropriate **application fee** (per 45CSR22 and 45CSR13).

20. Include a **Table of Contents** as the first page of your application package.

21. Provide a **Plot Plan**, e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is or is to be located as **Attachment E** (Refer to **Plot Plan Guidance**) .  
 - Indicate the location of the nearest occupied structure (e.g. church, school, business, residence).

22. Provide a **Detailed Process Flow Diagram(s)** showing each proposed or modified emissions unit, emission point and control device as **Attachment F**.

23. Provide a **Process Description** as **Attachment G**.  
 - Also describe and quantify to the extent possible all changes made to the facility since the last permit review (if applicable).

*All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.*

24. Provide **Material Safety Data Sheets (MSDS)** for all materials processed, used or produced as **Attachment H**.

– For chemical processes, provide a MSDS for each compound emitted to the air.

25. Fill out the **Emission Units Table** and provide it as **Attachment I**.

26. Fill out the **Emission Points Data Summary Sheet (Table 1 and Table 2)** and provide it as **Attachment J**.

27. Fill out the **Fugitive Emissions Data Summary Sheet** and provide it as **Attachment K**.

28. Check all applicable **Emissions Unit Data Sheets** listed below:

- |                                                                                    |                                                  |                                                                                  |
|------------------------------------------------------------------------------------|--------------------------------------------------|----------------------------------------------------------------------------------|
| <input type="checkbox"/> Bulk Liquid Transfer Operations                           | <input type="checkbox"/> Haul Road Emissions     | <input type="checkbox"/> Quarry                                                  |
| <input type="checkbox"/> Chemical Processes                                        | <input type="checkbox"/> Hot Mix Asphalt Plant   | <input type="checkbox"/> Solid Materials Sizing, Handling and Storage Facilities |
| <input type="checkbox"/> Concrete Batch Plant                                      | <input type="checkbox"/> Incinerator             | <input type="checkbox"/> Storage Tanks                                           |
| <input type="checkbox"/> Grey Iron and Steel Foundry                               | <input type="checkbox"/> Indirect Heat Exchanger |                                                                                  |
| <input checked="" type="checkbox"/> General Emission Unit, specify: ICE Data Sheet |                                                  |                                                                                  |

Fill out and provide the **Emissions Unit Data Sheet(s)** as **Attachment L**.

29. Check all applicable **Air Pollution Control Device Sheets** listed below:

- |                                             |                                                     |                                                |
|---------------------------------------------|-----------------------------------------------------|------------------------------------------------|
| <input type="checkbox"/> Absorption Systems | <input type="checkbox"/> Baghouse                   | <input type="checkbox"/> Flare                 |
| <input type="checkbox"/> Adsorption Systems | <input type="checkbox"/> Condenser                  | <input type="checkbox"/> Mechanical Collector  |
| <input type="checkbox"/> Afterburner        | <input type="checkbox"/> Electrostatic Precipitator | <input type="checkbox"/> Wet Collecting System |

Other Collectors, specify

Fill out and provide the **Air Pollution Control Device Sheet(s)** as **Attachment M**.

30. Provide all **Supporting Emissions Calculations** as **Attachment N**, or attach the calculations directly to the forms listed in Items 28 through 31.

31. **Monitoring, Recordkeeping, Reporting and Testing Plans.** Attach proposed monitoring, recordkeeping, reporting and testing plans in order to demonstrate compliance with the proposed emissions limits and operating parameters in this permit application. Provide this information as **Attachment O**.

➤ Please be aware that all permits must be practically enforceable whether or not the applicant chooses to propose such measures. Additionally, the DAQ may not be able to accept all measures proposed by the applicant. If none of these plans are proposed by the applicant, DAQ will develop such plans and include them in the permit.

32. **Public Notice.** At the time that the application is submitted, place a **Class I Legal Advertisement** in a newspaper of general circulation in the area where the source is or will be located (See 45CSR§13-8.3 through 45CSR§13-8.5 and **Example Legal Advertisement** for details). Please submit the **Affidavit of Publication** as **Attachment P** immediately upon receipt.

33. **Business Confidentiality Claims.** Does this application include confidential information (per 45CSR31)?

YES       NO

➤ If **YES**, identify each segment of information on each page that is submitted as confidential and provide justification for each segment claimed confidential, including the criteria under 45CSR§31-4.1, and in accordance with the DAQ's **"Precautionary Notice – Claims of Confidentiality"** guidance found in the **General Instructions** as **Attachment Q**.

### **Section III. Certification of Information**

34. **Authority/Delegation of Authority.** Only required when someone other than the responsible official signs the application. Check applicable **Authority Form** below:

- |                                                                            |                                                           |
|----------------------------------------------------------------------------|-----------------------------------------------------------|
| <input type="checkbox"/> Authority of Corporation or Other Business Entity | <input type="checkbox"/> Authority of Partnership         |
| <input type="checkbox"/> Authority of Governmental Agency                  | <input type="checkbox"/> Authority of Limited Partnership |

Submit completed and signed **Authority Form** as **Attachment R**.

*All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.*



35A. **Certification of Information.** To certify this permit application, a Responsible Official (per 45CSR§13-2.22 and 45CSR§30-2.28) or Authorized Representative shall check the appropriate box and sign below.

**Certification of Truth, Accuracy, and Completeness**

I, the undersigned  **Responsible Official** /  **Authorized Representative**, hereby certify that all information contained in this application and any supporting documents appended hereto, is true, accurate, and complete based on information and belief after reasonable inquiry I further agree to assume responsibility for the construction, modification and/or relocation and operation of the stationary source described herein in accordance with this application and any amendments thereto, as well as the Department of Environmental Protection, Division of Air Quality permit issued in accordance with this application, along with all applicable rules and regulations of the West Virginia Division of Air Quality and W.Va. Code § 22-5-1 et seq. (State Air Pollution Control Act). If the business or agency changes its Responsible Official or Authorized Representative, the Director of the Division of Air Quality will be notified in writing within 30 days of the official change.

**Compliance Certification**

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

SIGNATURE \_\_\_\_\_

*Joseph Fink*  
(Please use blue ink)

DATE: \_\_\_\_\_

*4-19-2018*  
(Please use blue ink)

35B. Printed name of signee: Joseph Fink

35C. Title: Authorized Representative

35D. E-mail: [joefink@cnx.com](mailto:joefink@cnx.com)

36E. Phone: 724-485-3254

36F. FAX:

36A. Printed name of contact person (if different from above): Kevin Aubele

36B. Title: Air Quality Engineer

36C. E-mail: [KevinAubele@cnx.com](mailto:KevinAubele@cnx.com)

36D. Phone: 724-485-4756

36E. FAX:

**PLEASE CHECK ALL APPLICABLE ATTACHMENTS INCLUDED WITH THIS PERMIT APPLICATION:**

- |                                                                                    |                                                                                         |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| <input type="checkbox"/> Attachment A: Business Certificate                        | <input type="checkbox"/> Attachment K: Fugitive Emissions Data Summary Sheet            |
| <input checked="" type="checkbox"/> Attachment B: Map(s)                           | <input checked="" type="checkbox"/> Attachment L: Emissions Unit Data Sheet(s)          |
| <input type="checkbox"/> Attachment C: Installation and Start Up Schedule          | <input type="checkbox"/> Attachment M: Air Pollution Control Device Sheet(s)            |
| <input checked="" type="checkbox"/> Attachment D: Regulatory Discussion            | <input checked="" type="checkbox"/> Attachment N: Supporting Emissions Calculations     |
| <input checked="" type="checkbox"/> Attachment E: Plot Plan                        | <input type="checkbox"/> Attachment O: Monitoring/Recordkeeping/Reporting/Testing Plans |
| <input checked="" type="checkbox"/> Attachment F: Detailed Process Flow Diagram(s) | <input type="checkbox"/> Attachment P: Public Notice                                    |
| <input checked="" type="checkbox"/> Attachment G: Process Description              | <input type="checkbox"/> Attachment Q: Business Confidential Claims                     |
| <input type="checkbox"/> Attachment H: Material Safety Data Sheets (MSDS)          | <input type="checkbox"/> Attachment R: Authority Forms                                  |
| <input checked="" type="checkbox"/> Attachment I: Emission Units Table             | <input type="checkbox"/> Attachment S: Title V Permit Revision Information              |
| <input type="checkbox"/> Attachment J: Emission Points Data Summary Sheet          | <input type="checkbox"/> Application Fee                                                |

*Please mail an original and three (3) copies of the complete permit application with the signature(s) to the DAQ, Permitting Section, at the address listed on the first page of this application. Please DO NOT fax permit applications.*

**FOR AGENCY USE ONLY – IF THIS IS A TITLE V SOURCE:**

- Forward 1 copy of the application to the Title V Permitting Group and:*
- For Title V Administrative Amendments:*
  - NSR permit writer should notify Title V permit writer of draft permit,*
- For Title V Minor Modifications:*
  - Title V permit writer should send appropriate notification to EPA and affected states within 5 days of receipt,*
  - NSR permit writer should notify Title V permit writer of draft permit.*
- For Title V Significant Modifications processed in parallel with NSR Permit revision:*
  - NSR permit writer should notify a Title V permit writer of draft permit,*
  - Public notice should reference both 45CSR13 and Title V permits,*
  - EPA has 45 day review period of a draft permit.*

*All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.*

# **ATTACHMENT A**

## **AMENDED PERMIT ATTACHMENTS**

### **Class I Administrative Update**

**Majorsville Station  
Dallas, West Virginia**

CONE Midstream Partners  
1000 Consol Energy Drive  
Canonsburg, PA 15317

# ATTACHMENT D - REGULATORY DISCUSSION

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## APPLICABLE REGULATIONS

The newly added and modified equipment at this facility are subject to the following applicable rules and regulations:

### **Federal and State:**

#### **45 CSR 13 – *Permits for Construction, Modification, Relocation, and Operation of Stationary Source of Air Pollutants***

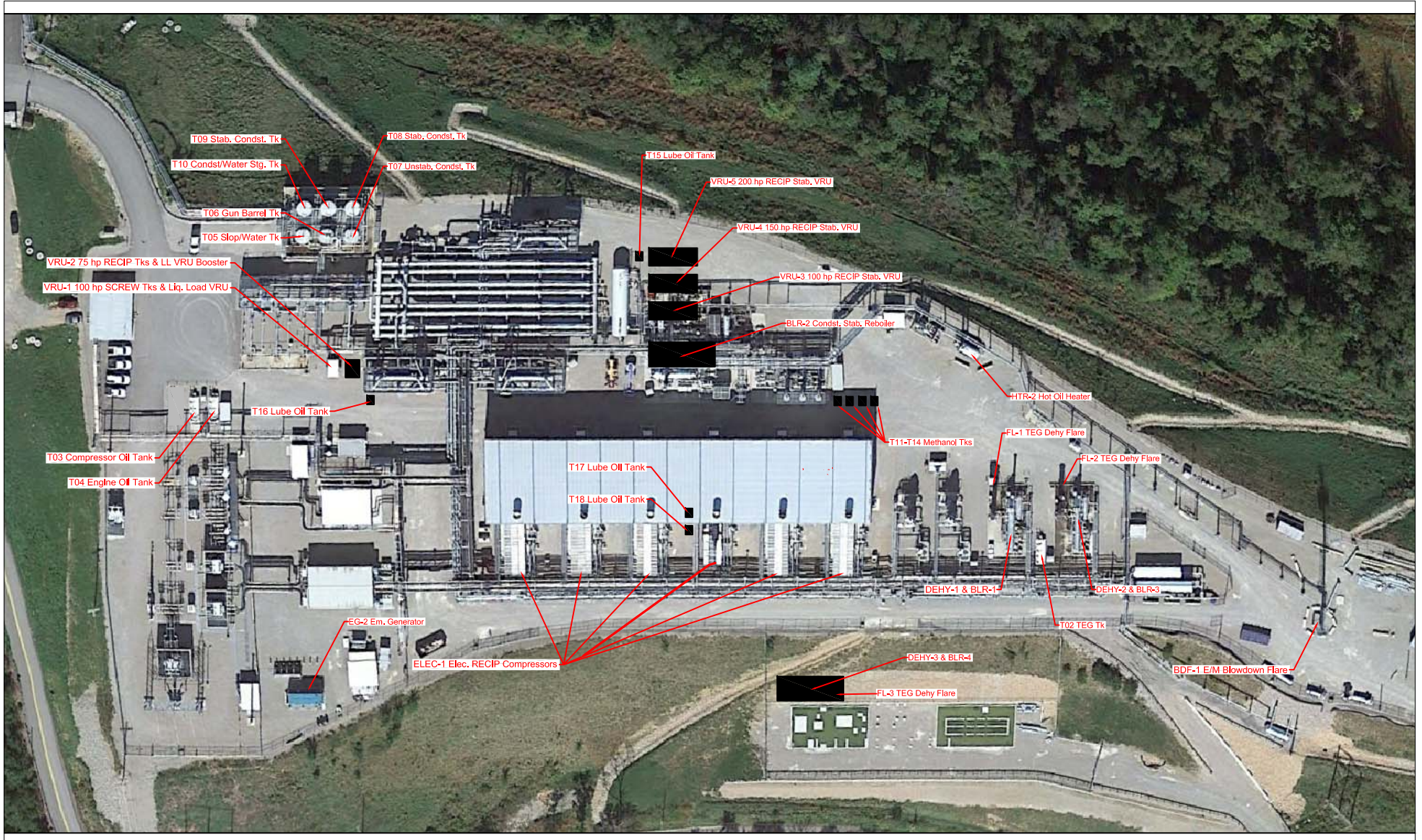
CONE has applied for a Class I Administrative Update of its current air permit for the Majorsville Station (R13-3081E) to reflect the removal and replacement of the 2,370 hp Caterpillar G3608 TALE Compressor Engine. The engine will be replaced with a 4,500 hp Electric Reciprocating Compressor. This change will result in an overall decrease of potential emissions.

**40 CFR 60 Subpart OOOOa – *Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification, or Reconstruction Commenced after September 18, 2015.*** The new electric compressor will trigger a modification under the NSPS since it will be newly installed.

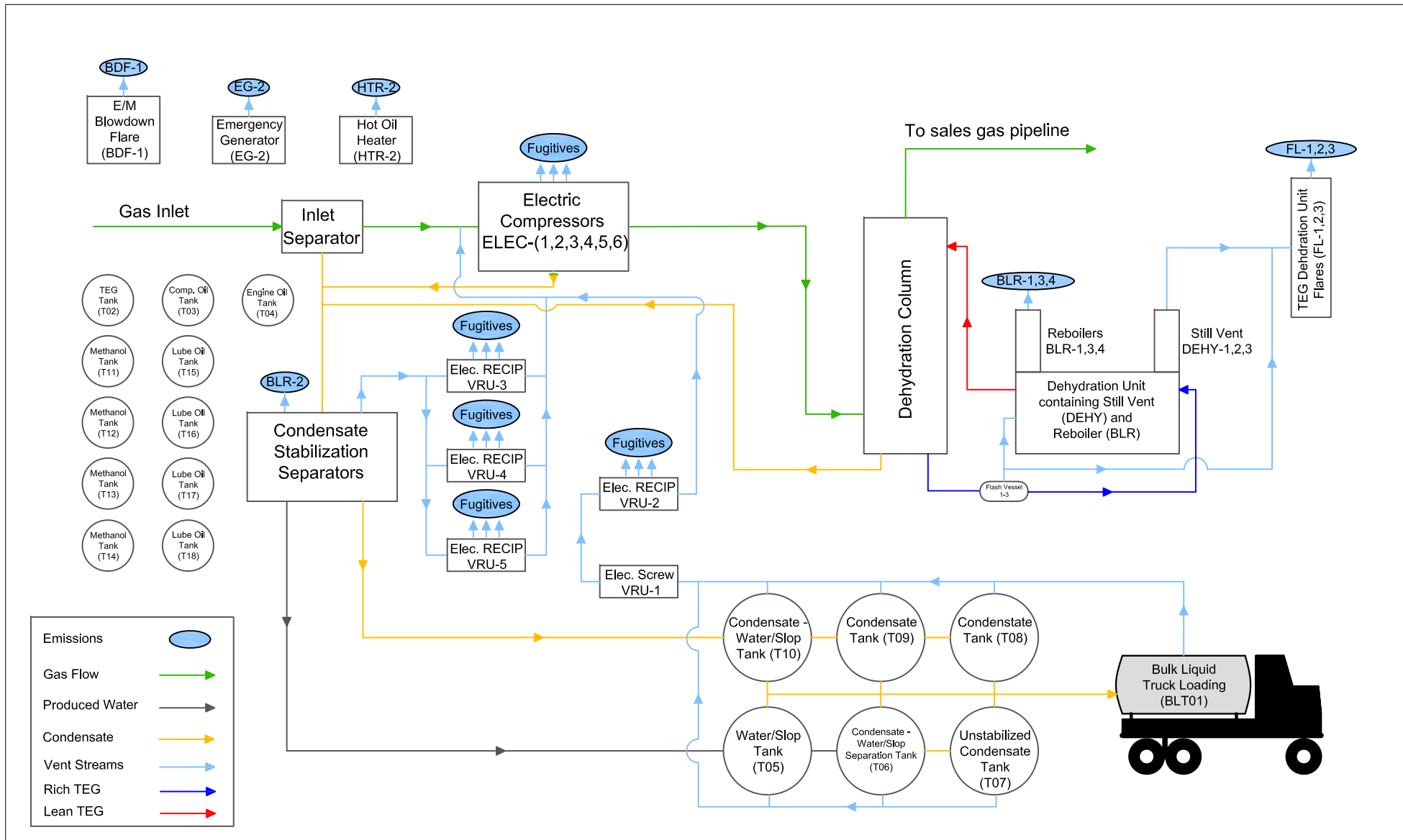
#### **Fugitive Components at Compressor Stations and Reciprocating Compressor Packing**

The reciprocating compressor associated with emission unit (ELEC-4) will also be subject to the rod packing standards of §60.5385a that requires them to be replaced/rebuilt every 26,000 hrs or 3 years. Records shall be maintained based on months or hours of operations since initial startup and each subsequent rebuild or replacement of the compressor's rod packing.





	CONE Gathering LLC	
	Attachment E - Plot Plan	
	Majorsville Station	April 2018





## **ATTACHMENT G - PROCESS DESCRIPTION**

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The process begins with natural gas entering the station by pipeline and going through an inlet separator slug catcher that removes any entrained liquids. Next, the gas is compressed by natural-gas fired and electric driven compressors before entering a glycol dehydration column where it is contacted with triethylene glycol (TEG) to strip water from the gas. The dry gas outlet from the dehydration column is sent to the natural gas sales line and exits the facility. The rich TEG from the dehydration unit is fed into a reboiler to remove water so the lean TEG can be recycled back to the column. The emissions from the reboiler stills (DEHY-1,2,3) are sent into FL-1 through FL-3. Condensate liquids separated from the gas streams are sent to stabilization where the stream undergoes a pressure reduction step which releases flash gas to VRU-3 through VRU-5 to be recycled back into the gas inlet line prior to compression. Produced water and condensate leave stabilization and are placed into tanks so they can be removed from the facility via tanker truck. Emissions from the tanks, as well as the truck loading emissions, are controlled by VRU-1 and VRU-2 which recycles the vapors back into the gas inlet line prior to compression.

### **DESCRIPTION OF PROCESS CHANGE**

CONE has applied for a Class I Administrative Update of its current air permit for the Majorsville Station (R13-3081E) to reflect the removal and replacement of the 2,370 hp Caterpillar G3608 TALE Compressor Engine. The engine will be replaced with a 4,500 hp Electric Reciprocating Compressor. This change will result in an overall decrease of potential emissions.

<b>Emission Unit ID</b>	<b>Emission Point ID</b>	<b>Emission Unit Description</b>	<b>Type of Change</b>	<b>Year Installed</b>	<b>Design Capacity</b>	<b>Control Device</b>
E-4	E-4	Caterpillar G3608 LE DM8606-02	Removal	2012	2,370 hp	Oxidation Catalyst
ELEC-4	Fugitive	Electric Reciprocating Compressor	New	2018	4,500 hp	None

**Attachment I**  
**Emission Units Table**  
(includes all emission units and air pollution control devices  
that will be part of this permit application review, regardless of permitting status)

Emission Unit ID <sup>1</sup>	Emission Point ID <sup>2</sup>	Emission Unit Description	Year Installed/ Modified	Design Capacity	Type <sup>3</sup> and Date of Change	Control Device <sup>4</sup>
E-4	E-4	Caterpillar G3608 LE DM8606-02	2012	2,370 hp	Removal	Oxidation Catalyst
ELEC-4	Fugitive	Electric Reciprocating Compressor	2018	4,500 hp	New	None

<sup>1</sup> For Emission Units (or Sources) use the following numbering system: 1S, 2S, 3S,... or other appropriate designation.

<sup>2</sup> For Emission Points use the following numbering system: 1E, 2E, 3E, ... or other appropriate designation.

<sup>3</sup> New, modification, removal

<sup>4</sup> For Control Devices use the following numbering system: 1C, 2C, 3C,... or other appropriate designation.



## INTERNAL COMBUSTION ENGINE DATA SHEET

Complete this data sheet for each internal combustion engine at the facility. Include manufacturer performance data sheet(s) or any other supporting document if applicable. Use extra pages if necessary. *Generator(s) and microturbine generator(s) shall also use this form.*

Emission Unit ID# <sup>1</sup>		E-4					
Engine Manufacturer/Model		Caterpillar/ G3608 TALE					
Manufacturers Rated bhp/rpm		2,370/1000					
Source Status <sup>2</sup>		REM					
Date Installed/ Modified/Removed/Relocated <sup>3</sup>		2012					
Engine Manufactured /Reconstruction Date <sup>4</sup>		2012					
Check all applicable Federal Rules for the engine (include EPA Certificate of Conformity if applicable) <sup>5</sup>		<input checked="" type="checkbox"/> 40CFR60 Subpart JJJJ <input type="checkbox"/> JJJJ Certified? <input type="checkbox"/> 40CFR60 Subpart IIII <input type="checkbox"/> IIII Certified? <input checked="" type="checkbox"/> 40CFR63 Subpart ZZZZ <input type="checkbox"/> NESHAP ZZZZ/ NSPS JJJJ Window <input type="checkbox"/> NESHAP ZZZZ Remote Sources		<input type="checkbox"/> 40CFR60 Subpart JJJJ <input type="checkbox"/> JJJJ Certified? <input type="checkbox"/> 40CFR60 Subpart IIII <input type="checkbox"/> IIII Certified? <input type="checkbox"/> 40CFR63 Subpart ZZZZ <input type="checkbox"/> NESHAP ZZZZ/ NSPS JJJJ Window <input type="checkbox"/> NESHAP ZZZZ Remote Sources		<input type="checkbox"/> 40CFR60 Subpart JJJJ <input type="checkbox"/> JJJJ Certified? <input type="checkbox"/> 40CFR60 Subpart IIII <input type="checkbox"/> IIII Certified? <input type="checkbox"/> 40CFR63 Subpart ZZZZ <input type="checkbox"/> NESHAP ZZZZ/ NSPS JJJJ Window <input type="checkbox"/> NESHAP ZZZZ Remote Sources	
		Engine Type <sup>6</sup>		NA			
APCD Type <sup>7</sup>		Oxidation Catalyst					
Fuel Type <sup>8</sup>		RG					
H <sub>2</sub> S (gr/100 scf)		0.25					
Operating bhp/rpm		2,370/1000					
BSFC (BTU/bhp-hr)		7,554					
Hourly Fuel Throughput		ft <sup>3</sup> /hr		gal/hr		ft <sup>3</sup> /hr gal/hr	
Annual Fuel Throughput (Must use 8,760 hrs/yr unless emergency generator)		MMft <sup>3</sup> /yr		gal/yr		MMft <sup>3</sup> /yr gal/yr	
Fuel Usage or Hours of Operation Metered		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		Yes <input type="checkbox"/> No <input type="checkbox"/>		Yes <input type="checkbox"/> No <input type="checkbox"/>	
Calculation Methodology <sup>9</sup>	Pollutant <sup>10</sup>	Hourly PTE (lb/hr) <sup>11</sup>	Annual PTE (tons/year) <sup>11</sup>	Hourly PTE (lb/hr) <sup>11</sup>	Annual PTE (tons/year) <sup>11</sup>	Hourly PTE (lb/hr) <sup>11</sup>	Annual PTE (tons/year) <sup>11</sup>
MD	NO <sub>x</sub>	2.61	11.44				
MD	CO	1.01	4.40				
AP	VOC	1.65	7.21				
MD	SO <sub>2</sub>	0.01	0.04				
MD	PM <sub>10</sub>	0.16	0.69				
AP	Formaldehyde	0.33	1.45				
AP	Total HAPs	0.64	2.81				
AP	GHG (CO <sub>2</sub> e)	1844.29	8078.00				

1 Enter the appropriate Source Identification Number for each natural gas-fueled reciprocating internal combustion engine/generator engine located at the well site. Multiple engines should be designated CE-1, CE-2, CE-3 etc. Generator engines should be designated GE-1, GE-2, GE-3 etc. Microturbine generator engines should be designated MT-1, MT-2, MT-3 etc. If more than three (3) engines exist, please use additional sheets.

2 Enter the Source Status using the following codes:

NS	Construction of New Source (installation)	ES	Existing Source
MS	Modification of Existing Source	RS	Relocated Source
REM	Removal of Source		

- 3 Enter the date (or anticipated date) of the engine's installation (construction of source), modification, relocation or removal.
- 4 Enter the date that the engine was manufactured, modified or reconstructed.
- 5 Is the engine a certified stationary spark ignition internal combustion engine according to 40CFR60 Subpart IIII/JJJJ? If so, the engine and control device must be operated and maintained in accordance with the manufacturer's emission-related written instructions. You must keep records of conducted maintenance to demonstrate compliance, but no performance testing is required. If the certified engine is not operated and maintained in accordance with the manufacturer's emission-related written instructions, the engine will be considered a non-certified engine and you must demonstrate compliance as appropriate.

**Provide a manufacturer's data sheet for all engines being registered.**

- 6 Enter the Engine Type designation(s) using the following codes:

2SLB	Two Stroke Lean Burn	4SRB	Four Stroke Rich Burn
4SLB	Four Stroke Lean Burn		
- 7 Enter the Air Pollution Control Device (APCD) type designation(s) using the following codes:

A/F	Air/Fuel Ratio	IR	Ignition Retard
HEIS	High Energy Ignition System	SIPC	Screw-in Precombustion Chambers
PSC	Prestratified Charge	LEC	Low Emission Combustion
NSCR	Rich Burn & Non-Selective Catalytic Reduction	OxCat	Oxidation Catalyst
SCR	Lean Burn & Selective Catalytic Reduction		
- 8 Enter the Fuel Type using the following codes:

PQ	Pipeline Quality Natural Gas	RG	Raw Natural Gas /Production Gas	D	Diesel
----	------------------------------	----	---------------------------------	---	--------
- 9 Enter the Potential Emissions Data Reference designation using the following codes. Attach all reference data used.

MD	Manufacturer's Data	AP	AP-42
GR	GRI-HAPCalc <sup>TM</sup>	OT	Other (please list)
- 10 Enter each engine's Potential to Emit (PTE) for the listed regulated pollutants in pounds per hour and tons per year. PTE shall be calculated at manufacturer's rated brake horsepower and may reflect reduction efficiencies of listed Air Pollution Control Devices. Emergency generator engines may use 500 hours of operation when calculating PTE. PTE data from this data sheet shall be incorporated in the *Emissions Summary Sheet*.
- 11 PTE for engines shall be calculated from manufacturer's data unless unavailable.

**Table 1. Annual Potential To Emit (PTE) Summary  
CONE Gathering LLC - Majorsville Station**

**Current Rule 13 Permit Allowables (R13-3018E)**

Source	PM/PM10/PM2.5	SO2	NOx	CO	VOC	Formaldehyde	Total HAPs	CO2e
Caterpillar 3608 RICE - E4 (ton/yr)	0.69	0.04	11.44	4.40	7.21	1.45	2.81	8078.00
Emergency Generator - EG-2 (ton/yr)	0.12	0.09	3.92	2.14	0.91	0.00	0.01	305.11
Glycol Dehy Flare - F-1 (ton/yr)	0.17	0.01	2.26	1.90	8.55	<0.01	0.68	3680.00
Glycol Dehy Flare - F-2 (ton/yr)	0.17	0.01	2.26	1.90	8.55	<0.01	0.68	3680.00
Glycol Dehy Flare - F-3 (ton/yr)	0.17	0.01	2.26	1.90	8.55	<0.01	0.68	3680.00
Glycol Dehy Reboiler - BLR-1 (ton/yr)	0.02	<0.01	1.02	0.85	0.06	<0.01	0.02	1467.00
Condensate Reboiler - BLR-2 (ton/yr)	0.04	0.00	0.47	0.39	0.03	0.00	0.01	548.38
Glycol Dehy Reboiler - BLR-3 (ton/yr)	0.02	<0.01	1.02	0.85	0.06	<0.01	0.02	1467.00
Glycol Dehy Reboiler - BLR-4 (ton/yr)	0.02	<0.01	1.02	0.85	0.06	<0.01	0.02	1467.00
VRU - Tanks (ton/yr)	0.00	0.00	0.00	0.00	42.20	0.00	1.19	0.00
Hot Oil Heater - HTR-2 (ton/yr)	0.05	0.02	2.54	2.13	0.14	-	0.05	3658.00
Emergency Blowdown Flare - BDF-1 (ton/yr)	<0.01	<0.01	1.05	4.77	2.11	<0.01	0.03	2094.00
Misc. Tank - T11-T8 (ton/yr)	-	-	-	-	0.02	-	-	-
Fugitive Component Leaks (ton/yr)	0.00	0.00	0.00	0.00	10.83	<0.01	3.96	262.34
<b>Total Emissions (ton/yr)</b>	<b>1.47</b>	<b>0.18</b>	<b>29.26</b>	<b>22.08</b>	<b>89.28</b>	<b>1.45</b>	<b>10.16</b>	<b>30386.83</b>
<b>Total Emissions (lb/hr)</b>	<b>0.34</b>	<b>0.04</b>	<b>6.68</b>	<b>5.04</b>	<b>20.38</b>	<b>0.33</b>	<b>2.32</b>	<b>6937.63</b>

**Proposed Rule 13 Permit Allowables (R13-3018F)**

Source	PM/PM10/PM2.5	SO2	NOx	CO	VOC	Formaldehyde	Total HAPs	CO2e
Emergency Generator - EG-2 (ton/yr)	0.12	0.09	3.92	2.14	0.91	0.00	0.01	305.11
Glycol Dehy Flare - F-1 (ton/yr)	0.17	0.01	2.26	1.90	8.55	<0.01	0.68	3680.00
Glycol Dehy Flare - F-2 (ton/yr)	0.17	0.01	2.26	1.90	8.55	<0.01	0.68	3680.00
Glycol Dehy Flare - F-3 (ton/yr)	0.17	0.01	2.26	1.90	8.55	<0.01	0.68	3680.00
Glycol Dehy Reboiler - BLR-1 (ton/yr)	0.02	<0.01	1.02	0.85	0.06	<0.01	0.02	1467.00
Condensate Reboiler - BLR-2 (ton/yr)	0.04	0.00	0.47	0.39	0.03	0.00	0.01	548.38
Glycol Dehy Reboiler - BLR-3 (ton/yr)	0.02	<0.01	1.02	0.85	0.06	<0.01	0.02	1467.00
Glycol Dehy Reboiler - BLR-4 (ton/yr)	0.02	<0.01	1.02	0.85	0.06	<0.01	0.02	1467.00
VRU - Tanks (ton/yr)	0.00	0.00	0.00	0.00	42.20	0.00	1.19	0.00
Hot Oil Heater - HTR-2 (ton/yr)	0.05	0.02	2.54	2.13	0.14	-	0.05	3658.00
Emergency Blowdown Flare - BDF-1 (ton/yr)	<0.01	<0.01	1.05	4.77	2.11	<0.01	0.03	2094.00
Misc. Tank - T11-T8 (ton/yr)	-	-	-	-	0.02	-	-	-
Fugitive Component Leaks (ton/yr)	0.00	0.00	0.00	0.00	10.83	<0.01	3.96	262.34
<b>Total Emissions (ton/yr)</b>	<b>0.78</b>	<b>0.14</b>	<b>17.82</b>	<b>17.68</b>	<b>82.07</b>	<b>0.00</b>	<b>7.35</b>	<b>22308.83</b>
<b>Total Emissions (lb/hr)</b>	<b>0.18</b>	<b>0.03</b>	<b>4.07</b>	<b>4.04</b>	<b>18.74</b>	<b>0.00</b>	<b>1.68</b>	<b>5093.34</b>

**Proposed Difference of Emissions**

Source	PM/PM10/PM2.5	SO2	NOx	CO	VOC	Formaldehyde	Total HAPs	CO2e
<b>Total Emissions (ton/yr)</b>	<b>-0.69</b>	<b>-0.04</b>	<b>-11.44</b>	<b>-4.40</b>	<b>-7.21</b>	<b>-1.45</b>	<b>-2.81</b>	<b>-8078.00</b>
<b>Total Emissions (lb/hr)</b>	<b>-0.16</b>	<b>-0.01</b>	<b>-2.61</b>	<b>-1.00</b>	<b>-1.65</b>	<b>-0.33</b>	<b>-0.64</b>	<b>-1844.29</b>

\*\* Total VOC emissions include CH2O emissions

**ATTACHMENT B**

**SUPPORTING DOCUMENTS**

**Class I Administrative Update**

**Majorsville Station**  
**Dallas, West Virginia**

CONE Midstream Partners  
1000 Consol Energy Drive  
Canonsburg, PA 15317



# DEARING

Compressors • Pumps • Service • Sales

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Phone: 330-599-5720 Fax: 330-599-5724

[www.dearingcomp.com](http://www.dearingcomp.com)

January 23, 2018

Mr. Chase Davis  
CONSOL Energy  
[chasedavis@cnx.com](mailto:chasedavis@cnx.com)

Dearing Compressor Proposal: **#17-0915A-R2**

Customer Reference: **Majorsville Unit #4**

Dear Chase:

Dearing Compressor is pleased to offer the following revised proposal for your consideration:

Revision #1 changes depicted in Red.

Revision #2 changes depicted in Blue.

## Ariel KBZ/6 & Toshiba 4500HP Electric Motor Driven Compression Package

<b>Scope of Supply:</b>	<b>Case 1</b>	<b>Case 2</b>	<b>Case 3</b>	<b>Case 4</b>	<b>Case 5</b>
Suction Pressure, psig	200	150	175	225	250
Suction Temperature, °F	80	80	80	80	80
Discharge Pressure, psig	875	875	875	875	875
Calculated Flow, MMSCFD	50.462	42.454	46.463	53.128	59.393
Number of Stages	3	2	3	3	3
Driver Compressor Speed, RPM	885	885	885	885	885
Compressor Brake HP	4332	4244	4315	4251	4429
Specific Gravity	0.7148	0.7147	0.7148	0.7148	0.7148

Ambient Temperature: 100°F

Elevation Above Sea Level: 1500 Feet

Product: Natural Gas

One (1) fully unitized and packaged Natural Gas Compressor complete with the following standard equipment:

- (1) **Ariel KBZ/6 Compressor** with six throw two / three stage convertible arrangement, 6.75" stroke, gray iron crankcase, gray iron crosshead guide, forged alloy steel crankshaft, forged carbon steel connecting rod, tri-metal main bearings, bronze thrust bearing, tri-metal connecting rod bearing, ductile iron crosshead, alloy steel crosshead pin, steel backed bronze crosshead pin bushing, 2.875" alloy steel piston rod and grade 8 stress bolts. Compressor also includes mounted simplex oil filter, pressure lubrication of the power frame and cylinder walls, analyzer drive shaft, dual 100Ω Platinum bearing RTD's, two DNFT non-programmable

no-flow switches, crosshead guide relief valves, externally lubricated pin, standard crosshead guides, 304 stainless steel tube and fittings and Ariel crosshead guide supports. The compressor is epoxy chocked with Chockfast Orange and sole-plates. Please see attached Ariel Performance for additional details.

- a. (3) **Ariel 15.875" Z10 Double Acting Gathering Cylinder** with 10" 400# ANSI suction and discharge connections, ductile iron body, ductile iron piston, alloy steel piston rod, GMFTFE piston ring, GMFTFE wear band, gray iron rod packing case, CFTFE rod packing rings, grade 8 stress bolts, ion nitride carbon steel piston rod and uncut piston ring technology. Cylinder contains six 158CT suction valves, six 158CT discharge valves and is rated at 845psi at 350°F.
  - i. (1) **Ariel 518 in<sup>3</sup> Fixed Volume Clearance Pocket (FVCP)** with 56.7 in<sup>3</sup> minimum clearance, 74 to 150psig actuation pressure requiring 7.692 SCFM and rated at 12 cycles per hour.
    - 1. (1) **ASCO Next Gen EE8316P054MB Three Way Solenoid Valves** with brass body material, 24VDC H coil class, 2.5 Cv value, 3/8" FNPT connections, 5/8" orifice diameter, 18" flying lead length and 250psi maximum operating pressure. Valves rated for the Class 1 Division 2 area.
    - 2. (1) **Swagelok SS-8C-1 Poppet Check Valve** with 316 stainless steel body and internals, 1/2" female tube inlet and outlet connections, Fluorocarbon FKM seals and 1 psig cracking pressure. Rated at 2185psi @ 375°F.
  - ii. (2) **Kiene KN-22 Indicator Valves** with 1/2" MNPT x standard indicator connection and operating non-locking handle rated for 4000psi at 400°F. Two mounted in each cylinder; one head end and one crank end.
    - 1. (1) **Kiene AX-17A Indicator Valve Cap** with pos-i-seal steel indicator cap, integral brass sealing plug, retainer chain and clip.
- b. (2) **Ariel 11.375" ZM Double Acting Pipeline Cylinder** with 8" 900# ANSI flat face suction and discharge connections, ductile iron body, gray iron piston, alloy steel piston rod, GMFTFE piston ring and wear band, gray iron rod packing case, CFTFE rod packing rings, grade 8 stress bolts, carbon steel ion nitride piston rod and uncut ring technology packing. Cylinder contains four 158CT suction valves, four 158CT discharge valves and is rated at 1700psi @ 350°F.
  - i. (1) **Ariel 198 in<sup>3</sup> Fixed Volume Clearance Pocket (FVCP)** with 35.9 in<sup>3</sup> minimum clearance, 115 to 200psig actuation pressure requiring 10.957 SCFM and rated at 12 cycles per hour.
    - 1. (1) **ASCO Next Gen EE8316P054MB Three Way Solenoid Valves** with brass body material, 24VDC H coil class, 2.5 Cv value, 3/8" FNPT connections, 5/8" orifice diameter, 18" flying lead length and 250psi maximum operating pressure. Valves rated for the Class 1 Division 2 area.
    - 2. (1) **Swagelok SS-8C-1 Poppet Check Valve** with 316 stainless steel body and internals, 1/2" female tube inlet and outlet connections, Fluorocarbon FKM seals and 1 psig cracking pressure. Rated at 2185psi @ 375°F.
  - ii. (2) **Kiene KN-22 Indicator Valves** with 1/2" MNPT x standard indicator connection and operating non-locking handle rated for 4000psi at 400°F. Two mounted in each cylinder; one head end and one crank end.
    - 1. (1) **Kiene AX-17A Indicator Valve Cap** with pos-i-seal steel indicator cap, integral brass sealing plug, retainer chain and clip.
- c. (1) **Ariel 12.00" Z10 Double Acting Gathering Cylinder** with 8" 900# ANSI flat face suction and discharge connections, ductile iron body, gray iron piston, alloy steel piston rod, GMFTFE piston ring and wear band, gray iron rod packing case, CFTFE rod packing rings, grade 8 stress bolts, carbon steel ion nitride piston rod and uncut ring technology packing. Cylinder contains four 148CT suction valves, four

148CT discharge valves and is rated at 1700psi @ 350°F.

- i. (1) **Ariel 194 in<sup>3</sup> Fixed Volume Clearance Pocket (FVCP)** with 27.20 in<sup>3</sup> minimum clearance, 75 to 200psig actuation pressure requiring 7.804 SCFM and rated at 12 cycles per hour.
  - 1. (1) **ASCO Next Gen EE8316P054MB Three Way Solenoid Valves** with brass body material, 24VDC H coil class, 2.5 Cv value, 3/8" FNPT connections, 5/8" orifice diameter, 18" flying lead length and 250psi maximum operating pressure. Valves rated for the Class 1 Division 2 area.
  - 2. (1) **Swagelok SS-8C-1 Poppet Check Valve** with 316 stainless steel body and internals, 1/2" female tube inlet and outlet connections, Fluorocarbon FKM seals and 1 psig cracking pressure. Rated at 2185psi @ 375°F.
- ii. (2) **Kiene KN-22 Indicator Valves** with 1/2" MNPT x standard indicator connection and operating non-locking handle rated for 4000psi at 400°F. Two mounted in each cylinder; one head end and one crank end.
  - 1. (1) **Kiene AX-17A Indicator Valve Cap** with pos-i-seal steel indicator cap, integral brass sealing plug, retainer chain and clip.
- d. **Compressor Lubricating Oil System** including Ariel standard equipment plus the following:
  - i. (1) **Ariel Duplex Oil Filters** mounted off the compressor and on the skid and piping to and from.
  - ii. (1) **Kenco KSHL-10-HP-A Automatic Oil Level Maintainer** with low level shutdown switch, Nitrile valve seat, aluminum housing and valve orifice, closed cell polyurethane float material, 20 mesh brass oil inlet screen. Also includes UV stabilized transparent sight window rated for 10-to 35psi of oil pressure and is rated for the Class 1 Division 2 area.
  - iii. (6) **Balon 3F-F13-RF Floating Ball Valve** with carbon steel body, lever operated, 3" 150# ANSI raised face flange inlet and outlet connections, fire safe design, rugged locking device, Buna-N stem O-ring material, TFE stem seal material, carbon steel stem, nickel plated carbon steel ball and nylon ball seat. Rated for 250°F.
  - iv. (1) **Fluid Power Energy A3010 Thermostatic Mixing Valve** with cast iron body, 3" 125# ANSI flanges and two 170°F elements.
  - v. (1) **Balon 3T-150 Thin Pattern Wafer Check Valve** with A105 carbon steel body, carbon steel seat, 316 stainless steel disc, replaceable stainless steel seat disc cartridge, fluorocarbon seat seal O-ring, stainless steel retainer, stainless steel set screw and NACE compliant. Check valve is designed to be installed between two 3" 150# ANSI raised face flanges and rated for 285psi.
  - vi. (1) **Kimray ENZ Low Pressure Oil Stop Motor Valve** with cast ductile iron body, 303 stainless steel valve stem, stainless steel spring, oil resistant synthetic rubber seating material and 3" 150# ANSI raised face inlet and outlet flanges. Valve is rated at 285psi and requires an actuation pressure of 10-100psi.
- e. (1) **Compressor Full Flow Pre & Post Lube Oil System** with Baldor electric motor, Viking pump and interconnect piping.
  - i. (1) **General Electric M9431 X\$D Ultra 841 10HP Electric Motor**, 1800RPM 3Ø 460VAC 60Hz, NEMA design B, 40°C ambient temperature, ball bearings, cast iron frame, insulation class H, cast aluminum rotor and continuous duty operation.

- ii. (1) **Viking LQ4124A Oil Pump** with cast iron heavy duty construction, 2-1/2" 125# ANSI sized inlet and outlet flanges, Viton mechanical seals, internal relief valve and base mount with speed reducer. Pump is rated at 113 GPM at 520 RPM.
  - iii. (1) **Wattco FLS307X2420-TX Immersion Heater** with 60 watts per square inch density, 7.00KW total, 3" 150# ANSI 316L stainless steel mounting flange, 0.430" diameter 316L stainless steel sheath, 20" immersion length and 50-250°F mechanical thermostat. Heater requires 8.8 amps of 3Ø 460VAC 60Hz power and is rated for the Class 1 Division 2 area.
  - iv. (2) **CPI ProFloa Model PF1** with 24VDC power, trends and stores oil consumption, lubricator pump failure, divider block failure and compressor run time with adjustable alarm timer
  - v. (6) **Balon 3F-F13-RF Floating Ball Valve** with carbon steel body, lever operated, 3" 150# ANSI raised face flange inlet and outlet connections, fire safe design, rugged locking device, Buna-N stem O-ring material, TFE stem seal material, carbon steel stem, nickel plated carbon steel ball and nylon ball seat. Rated for 250°F.
  - vi. (2) **Balon 3T-150 Thin Pattern Wafer Check Valve** with A105 carbon steel body, carbon steel seat, 316 stainless steel disc, replaceable stainless steel seat disc cartridge, fluorocarbon seat seal O-ring, stainless steel retainer, stainless steel set screw and NACE compliant. Check valve is designed to be installed between two 3" 150# ANSI raised face flanges and rated for 285psi.
- f. **Compressor Miscellaneous Equipment:**
- i. (2) **Vitec 53290-00 Vibration Transmitter** with stainless steel case material, 4-20mA at 0-1 IPS, 5% accuracy per full scale, 2% repeatability, 14-30VDC supply voltage and 3/8-24 mounting threads. Rated for the Class 1 Division 2 area. Mounted on drive and non-drive end.
  - ii. (1) **Oil Catch Bottle Assembly**, carbon steel construction, 6"Ø x 60" seam to seam, 8.00 gallon capacity with sight glass and manual drain. Partially mounted inside sub-base.
2. (1) **Toshiba 4500HP motor supplied by CNX gas.**
- a. (4) **Superbolt MT-225-4.5/W** 2-1/2" multi-jackbolt tensioners for the main motor hold down bolts with vinyl cap.
  - b. (2) **Vitec 53290-00 Vibration Transmitter** with stainless steel case material, 4-20mA at 0-1 IPS, 5% accuracy per full scale, 2% repeatability, 14-30VDC supply voltage and 3/8-24 mounting threads. Rated for the Class 1 Division 2 area. Mounted on drive and non-drive end.
3. (1) **Rexnord 925CMR Flexible Disk Drive Coupling** with carbon steel hubs and Tomaloy steel disc packs, alloy steel hardware and cast iron center member.
- a. **RBTS API 618 Torsional Analysis** to verify the integrity of the mechanical system including mass-elastic modeling, natural frequency calculation, interference diagram, forced harmonic response analysis, transient start-up analysis and loaded shutdown analysis. Results from previous analysis will be used.
  - b. (1) **OSHA Compliant Removable Coupling Guard** with aluminum construction and inspection viewing window.
  - c. (1) **Ariel C-4046 Internal Donut Detuner**, 9,900 lb-in<sup>2</sup>, installed between throws 4 & 5.
4. (1) **Heavy Duty Four Runner Structural Steel Skid Assembly** fabricated from 21" x 101# wide flange beam with grout inspection holes, 2" heavy duty drip lip around the outside, full width pedestal sub-base (no A-frames), concrete fill under the compressor and driver with #4 1/2" rebar, four lifting lugs, grounding provisions at each corner, leveling screws and mounting holes. Open areas will be covered with 3/16" solid



raised pattern deck plate ground flush. Material will conform to ASTM A36 and ASTM A992 grade 50. All structural welding will be performed per American Welding Society D1.1 specification and all lifting lugs will be dry magnetic particle tested per ASME Section V, Article 7.

- a. **Tech Transfer Skid Stress and Dynamic Analysis** with 3D skid modeling lift & stress analysis, installed skid operating analysis and installed skid dynamic analysis. Results from previous analysis will be used.
5. **Process Piping** will be carbon steel ASTM A106 Grade B seamless with wall thickness to meet the individual design criteria, minimum schedule 40, based upon ASME B31.3 Normal Fluid Service, including zero corrosion allowance. All flanges will conform to ANSI B16.5 and ASTM A105 and all fittings will conform to ANSI B16.9 and ASTM A234 Grade WPB. Piping 2" and smaller will be minimum schedule 80. All flanges and fittings will use alloy steel flange stud bolts, ASTM A-193 grade B7 with heavy hex nuts ASTM-194 grade 2H and stainless steel Flexitallic gaskets. Process piping will be secured using heavy duty pipe clamps not U-bolts. Process gas piping will be 100% radiography per ASME B31.3 and 100% hydrostatic tested for thirty minutes at 1.5 times MAWP.
- a. **Tech Transfer Acoustic Pulsation Analysis API618 Design Approach 3**, M2 thru M8 with M11, including on and off skid process piping pulsation analysis M2 & M3, piping mechanical review M4, pulsation vessel mechanical natural frequency analysis M5, process piping mechanical natural frequency analysis M7 and process piping flexibility analysis M11. Study also includes off-skid piping dynamic and flexibility analysis and thermal stress analysis with pipe support locations. Results from previous analysis will be used.
  - b. (5) **Mercer Pilot Operated Flanged Relief Valve** with carbon steel body, carbon steel bonnet, 316 stainless steel nozzle, 316 stainless steel disk, Teflon seat, Viton & Buna-N O-ring, auxiliary filter and pressure snubber.
    - i. (1) **Suction Relief Valve 95-71P1327S/S-1A01012** set at 635psi at 80°F with 7.069 in<sup>2</sup> P orifice, 4" 300# ANSI raised face inlet flange and 6" 150# ANSI raised face outlet flange.
      1. (1) **Balon 4F-F33-RF Floating Ball Valve** with carbon steel body, lever operated, 4" 300# ANSI raised face flange inlet and outlet connections, fire safe design, rugged locking device, Buna-N stem O-ring material, TFE stem seal material, carbon steel stem, nickel plated carbon steel ball and nylon ball seat. Rated for 250°F.
    - ii. (1) **1<sup>st</sup> Stage Discharge Relief Valve 95-71P1327S/S-1A01012** set at 635psi at 350°F with 7.069 in<sup>2</sup> P orifice, 4" 300# ANSI raised face inlet flange and 6" 150# ANSI raised face outlet flange.
      1. (1) **KF E3782-129G614 Trunnion Ball Valve** with carbon steel body, lever operated, 4" 300# ANSI raised face inlet and outlet flanges, fire safe design, locking handle, B7M bolting, carbon steel ENP trim, Devlon seat insert and HNBR seal. Rated for 350°F.
    - iii. (1) **2nd Stage Discharge Relief Valve 95-72N1327S/S-1C01013** set at 1000psi at 350°F with 4.909 in<sup>2</sup> N orifice, 4" 600# ANSI raised face inlet flange and 6" 150# ANSI raised face outlet flange. To be used in three stage configuration.
    - iv. (1) **2nd Stage Discharge Relief Valve 95-72M1327S/S-1C01013** set at 1138psi at 350°F with 4.083 in<sup>2</sup> M orifice, 4" 600# ANSI raised face inlet flange and 6" 150# ANSI raised face outlet flange. To be used in two stage configuration.
      1. (1) **KF M315-199N6AG4 Trunnion Ball Valve** with carbon steel body, lever operated, 4" 600# ANSI raised face inlet and outlet flanges, fire safe design, locking handle, B7M bolting, carbon steel ENP trim, Devlon seat insert and HNBR seal. Rated for 350°F.
    - v. (1) **3<sup>rd</sup> Stage Discharge Relief Valve 95-66.1L1327S/S-1C01053** set at 1440psi at 350°F with 3.205 in<sup>2</sup> L orifice, 3" 900# ANSI raised face inlet flange and 4" 300# ANSI raised face outlet flange.

1. (1) **KF V315-199A6AG4 Trunnion Ball Valve** with carbon steel body, lever operated, 3" 900# ANSI raised face inlet and outlet flanges, fire safe design, locking handle, B7M bolting, carbon steel ENP trim, Devlon seat insert and HNBR seal. Rated for 350°F.
- c. (1) **Fisher NPS 3" HPT 667 Recycle Valve** with WCC steel globe body, fail closed 667 actuator with 2" travel, 3" 900# raised face flanged inlet and outlet connections, S17400 SST cage material, S41600 SST seat ring material, 2.875" port size, whisper III Level A1 trim, S20910 SST stem material, PTFE packing, DVC6200 digital positioner, 4-20mA input signal, 67CFR filter regulator and Topworx valve monitor with position feedback and limit switches.
  - i. (3) **WKM 370D6-24-YRF-24 Trunnion Ball Valve** with carbon steel NACE body, gear operator, 3" 900# ANSI raised face inlet and outlet connections, fire tested, full port, nylon 6 seat group, HNBR seal group, fire tested and carbon steel NACE internal group. Rated for 250°F.
  - d. (1) **Fisher 2" NPS D4 Blowdown Valve** with LCC Steel 20B101 body material, 2" 1500# raised face flanged inlet and outlet connections, micro-form equal percentage trim, 1.25" port diameter, NBR bonnet O-ring material, fails closed action, S41000 SST & S41600 SST HT valve plug material, S17400 SST DBL H1150 seat ring material, S20910 SST stem material and 0.75" travel.
    - i. (3) **WKM 370D6-24-YRF-24 Trunnion Ball Valve** with carbon steel NACE body, gear operator, 2" 900# ANSI raised face inlet and outlet connections, fire tested, full port, nylon 6 seat group, HNBR seal group, fire tested and carbon steel NACE internal group. Rated for 250°F.
    - ii. (1) **ASCO Nest Gen EE8316P054 Three Way Solenoid Valve** with brass body material, 24VDC H coil class, 2.5 Cv value, 3/8" FNPT connections, 5/8" orifice diameter, 18" flying lead length and 250psi maximum operating pressure. Rated for the Class 1 Division 2 area.
  - e. (1) **Suction Tee Strainer** with 12" 300# ANSI raised face inlet and outlet flanges, 100 mesh strainer, two 1/2" FNPT differential pressure ports and quick access enclosure. Shipped loose to be installed by customer.
  - f. (1) **Aitken Temporary Bypass Strainer** with 3" 900# ANSI pattern, 200% open area, 1/8" perforations on 3/16" centers with 304 stainless steel 40 mesh on the outside, 304 stainless steel construction and 14 gauge flange ring.
    - i. (1) **Orange Research 1504DGS-1C-4.5B-C-C Differential Pressure Gauge** with diaphragm sensor, 316 stainless steel pressure body, 4.5" dial case, SPDT contact and 0-30psid range. Gauge is rated for the Class 1 Division 2 area.
  - g. (3) **Spectacle Blinds** per ASME B31.3 Normal Fluid Service fabricated from SA516 grade 70 carbon steel with serrated flange surface and pivot hole. Used for conversion between two stage and three stage configurations.
  - h. **Lot Flexitallic CG Style Gaskets** with 304 stainless steel metallic winding material, Flexicarb filler material and outer ring center gasket on all ANSI class flanges.
6. **Utility Piping** will be carbon steel ASTM A106 Grade B seamless with wall thickness to meet the individual design criteria, including zero corrosion allowance. All flanges will conform to ANSI B16.5 and ASTM A105 and all fittings will conform to ANSI B16.9 and ASTM A234 Grade WPB. Piping 2" and smaller will be minimum schedule 80. All flanges and fittings will use alloy steel flange stud bolts, ASTM A-193 grade B7 with heavy hex nuts ASTM-194 grade 2H and paper gaskets. Utility piping will be secured using U-bolts. All piping to include 1/2" vent & drain connections. Threaded fittings, 1-1/2" and smaller, will be forged steel 2000psi rated and all first out threaded nipples will be minimum SCH160. Utility piping will be tested per the requirements of ASME B31.3 Category D Fluid Service.

7. **Instrumentation Tubing** will consist of 316 grade seamless stainless steel conforming to ASTM 269 and ASTM 213. Tube fittings will be Swagelok stainless steel. Minimum tubing outside diameter will be 3/8" with wall thicknesses determined by process conditions and ISO13631.
8. **Instrumentation Wiring** consisting of Belden 1030A Multi-Conductor 300V Power Limited Tray Cable with two 16AWG conductors, 18AWG tinned copper shield and PVC Polyvinyl Chloride insulation and Belden 1031A Multi-Conductor 300V Power Limited Tray Cable with three 16AWG conductors, 18AWG tinned copper shield and PVC Polyvinyl Chloride insulation. All terminals and strips will be designed for the individual installed wires and contain 20% spares. All on-skid wiring and components will meet the criteria of NEC Class 1 Division 2 Groups C & D.
9. (3) **Suction Scrubber**, constructed using carbon steel, ASME coded, stamped, national board registered per Section VIII Division 1 and sized per API 11P and GPSA Section 7. Includes vane style extractor, manual drain and accessories listed below. 1<sup>st</sup> stage scrubber will be 36"Ø x 92" seam to seam rated at 645psi @ -20 to 200°F, 2<sup>nd</sup> stage scrubber will be 30"Ø x 90" seam to seam rated at 645psi @ -20 to 200°F and 3<sup>rd</sup> stage scrubber will be 26"Ø x 84" seam to seam rated at 1287psi @ -20 to 200°F. Scrubbers will be hydro tested for thirty minutes at 1.3 times MAWP, 100% RT-1 radiography, Post Weld Heat Treat (PWHT) and 1/8" corrosion allowance.
  - a. Note: Scrubber drains will be headered together with one skid edge connection. Each scrubber will be isolated with a check valve.
  - b. (3) **Murphy MLS-020 Liquid Level Switch** with 304 stainless steel float, 304 cast stainless steel body rated for 2000psi, clean magnet design, seal free construction and 2" MNPT threaded vessel connection. Rated for the Class 1 Division 2 area.
  - c. (1) **Penberthy RL Series Reflex Low Pressure Liquid Level Gauge** with ASTM A105 forged steel chamber, flat Borosilicate armored glass, standard GRAFOIL chamber gasket and 3/4" FNPT connections. Rated at 1900psi @ 200°F.
    - i. (2) **Penberthy 330J GageCocks** with offset pattern, integral bonnet, 3/4" MNPT union vessel connection, ball check shutoff, integral seat and 1/2" MNPT gage connections. Rated at 3900psi @ 200°F.
  - d. (1) **Actuated Scrubber Dump Valve Systems** complete with Centura actuators, Flowserve ball valves, stainless steel drain piping and stainless steel flanges.
    - i. (2) **Centura CE2C Actuators** with 24VDC motors, aluminum housing, 3/4" conduit entry, quickset adjustable cams, stainless steel bolts with captive cover, 250 in-lb torque rating and six second cycle time. Rated for the Class 1 Division 2 area. Used for 1<sup>st</sup> stage and 2<sup>nd</sup> stage scrubbers.
    - ii. (8) **Flowserve Series 51 Ball Valves** with one piece cast 316 stainless steel bodies, 1" 300# inlet and outlet connections, blowout proof stems, smooth two way flow path, 316 stainless steel end plugs, 316 stainless steel ball stem, TFE seat and seal material and manual handle.
    - iii. (1) **Centura CE4C Actuators** with 24VDC motors, aluminum housing, 3/4" conduit entry, quickset adjustable cams, stainless steel bolts with captive cover, 400 in-lb torque rating and eight second cycle time. Rated for the Class 1 Division 2 area. Used for 3<sup>rd</sup> stage scrubber.
    - iv. (4) **McCanna S Series Ball Valves** with top entry wedge seated one piece 316 stainless steel bodies, 1" 600# inlet and outlet connections, 316 stainless steel seats, 316 stainless steel trim, bi-directional flow and manual handle.
    - v. (1) **Balon 2T-600 Thin Pattern Wafer Check Valve** with A105 carbon steel body, carbon steel seat, 316 stainless steel disc, replaceable stainless steel seat disc cartridge, fluorocarbon seat seal O-ring, stainless steel retainer, stainless steel set screw and NACE compliant. Check valve is designed to be

installed between two 2" 600# ANSI raised face flanges.

- e. (1) **Scrubber Heat Trace and Insulation System** consisting of the following:
- i. **Lot Raychem 5XTV-CT-T3 Self-Regulating High Temperature Heat Tracing** with 14 AWG nickel plated copper bus wires separated by a fluoropolymer spacer, helically wrapped with a self-regulating fluoropolymer fiber, ground fault protection and tinned copper braid. Supply power is 1Ø 100-130 VAC 5 watts per foot. Rated for the Class 1 Division 2 area.
  - ii. (1) **Raychem E-100-L1-A Above Insulation Lighted End Seal Kit**. Mounts on the pipe and projects through the insulation and cladding for ease of maintenance. With LED light. Rated for the Class 1 Division 2 area.
  - iii. (1) **Raychem JBM-100-A Connection Kit**. Serves as power, splice or tee connection and mounts above the insulation and cladding. Rated for the Class 1 Division 2 area.
  - iv. **Lot 2" Scrubber Drain Removable Insulation** consisting of 2" Microflex insulation with Teflon coated fiberglass cloth rated to 500°F, thinning to smaller thicknesses where needed, hybrid buckles, Velcro closure flaps. Insulation is chemical, oil, abrasion and weather resistant.
  - v. (1) **2" Removable Calcium Silicate Insulation** for the lower scrubber bodies covering the scrubber from the top of the skid to the high liquid level switch.
10. (4) **Pulsation Vessels**, constructed using carbon steel, ASME coded, stamped and national board registered per Section VIII Division 1. 1<sup>st</sup> stage suction pulsation bottle will be 28"Ø x 131" seam to seam rated at 645psi @ -20 to 200°F, 1<sup>st</sup> stage discharge pulsation bottle will be 26"Ø x 132" seam to seam rated at 645psi @ -20 to 350°F, combined 2<sup>nd</sup> stage & 3<sup>rd</sup> stage suction pulsation bottle will be 28"Ø x 132" seam to seam rated at 1440psi @ -20 to 200°F and combined 2<sup>nd</sup> & 3<sup>rd</sup> stage discharge pulsation bottle will be 26"Ø x 228" seam to seam rated at 1440psi @ -20 to 350°F. Included are orifice plates and internals required by the Tech Transfer API 618 DA3 pulsation study. Pulse bottles will be hydro tested for thirty minutes at 1.3 times MAWP, include 100% RT-1 radiography, Post Weld Heat Treat (PWHT) and 1/8" corrosion allowance.
- a. (1) **Kiene CV-72 Indicator Valves** with ½" MNPT x standard indicator connection and operating non-locking handle rated for 2000psi at 250°F. One mounted in each suction pulse bottle nozzle.
    - i. (1) **Kiene AX-17A Indicator Valve Cap** with pos-i-seal steel indicator cap, integral brass sealing plug, retainer chain and clip.
  - b. (1) **Kiene KN-22 Indicator Valves** with 1/2" MNPT x standard indicator connection and operating non-locking handle rated for 4000psi at 400°F. One mounted in each discharge pulse bottle nozzle.
    - i. (1) **Kiene AX-17A Indicator Valve Cap** with pos-i-seal steel indicator cap, integral brass sealing plug, retainer chain and clip.
11. (1) **Air-X-Limited 156-2ZF Gas & Oil Cooler**, horizontal coil, horizontal air intake, vertical air discharge, forced draft, electric motor driven air cooled heat exchanger. Complete with two gas intercooler sections, one aftercooler section, one compressor oil section, two electric motors and galvanized finish. Designed per the Air-X-Limited specification sheet 177774 dated 02-Sep-17. If there are multiple units on site please place the coolers with one tube length of distance in between units. Cooler is mounted off-skid with interconnect piping by Dearing.
- a. (1) **Gas Intercooler Section #1** with 103 16 BWG 1.50"OD SA214 welded carbon steel tubes, 0.0020 fouling factor, SA-516 Grade 70 header material, A-105 steel shoulder plugs and 35°F approach based upon 95°F ambient temperature. Section is ASME coded, stamped and national board registered rated at 645psi @ -20 to 350°F with 1/16" corrosion allowance, manual adjustable louvers, even pass arrangement, ANSI 300# class flanges, 10% excess surface area and 100% radiography.

- b. (1) **Gas Intercooler Section #2** with 113 16 BWG 1.25"OD SA214 welded carbon steel tubes, 0.0020 fouling factor, SA-516 Grade 70 header material, A-105 steel shoulder plugs and 35°F approach based upon 95°F ambient temperature. Section is ASME coded, stamped and national board registered rated at 1138psi @ -20 to 350°F with zero corrosion allowance, manual adjustable louvers, even pass arrangement, ANSI 600# class flanges, 10% excess surface area and 100% radiography.
  - c. (1) **Gas Aftercooler Section** with 133 14 BWG 1.25"OD SA214 welded carbon steel tubes, 0.0020 fouling factor, SA-516 Grade 70 header material, A-105 steel shoulder plugs and 25°F approach based upon 95°F ambient temperature. Section is ASME coded, stamped and national board registered rated at 1440psi @ -20 to 350°F with 1/16" corrosion allowance, manual adjustable louvers, even pass arrangement, ANSI 900# class flanges, 10% excess surface area and 100% radiography.
  - d. (1) **Compressor Oil Section** with 28 16BWG 1.25"OD SA214 welded carbon steel tubes, 0.001 fouling factor, A500 header material, A-105 steel shoulder plugs and 10°F temperature reduction based upon 100°F ambient temperature. Section is not coded rated at 150psi @ -20 to 350°F with 1/16" corrosion allowance, hail guard, no louvers, even pass arrangement and ANSI 150# class flanges.
  - e. (2) **Moore Class 10K-48VE-EC 156" Six Blade Low Noise Fan** with aluminum fan blade material, resilient blade mounting, low noise Vortex blade tips and manually adjustable 7.8° blade pitch.
  - f. (2) **50HP Electric Motor** 460VAC 60Hz with TEFC enclosure, 1800RPM, VFD duty and rated for the Class 1 Division 2 Area. Motor shaft will be orientated shaft up.
  - g. (2) **Vitec 53290-00 Vibration Transmitter** with stainless steel case material, 4-20mA at 0-1 IPS, 5% accuracy per full scale, 2% repeatability, 14-30VDC supply voltage and 3/8-24 mounting threads. Rated for the Class 1 Division 2 area. Mounted on each motor support.
12. (1) **Allen Bradley Control Logix PLC** control panel complete with Schneider Electric Magelis 15" HMI, 17 slot chassis, 13A 24VDC power supply, L71 processor with 2MB memory, EtherNet 10/100 bridge module, three 16 point digital input card, three 8 point digital output card, four 16 point analog input card, two 4 point analog output card, 3 slot filler cards, N-Tron managed Ethernet switch, four Ethernet patch cables and miscellaneous terminals, pushbuttons and lights. Housing is a Saginaw 304 stainless steel. Panel is powered by 120VAC and is rated for the Class 1 Division 2 area. See attached literature for additional details. This is identical to panel 52-30-10244.
- a. (7) **Rosemount 3051S1CG5A2A11A1AE5M5 Pressure Transmitter** complete with 0.025% span accuracy, 200:1 range down, 10 year stability warranty, 12 year limited warranty, coplanar connection type, 316 stainless steel isolating diaphragm, 4-20mA output signal based on HART protocol, aluminum housing with ½"MNPT connection, FM explosion proof, dust ignition proof and PlantWeb LCD display. Used for 1<sup>st</sup> stage suction, 1<sup>st</sup> stage discharge, 2<sup>nd</sup> stage suction, 2<sup>nd</sup> stage discharge, 3<sup>rd</sup> stage suction, 3<sup>rd</sup> stage discharge and compressor oil.
  - i. (7) **Rosemount 0305RC22B11 Integral Manifold** with coplanar manifold style, two-valve design, 316 stainless steel body, 316 stainless steel bonnet, 316 stainless steel stem, 316 stainless steel tip, 1/2" FNPT process connection, PTFE packing and integral valve seat.
  - b. (17) **Rosemount 3144PD1A2I5M5U2 Temperature Transmitter** complete with filed mount dual compartment aluminum housing with ½-14 MNPT connection, 4-20 mA with digital single based upon HART protocol output, dual sensor input, FM intrinsically safe and non-incentive design, LCD display and average temperature with hot backup and sensor drift alert. Used for 1<sup>st</sup> stage suction, 2<sup>nd</sup> stage suction, 3<sup>rd</sup> stage suction, each cylinder discharge, final discharge, compressor oil and six compressor bearing temperatures.
  - c. (11) **Rosemount 0078D25N00A040T20 RTD Assembly** with dual 100Ω Platinum spring loaded elements, aluminum connection head with ½" FNPT connection, 316 stainless steel thermowell, 4.0"

thermowell immersion length and ½"-14 MNPT thermowell connection. Used for 1<sup>st</sup> stage suction, 2<sup>nd</sup> stage suction, 3<sup>rd</sup> stage suction, each cylinder discharge, final discharge and compressor oil.

13. (1) **Stainless Steel Instrumentation Identification Tag Set** 3" long x 1" wide x 0.032" thick, 304 stainless steel, etched with black filled graphics, 0.125" characters and round corners connected to each instrumentation component with stainless steel wire.
14. Lot analog **Winters PFQ Series Pressure Gauges** and **Ashcroft 30EI60E Series Thermometers** locally mounted with stainless steel thermowells.
15. **CNX Gas Paint Procedure** consisting of SSPC-SP6 Commercial Blast Clean of skid, sub-base, pulse bottles, scrubbers, structural steel and process piping with zinc rich primer and Sherwin Williams Gray top coat.
16. **Discharge Pipe Galvanizing** including SSPC-SP6 Commercial Blast Clean, hot-dip galvanization with external and internal coverage and flange facing. This is for the 1<sup>st</sup> stage discharge, 2<sup>nd</sup> second stage discharge and 3<sup>rd</sup> stage discharge piping from the discharge pulse bottle to the cooler flange.
17. (2) **CD Sets of Instruction, Operation and Maintenance Manuals** complete with as-built drawings, radiography reports, hydro charts, ASME vessel U1A data reports, relief valve calculations, major component drawings, acoustic report (if applicable), torsional analysis (if applicable), individual component cut sheets and parts list for engine and compressor.
18. **Set of Engineering Drawings** complete with General Arrangement drawings, Piping & Instrumentation Diagrams per ISA standard, foundation anchor bolt layout, electrical control panel drawings, electrical loop drawings and weld map via Autodesk Inventor 2017 (3D) and AutoCAD 2017 (2D) with FTP site access.

**Package Price** ..... **\$ 2,145,000.00 per unit**

**Adders & Deducts**

19. **Long Term Preservation** to protect the entire package from internal corrosion for a period of 6 months. This includes the compressor frame and cylinders, scrubbers, pulse bottles, process gas piping, and utility piping. A contact rust preventative oil and liquid vapor phase corrosion inhibitor oil to be used in conjunction with Ariel ER-25 and Dearing standards. Package should be re-preserved every six months or when the integrity of the seals are compromised. **Adder \$10,000.00 per package.**

**Exceptions, Notes & Clarifications:**

- Proposal does not include any applicable sales or use tax.
- Proposal does not include oil or fluids. These are the responsibility of the end user.
- No material origin or chemistry requirements are included. Dearing will not purchase pipe or fittings from China, India, Korea or Malaysia.
- This proposal is duplicating 403329-330 Majorsville #6-5, 403413-414 Majorsville #1-2 and 403464 Majorsville #3 except where manufacturing standards and practices have changed.
- Compressor performance includes 1% suction pressure loss and 2% discharge pressure loss.

**The preceding quote is based upon the following information provided by the requestor:**

- No specification was used to prepare this proposal.

**Outbound Shipping Point: F.O.B. Youngstown, Ohio.**

**Outbound Shipping Terms:** Crane loading charges are included in the selling price. If transportation charges are designated as prepaid and add, Dearing will handle all freight arrangements and add an 8% processing and handling fee to cover billing costs and contingency. If transportation modifiers other than prepaid and add are designated, Dearing will work with the multiple freight carriers to generate quotes, on behalf of the buyer, for the transportation of all Dearing supplied components to site.

**Proposal Validity:** (30) Thirty days from date above.

**Delivery Capability:** **13-Aug-2018** based upon the motor supplied by CNX Gas and the Purchase Order issued to Dearing Compressor on or before 26-Jan-18.

**Payment Schedule:**

**Line 1.0: Dearing Engineering & Drawing Package: \$ 300,000.00**

6-8 Weeks after Receipt of Purchase Order

**Line 2.0: Ariel KBZ/6 Compressor: \$ 945,000.00**

20-22 Weeks after Receipt of Purchase Order

**Line 3.0: Compressor Package: \$ 900,000.00**

**13-Aug-2018**

**Payment Terms:** NET 30 Days

Dearing Compressor & Pump Company warrants the entire package for twelve months from installation or eighteen months from date of notification of ready to ship, whichever period is shorter, while relying upon the original OEM manufactures standard warranties. Please see Dearing's terms and conditions for additional details.

**Site Re-Assembly or Supervision, Start-Up Commissioning, Service Support and Preventative Maintenance Programs** are available and coordinated through our Youngstown, Ohio facility. Labor charges for these services will be invoiced at Dearing Compressor's current standard service rates. These rates are \$100.00 per hour straight time, \$150.00 per hour overtime (over eight hours per day and weekends) and \$200.00 per hour during holidays. If an Engineer is required the hourly rate is \$135.00 per hour straight time, \$202.50 per hour overtime (over eight hours per day and weekends) and \$270.00 per hour during holidays. There is an additional charge of \$2.00 per mile for travel, meals will be billed at \$60.00 per diem and travel/lodging expenses will be billed at cost plus 10%.

We thank you very much for this fine inquiry and opportunity to quote your compression requirements and hope that we may be favored with your valued business. In the meantime, if you should have any questions, please do not hesitate to contact us.

Best Regards,

*Tim Warzer*

Applications Engineer

**Dearing Compressor & Pump Company**

Office Direct: 330-599-5744

E-Mail: [twurzer@dearingcomp.com](mailto:twurzer@dearingcomp.com)

CC: Rick Dearing  
Bryon Helton  
John Mentzer  
Aubrey Kudler





# DEARING

*Compressors • Pumps • Service • Sales*

3974 Simon Road ♦ Youngstown, OH 44512

Phone: 330-599-5720 Fax: 330-599-5724

[www.dearingcomp.com](http://www.dearingcomp.com)

## 1. OFFER AND ACCEPTANCE

Dearing Compressor & Pump Company (Dearing) offers to sell the products indicated in strict accordance with the terms and conditions stated below. Submittal of a purchase order or execution of this offer by Buyer, or allowing Dearing to commence work is an acceptance of this offer, which offer and acceptance constitute a legally enforceable contract between Buyer and Dearing. Any additional or differing terms and conditions contained on Buyer's purchase order are rejected by Dearing and become no part of the contract between Buyer and Dearing unless expressly consented to in writing by Dearing.

Unless specifically restricted on a purchase order, Dearing reserves the right to substitute the latest superseding design and manufactured equivalent minor component within the package where the interchangeability of the product is based on form, fit, and function, in place of the component quoted.

Dearing presents this offer for Buyer's use only. Regardless of form, all design, configuration and commercial information received by Buyer from Dearing, in connection with this offer, are considered proprietary and confidential and may not be disclosed by Buyer to anyone else without Dearing's prior written consent.

## 2. PRICES AND TAXES

Unless otherwise stated in the quotation, quoted prices are firm only if an order is placed within thirty (30) days of the submission of this offer. In the case of fabricated products, quoted prices are firm further provided that within three months of Buyer's acceptance Buyer authorizes Dearing to release for fabrication (in accordance with approved submittal data) and shipment immediately upon completion of fabrication. If Buyer's release for fabrication is not received by Dearing within the three month period, prices are subject to increase to current prices in effect at the time Buyer's release is actually received by Dearing. Unless otherwise stated within, prices quoted are FOB shipping point.

Prices shown do not include any fees, duties or other taxes imposed on the sale of goods. The amount of any sales, use, privilege, service, excise, federal, state, local, foreign or other similar tax for which Dearing is liable, either on its own behalf or on behalf of the Buyer, with respect to any orders for materials or equipment, is in addition to the billing prices and paid by Buyer.

## 3. TERMS OF PAYMENT

Subject to credit approval by Dearing and unless otherwise stated in the quotation, the payment terms are as shown on the proposal. All payments are due and payable upon receipt of Dearing's invoice. Amounts past due are subject to a service charge of 1.5% per month.



#### **4. PERFORMANCE AND DELIVERY**

Dearing is not liable for failure or delays where the failure or delay is due to strikes, fires, accidents, national emergency, failure to secure materials from the usual sources of supply, or any other circumstances beyond Dearing's control. Upon the occurrence of any of the above events, Dearing may cancel this order without any liability on Dearing's part. Receipt of the equipment by Buyer upon its delivery constitutes a waiver of all claims for delay.

Shipping dates are approximate only. No shipping date requested or specified by Buyer is binding on Dearing unless the request or specification is specifically agreed to in writing by an officer of Dearing.

#### **5. WARRANTY OF MATERIALS AND WORKMANSHIP**

Dearing warrants that the products covered by this warranty will be free from defects in workmanship and material (if properly installed, operated and maintained in accordance with specifications) for a period of twelve months from date of installation or eighteen months from date of notification of readiness to ship, whichever period is shorter. Dearing will repair or replace F.O.B. point of manufacture such products or components Dearing finds defective. This warranty does not include the cost of labor or rigging to remove or reinstall any defective components, nor does it include cost of handling, shipping or transportation involved in supplying replacements for defective components. Dearing makes no warranties or representations of any kind whatsoever on any products which are not originally manufactured by Dearing. On products and components furnished by Dearing, but manufactured by others, Dearing will extend the same guarantee it receives from the original manufacturer. Liability shall be limited to the cost of repairing or replacing said defective products or components, as determined by Dearing. This warranty shall not apply to materials, components or design provided by Buyer or on behalf of Buyer, to negligence or other improper acts or omissions of Buyer, his employees or agents or other third parties, to other than the use of OEM Spare Parts, to improper installation or alterations carried out without Dearing's consent in writing, to design errors, omissions or operating conditions which were unknown to Dearing and Buyer and which could only be detected through operation of the installed equipment or failure of Buyer to follow Dearing's and original manufacturer's design, operation or installation recommendations. In particular, this warranty does not cover any defects that are caused by or connected with normal wear and tear, corrosion, abuse, misuse, over-loading or with any use, maintenance, service or operation of the equipment or any part thereof which is not in conformance with Dearing's or the original manufacturer's manuals, instruction or specifications.

**DEARING MAKES NO OTHER EXPRESSED OR IMPLIED OR STATUTORY WARRANTIES, AND SPECIFICALLY MAKES NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. NO WARRANTIES OR REPRESENTATIONS AT ANY TIME MADE BY ANY REPRESENTATIVE OF DEARING SHALL BE EFFECTIVE TO VARY OR EXTEND THE ABOVE REFERENCED EXPRESS WARRANTIES OR ANY OTHER TERMS HEREOF.**

#### **6. LIMITATION OF LIABILITY**

All claims, causes of action or legal proceeding against Dearing arising from Dearing's performance under this contract must be commenced by Buyer within the express warranty period specified under Paragraph 5 above. Failure to commence any claim, cause of action or legal proceeding within the period constitutes a voluntary and knowing waiver of the claim, cause of action or legal proceeding by Buyer.

**DEARING'S LIABILITY FOR ANY AND ALL CLAIMS, DAMAGES, LOSSES, AND INJURIES ARISING OUT OF OR RELATING TO DEARING'S PERFORMANCE OR BREACH OF ANY TERM HEREIN SHALL NOT EXCEED THE PURCHASE PRICE OF THE GOODS. IN NO EVENT IS DEARING LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES. THIS LIMITATION ON DAMAGES APPLIES UNDER ALL THEORIES OF LIABILITY OR CAUSES OF ACTION, INCLUDING CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE) OR STRICT LIABILITY. THE ABOVE LIMITATIONS INURE TO THE BENEFIT OF DEARING'S SUPPLIERS AND SUBCONTRACTORS.**

#### **7. CANCELLATION**

Buyer cannot cancel orders under any circumstance without Dearing's written agreement and consent covering

all of Dearing's damages. At a minimum, such an agreement must include the non-refundable 10% down payment and reimburse Dearing for all expenses incurred, including but not limited to costs of purchased materials, engineering costs and a reasonable markup to cover overhead and profit.

#### **8. APPLICABLE LAW**

The terms and conditions applicable to the transaction shall be governed by the laws of the State of Ohio and Buyer and Dearing agree to submit to the jurisdiction of the appropriate State of Federal Court within Ohio for purposes of resolving any dispute or claim arising in connection with this transaction.

#### **9. TRANSPORTATION, STARTUP AND COMMISSIONING**

Equipment is transported, installed and connected at Buyer's risk and expense. Dearing will provide a service technician, upon request, to place the unit into service once it has been installed and connected. The cost for this service is based upon time and materials unless otherwise stated in the quotation. Dearing is not responsible for materials furnished by Buyer. The use of a service technician does not relieve the responsibility of Buyers for materials and services furnished by Buyer. Buyers should be ready to perform startup services before contracting a service technician. The time when the service technician is ready, willing and able to work at the job site, is considered time worked even though his services are not in fact utilized because of delays by the Buyer. If this service has been included in the quotation, time spent over and above the reasonable and customary startup allowance will be invoiced at the current rate for time and materials.

#### **10. INDEMNITY**

Dearing shall indemnify and hold Buyer, its affiliates and their employees, directors, officers, and agents harmless from and against any and all loss, damage, or liability and from any and all claims for damages on account of or by reason of bodily injury, including death which may be sustained or claimed to be sustained by any person, including the employees of Dearing and of any agent of Dearing, and from and against any and all damages to property, including loss of use, and including property of Buyer caused by or arising out of or claimed to have been caused by or have arisen out of an act or omission of Dearing or its agents, employees or subcontractors in connection with the performance of this Agreement.

Buyer will indemnify, defend and hold Dearing, its affiliates and their employees, directors, officers, and agents harmless from any loss, claim or damage (including payment of reasonable attorney's fees) caused by any negligence or intentional misconduct on the part of the Buyer in the servicing, repair, modification, assembly, demonstration or application of equipment furnished by Dearing.



# Project Report

Company: Dearing Compressor & Pump  
 Quote: [17-0915A-R0](#)  
 Case 1:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

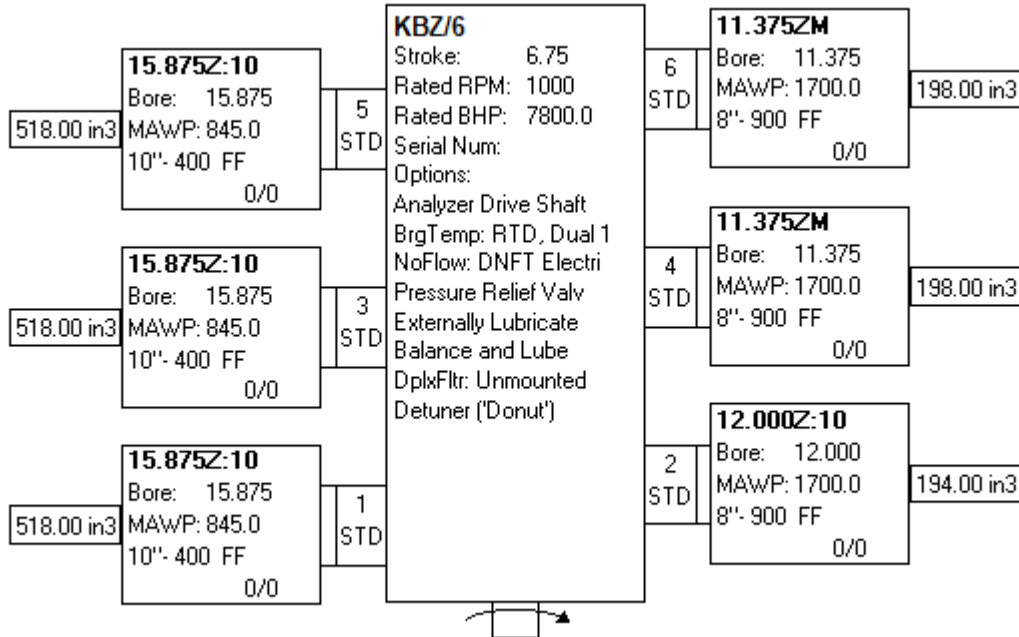


Project Engr: John Mentzer  
 Ordered By: John Mentzer

## Driver Information

Type: Electric  
 Mfg: Toshiba  
 Model: 4500HP  
 RPM: 885.0

Order Weight: [71390.00](#) lbs



## Application Notes

Pre-Lube Pump Automated frame oil system pre-lube pump is required, 30.00 psi for 2 minutes prior to starting. Size pre-lube pump approximately 25% of the rated frame oil flow.

HEH FVCP 56.70 - 518.00  
 HEH FVCP 27.20 - 194.00  
 HEH FVCP 56.70 - 518.00  
 HEH FVCP 35.90 - 198.00  
 HEH FVCP 56.70 - 518.00  
 HEH FVCP 35.90 - 198.00

## Cylinder Lubrication

Oil consumption during normal operation for Applied Speed of 885 RPM

### Cylinders/Packings:

Selected	Type	Grade	Common to Frame Oil	Oil Flow Pints/day
X	Mineral Oil	<b>R&amp;O Oil (ISO 150)</b>	Yes	64.65
	Synthetics	Synthetic PAO (ISO 100)	Yes	51.72
	Synthetic PAG	Synthetic PAG (ISO 100)	Yes	51.72

### Frame:

Selected	Type	Grade	Sump Capacity, gal
X	Mineral Oil	SAE 40 wt Engine Oil <b>R&amp;O Oil (ISO 150)</b> Refrigerant Oil (ISO 150)	107.0



# Project Report



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 Project: Majorsville #4

7.7.4.0

Selected	Type	Grade	Sump Capacity, gal
	Synthetics	Synthetic Ester (ISO 150)	
		Synthetic PAO (ISO 100)	
		Synthetic PAO (ISO 150)	
	Synthetic PAG	Synthetic PAG (ISO 100)	

Compressor frame lube oil is used for cylinder lubrication.

[See Section 6 of the Ariel Packager Standards for more information.](#)

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**Project Report**



Company: Dearing Compressor & Pump  
Quote: 17-0915A-R0  
Case 1:

Customer: Cone Gathering (CNX Gas Co)  
Inquiry: Nathan Horne  
Project: Majorsville #4



**7.7.4.0**

**CLIENT**

**PACKAGER**

**PROVIDER**

**Application Engineer**

Company: Dearing Compressor & Pump  
Contact: John Mentzer  
Email: [jmentzer@dearingcomp.com](mailto:jmentzer@dearingcomp.com)  
Phone: 330-599-5763



### Case Summary

Company: Dearing Compressor & Pump  
Quote: 17-0915A-R0

Customer: Cone Gathering (CNX Gas Co)  
Inquiry: Nathan Horne  
Project: Majorsville #4



7.7.4.0

Pkg	Description	Cmpr	Throw 1	Throw 2	Throw 3	Throw 4	Throw 5	Throw 6	Driver
1		KBZ/6	15.875Z:10	12.000Z:10	15.875Z:10	11.375ZM	15.875Z:10	11.375ZM	4500HP

Pkg	Case	Description	Available BHP	Calc BHP	RPM	Stgs	Req, MMSCFD	Stg1-Calc, MMSCFD	Ps, psig
1	1		4500	4332	885.0	3	50.000	50.463	200.00
1	2		4500	4244	885.0	2	50.000	42.454	150.00
1	3		4500	4315	885.0	3	50.000	46.463	175.00
1	4		4500	4251	885.0	3	50.000	53.128	225.00
1	5		4500	4429	885.0	3	50.000	59.393	250.00

Pkg	Case	Stg1-Pd, psig	Stg2-Pd, psig	Pd, psig	Ts, F	Errors	BHP/MMSCFD	Thw1-RLTot, %	Thw3-RLTot, %
1	1	457.82	704.12	875.00	80.00		85.85	75.4	75.4
1	2	343.71	885.00	875.00	80.00		99.97	56.6	56.6
1	3	425.97	663.86	875.00	80.00		92.88	72.8	72.8
1	4	478.98	730.61	875.00	80.00		80.02	37.2	75.1
1	5	527.28	791.89	875.00	80.00		74.57	40.7	82.1

Pkg	Case	Thw5-RLTot, %	Thw4-RLTot, %	Thw6-RLTot, %	Thw2-RLTot, %	Stg1-Disch Temp, F	Stg2-Disch Temp, F	Stg3-Disch Temp, F	Thw1-Vol Pkt, %
1	1	75.4	36.8	36.8	39.9	192.94	183.13	166.02	43.02 (F)
1	2	56.6	75.5	75.5	88.3	189.65	254.82		43.02 (F)
1	3	72.8	35.4	35.4	45.3	199.34	184.35	173.75	43.02 (F)
1	4	75.1	37.7	37.7	36.3	185.31	182.38	161.19	N/A
1	5	82.1	39.8	39.8	28.1	185.32	180.90	150.64	N/A

Pkg	Case	Thw3-Vol Pkt, %	Thw5-Vol Pkt, %	Thw4-Vol Pkt, %	Thw6-Vol Pkt, %	Thw2-Vol Pkt, %
1	1	43.02 (F)	43.02 (F)	5.23 (F)	5.23 (F)	3.56 (F)
1	2	43.02 (F)	4.24 (F)	5.23 (F)	5.23 (F)	3.56 (F)
1	3	43.02 (F)	4.24 (F)	5.23 (F)	5.23 (F)	3.56 (F)
1	4	43.02 (F)	43.02 (F)	5.23 (F)	5.23 (F)	3.56 (F)
1	5	43.02 (F)	43.02 (F)	5.23 (F)	5.23 (F)	3.56 (F)



# Ariel Performance



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 1:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

### Compressor Data:

Elevation,ft:	1500.00	Barmtr,psia:	13.906	Ambient,F:	100.00
Frame: <b>(ELP)</b>	KBZ/6	Stroke, in:	6.75	Rod Dia, in:	2.875
Max RL Tot, lbf:	150000	Max RL Tens, lbf:	75000	Max RL Comp, lbf:	80000
Rated RPM:	1000	Rated BHP:	7800.0	Rated PS FPM:	1125.0
Calc RPM:	885.0	BHP:	4332	Calc PS FPM:	995.6

### Driver Data:

Type:	Electric
Mfg:	Toshiba
Model:	4500HP
BHP:	4500
Avail:	4500

### Services

Gas Model

### Service 1

VMG

### Stage Data:

	<b>1</b>	---	---	<b>2</b>	---	<b>3</b>
Target Flow, MMSCFD	50.000	---	---	50.000	---	50.000
Flow Calc, MMSCFD	50.463	---	---	50.463	---	50.463
BHP per Stage	2255.7	---	---	1207.6	---	807.8
Specific Gravity	0.7148	---	---	0.7148	---	0.7148
Ratio of Sp Ht (N)	1.2522	---	---	1.2592	---	1.2726
Comp Suct (Zs)	0.9471	---	---	0.9102	---	0.8671
Comp Disch (Zd)	0.9339	---	---	0.9033	---	0.8647
Pres Suct Line, psig	200.00	---	---	N/A	---	N/A
Pres Suct Flg, psig	197.86	---	---	450.99	---	694.12
Pres Disch Flg, psig	457.82	---	---	704.12	---	885.00
Pres Disch Line, psig	N/A	---	---	N/A	---	875.00
Pres Ratio F/F	2.228	---	---	1.544	---	1.270
Temp Suct, F	80.00	---	---	120.00	---	120.00
Temp Clr Disch, F	120.00	---	---	120.00	---	120.00

### Cylinder Data:

	<b>Throw 1</b>	<b>Throw 3</b>	<b>Throw 5</b>	<b>Throw 4</b>	<b>Throw 6</b>	<b>Throw 2</b>
Cyl Model	15-7/8Z:10	15-7/8Z:10	15-7/8Z:10	11-3/8ZM	11-3/8ZM	12-1/2Z:10
Cyl Bore, in	15.875	15.875	15.875	11.375	11.375	12.000
Cyl RDP (API), psig	768.2	768.2	768.2	1545.5	1545.5	1545.5
Cyl MAWP, psig	845.0	845.0	845.0	1700.0	1700.0	1700.0
Cyl Action	DBL	DBL	DBL	DBL	DBL	DBL
Cyl Disp, CFM	1346.1	1346.1	1346.1	680.2	680.2	759.5
Pres Suct Intl, psig	188.10	188.10	188.10	441.46	441.46	658.12
Temp Suct Intl, F	86	86	86	123	123	122
Pres Disch Intl, psig	478.45	478.45	478.45	721.70	721.70	930.43
Temp Disch Intl, F	193	193	193	183	183	166
HE Suct Gas Vel, FPM	6585	6585	6585	4518	4518	6918
HE Disch Gas Vel, FPM	5807	5807	5807	4307	4307	5954
HE Spcrs Used/Max	0/6	0/6	0/6	0/4	0/4	0/4
HE Vol Pkt Avail, %	4.24+38.77	4.24+38.77	4.24+38.77	5.23+28.86	5.23+28.86	3.56+25.41
Vol Pkt Used, %	43.02 (F) %	43.02 (F) %	43.02 (F) %	5.23 (F) %	5.23 (F) %	3.56 (F) %
HE Min Clr, %	17.21	17.21	17.21	29.12	29.12	19.91
HE Total Clr, %	60.23	60.23	60.23	34.35	34.35	23.47
CE Suct Gas Vel, FPM	6369	6369	6369	4230	4230	6521
CE Disch Gas Vel, FPM	5616	5616	5616	4032	4032	5612
CE Spcrs Used/Max	0/6	0/6	0/6	0/4	0/4	0/4
CE Min Clr, %	18.26	18.26	18.26	32.10	32.10	21.63
CE Total Clr, %	18.26	18.26	18.26	32.10	32.10	21.63
Suct Vol Eff HE/CE, %	40.2/78.9	40.2/78.9	40.2/78.9	82.3/83.2	82.3/83.2	92.5/92.8
Disch Event HE/CE, ms	9.6/16.2	9.6/16.2	9.6/16.2	17.7/19.8	17.7/19.8	22.0/23.9
Suct Pseudo-Q HE/CE	4.1/4.0	4.1/4.0	4.1/4.0	2.5/2.2	2.5/2.2	4.7/4.2
Gas Rod Ld Comp, %	73.5 C	73.5 C	73.5 C	39.3 C	39.3 C	43.9 C
Gas Rod Ld Tens, %	72.4 T	72.4 T	72.4 T	31.7 T	31.7 T	33.0 T
Gas Rod Ld Total, %	75.4	75.4	75.4	36.8	36.8	39.9
Xhd Pin Deg/%Rvrsl lbf	175/84.6	175/84.6	175/84.6	163/82.9	163/82.9	163/79.9
Flow Calc, MMSCFD	16.821	16.821	16.821	25.231	25.231	50.463
Cyl BHP	751.9	751.9	751.9	603.8	603.8	807.8



# Gas Analysis Data



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 1:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

Services	Service					
Gas Model	VMG					
Gas Type	FIELDGAS					
Stage	# 1	# 1	# 2	# 3	Final	Final
Stream	Main	Vapor	Vapor	Vapor	Liq1	Vapor
Suction Press, psig	200.00	197.86	450.99	694.12		875.00
Disch Press, psig		457.82	704.12	885.00		875.00
Suction Temp, F	80.00	80.00	120.00	120.00		120.00
Disch Temp, F		192.94	183.13	166.02		120.00
Flow, MMSCFD	50.463	50.463	50.463	50.463	0.011	50.452
Flow, lb/h	114710.6	114710.6	114711.1	114710.6	21.3	114689.3
Flow, GPM					0.043	
Dropout, %					0.021	
Specific Gravity	0.7148	0.7148	0.7148	0.7148	0.9865	0.7148
Mole Weight	20.70	20.70	20.70	20.70	18.02	20.70
Ratio of Sp Ht (N)		1.2522	1.2592	1.2726		N/A
Comp Suct (Zs)		0.9471	0.9102	0.8671		0.8376
Comp Disch (Zd)		0.9339	0.9033	0.8647		0.8376
Humidity	100.00	100.00				
WATER	0.24138	0.24138	0.24138	0.24138	99.90795	0.22011
METHANE	77.39690	77.31050	77.31050	77.31050	0.07508	77.32699
ETHANE	14.75420	14.73773	14.73773	14.73773	0.01206	14.74087
PROPANE	4.70520	4.69995	4.69995	4.69995	0.00251	4.70095
ISOBUTANE	0.56700	0.56637	0.56637	0.56637	0.00006	0.56649
n-BUTANE	1.20410	1.20276	1.20276	1.20276	0.00039	1.20301
ISOPENTANE	0.28520	0.28488	0.28488	0.28488	0.00002	0.28494
n-PENTANE	0.29700	0.29667	0.29667	0.29667	0.00002	0.29673
n-HEXANE	0.17330	0.17311	0.17311	0.17311		0.17314
CARBON DIOXIDE	0.12490	0.12476	0.12476	0.12476	0.00168	0.12479
NITROGEN	0.36230	0.36190	0.36190	0.36190	0.00022	0.36197





# Gas Analysis Data



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 1:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

## Calculated Gas Properties:

### Services

### Service

Gas Model VMG  
 Gas Type FIELDGAS

Stage	# 1	# 1	# 2	# 3	Final	Final
Stream	Main	Vapor	Vapor	Vapor	Liq1	Vapor
Comp @ Std (Zstd)		0.9959	0.9959	0.9959		0.9959
Density @ Std, lb/ft3		0.055	0.055	0.055		0.055

### Suction:

Press, psig		197.86	450.99	694.12		875.00
Temp, F		80.00	120.00	120.00		120.00
Density, lb/ft3		0.799	1.699	2.718	61.61	3.534
Enthalpy, Btu/lb		215.57	227.22	218.04		211.17
Entropy, Btu/lb-F		1.9960	1.9467	1.8949		1.8643
Speed of Sound, ft/s		1229.33	1247.85	1226.89		1217.91
Pseudo-Pc, psig		659.675	659.675	659.675		659.136
Pseudo-Tc, F		-58.02	-58.02	-58.02		-58.18
Cp, Btu/lb-F		0.5199	0.5629	0.5992		0.6295
Cv, Btu/lb-F		0.4001	0.4187	0.4220		0.4246
K		1.2994	1.3443	1.4198		1.4825
Z at Flange		0.9471	0.9102	0.8671		0.8376
Interal Energy, Btu/lb		166.5608	176.6210	169.8572		164.6482
JT Coefficient, F/psi		0.0801	0.0666	0.0633		0.0602
Viscosity, lb/ft-s		7.11e-06	7.69e-06	7.85e-06		8.03e-06
Thermal Cond., Btu/ft-h-F		1.97e-02	2.29e-02	2.43e-02		2.55e-02
NHV Mass, Btu/lb		20756.38	20756.38	20756.38		20760.23

### Discharge:

Press, psig		457.82	704.12	885.00		875.00
Temp, F		192.94	183.13	166.02		120.00
Density, lb/ft3		1.482	2.372	3.160		3.534
Enthalpy, Btu/lb		268.53	255.46	239.51		211.17
Entropy, Btu/lb-F		2.0125	1.9550	1.9106		1.8643
Speed of Sound, ft/s		1340.70	1316.07	1287.45		1217.91
Pseudo-Pc, psig		659.675	659.675	659.675		659.136
Pseudo-Tc, F		-58.02	-58.02	-58.02		-58.18
Cp, Btu/lb-F		0.5777	0.5997	0.6195		0.6295
Cv, Btu/lb-F		0.4477	0.4464	0.4418		0.4246
K		1.2905	1.3434	1.4023		1.4825
Z at Flange		0.9405	0.9082	0.8771		0.8376
Interal Energy, Btu/lb		209.6600	199.4695	186.8933		164.6481
JT Coefficient, F/psi		0.0508	0.0499	0.0505		0.0602
Viscosity, lb/ft-s		8.46e-06	8.51e-06	8.50e-06		8.03e-06
Thermal Cond., Btu/ft-h-F		2.63e-02	2.70e-02	2.72e-02		2.55e-02
NHV Mass, Btu/lb		20756.38	20756.38	20756.38		20760.23
Heat Load, BTU/h		4.80e+06	4.34e+06	3.28e+06		N/A



# Ariel Frame Data Sheet



Model: KBZ/6

Stroke: 6.75 in

Class: (KBZ)

### Frame:

Number of Throws: 6  
 Rated Power: 7800.0 BHP  
 Frame Friction Power: 69.00 BHP  
 Cyl Friction Factor: 0.95  
 Guide Type: Separate

### Weights:

Avg. Weight without Cylinders: 39800.00 lbs  
 Maximum Recip: 1604.65 lbs  
 Maximum Imbalance: 5.00 lbs  
 Crankshaft: 3730.00 lbs  
 Connecting Rod: 273.90 lbs  
 Pin Assembly: 93.10 lbs  
 Stub Shaft: 9.30 lbs

### Speed Ratings:

Rated Piston Speed @ RPM: 1125.0 FPM  
 Maximum Speed: 1000.00 RPM  
 Minimum Speed: 500.00 RPM  
 Minimum PRC Speed: 500.00 RPM  
 Maximum Process Speed: 750.00 RPM

### Frame Dimensions:

Center Line Height: 24.00 in  
 Max. Overall Height: 42.00 in  
 Max. Overall Width with Cylinders: 192.00 in  
 (Std Guide, widest dbl. Cyl, No HEH devices)  
 Length: 183.00 in

### Component Dimensions:

Piston Rod Diameter: 2.875 in  
 Connecting Rod Center Distance: 18.500 in  
 Crankshaft Pin Diameter: 8.000 in  
 Crankshaft Journal Diameter: 8.000 in  
 Main Bearing Width: 4.750 in

### Internal Gas Rod Loads:

Total: 150000 lbf  
 Compression: 80000 lbf  
 Tension: 75000 lbf  
 Single Acting Tension: 75000 lbf

### Lubrication:

Oil Pump Flow Rate: 113.0 GPM  
 Oil Sump Capacity: 107.0 gal  
 Oil Heat Rejection: 195000.0 BTU/h

### Material Specifications:

Crankcase: Gray Iron  
 Crosshead Guide: Gray Iron  
 Crankshaft: Forged Alloy Steel  
 Connecting Rod: Forged Carbon Steel  
 Main Bearing: Tri-metal  
 Thrust Bearing: Bronze  
 Connecting Rod Bearing: Tri-metal  
 Crosshead: Ductile Iron  
 Crosshead Pin: Alloy Steel  
 Crosshead Pin Bushing: Steel Backed Bronze  
 Stress Bolts, standard: Grade 8

### Ariel Spec

12G  
 12G  
 20N  
 18N  
 11B  
 16D

### (Reference)

(ASTM A48 Class 30)  
 (ASTM A48 Class 30)  
 (ASTM A668 Class M/AISI 4340)  
 (ASTM A521 Class AC or CG/AISI 1045)  
 (Tri-metal)  
 (SAE 64)  
 (Tri-metal)  
 (ASTM A536 Grade 65-45-12)  
 (AISI 8620)  
 (Steel Backed Bronze)  
 (Grade 8)



# Ariel Cylinder Data Sheet



**Model: 15-7/8Z:10**

**Bore: 15.875in**

**MAWP: 845.0 psig**

Flange: 10"- 400 FF

Stroke: 6.75 in  
Rated Speed: 1000 RPM

Cyl Assembly Wt: 4730.00 lbs  
Piston/Rod Std Wt: 318.90 lbs

**Pressure Ratings:**

MAWP: 845.0 psig

RDP: 768.2 psig

HTP: 1267.5 psig

**Piston and Velocity Data:**

	HE	CE	Total
Piston Rod Diameter, in	n/a	2.875	
Piston Area, in <sup>2</sup>	197.93	191.44	
Piston Displacement at 1000 RPM, CFM	773.17	747.82	1520.99
API Suct Valve Velocity at 1000 RPM, FPM	5941.31	5746.44	

**Clearance:**

		w/lvs		w/lvs
Normal Clearance, % (in <sup>3</sup> )	9.40 (125.654)	17.21	10.19 (131.695)	18.26
Non-Std Clearance, % (in <sup>3</sup> )	0.00 (0.000)		0.00 (0.000)	

**Spacer Data:**

	Suction	Discharge	Suction	Discharge
Spacers (Maximum)	3	3	3	3
Spacer Clearance, % (in <sup>3</sup> )	2.52 (33.680)		2.61 (33.680)	

**Cylinder ADJ Equivalent Area, in<sup>2</sup>**

45.027      63.908      45.027      63.908

<b>Valve Data:</b>	HE	Suction	CE	HE	Discharge	CE
Num valves/Corner:	3	3	3	3	3	3
Nominal Diameter, in:	7.14	7.14	7.14	7.14	7.14	7.14
Model:	158CT	158CT	158CT	158CT	158CT	158CT
Clearance, % (in <sup>3</sup> ):	1.00 (13.420)	1.04 (13.420)	1.60 (21.350)	1.65 (21.350)	1.65 (21.350)	1.65 (21.350)
Lift, in (Area, in <sup>2</sup> ):	0.102 (12.493)	0.102 (12.493)	0.102 (12.493)	0.102 (12.493)	0.102 (12.493)	0.102 (12.493)
Adj Equivalent, in <sup>2</sup> :	13.351	13.351	13.351	13.351	13.351	13.351
Plate Material:	NYX (Low Temp Nylon X)	NYX (Low Temp Nylon X)	MTX (Med Temp Nylon X)	MTX (Med Temp Nylon X)	MTX (Med Temp Nylon X)	MTX (Med Temp Nylon X)
Seat Material:	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)
Guard Material:	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)
Spring Material(s):	SS 17 - 7PH	SS 17 - 7PH	SS 17 - 7PH	SS 17 - 7PH	SS 17 - 7PH	SS 17 - 7PH
Bolt Material:	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)

**Variable Volume Clearance Pockets:**

----- Minimum -----	----- Pocket -----	Total	Total	Total	Total	Chg per	Chg per	Weight
in <sup>3</sup> %	in <sup>3</sup> %	Turns	Stk, in	Pos, in	%	in, %	turn, %	lbs
9.21      0.69	530.93      39.74	32.00	4.00	8.63	40.43	9.9	1.2	555.00

**Fixed Volume Clearance Pockets:**

----- Pocket 1 -----				----- Pocket 2 -----				----- Pocket 3 -----			
----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----				
in <sup>3</sup> %	in <sup>3</sup> %	in <sup>3</sup> %	in <sup>3</sup> %	in <sup>3</sup> %	in <sup>3</sup> %	in <sup>3</sup> %	in <sup>3</sup> %				
56.70      4.24	196.00      14.67	56.70      4.24	272.00      20.36	56.70      4.24	354.00      26.50	56.70      4.24	430.00      32.18				
Selected      56.70      4.24	518.00      38.77										



# Ariel Cylinder Data Sheet



Model: 15-7/8Z:10

Bore: 15.875in

MAWP: 845.0 psig

## Material Specifications:

Body: Ductile Iron  
Piston: Ductile Iron  
Piston Rod: Alloy Steel  
Piston Ring: GMFTFE  
Piston Wear Band: GMFTFE  
Rod Packing Case: Gray Iron  
Rod Packing Rings: CFTFE  
Stress Bolt: Grade 8

## Ariel Spec

14D  
10D  
13C

## (Reference)

(ASTM A395 Grade 60-40-18)  
(ASTM A536 Grade 80-55-06)  
(AISI 4100 Series)  
(Glass Moly Filled Teflon)  
(Glass Moly Filled Teflon)  
(ASTM A278 Class 30)  
(Carbon Filled Teflon)  
(Grade 8)



# Ariel Cylinder Data Sheet



Model: 11-3/8ZM

Bore: 11.375in

MAWP: 1700.0 psig

Flange: 8"- 900 FF

Stroke: 6.75 in  
Rated Speed: 1000 RPM

Cyl Assembly Wt: 5000.00 lbs  
Piston/Rod Std Wt: 263.00 lbs

### Pressure Ratings:

MAWP: 1700.0 psig

RDP: 1545.5 psig

HTP: 2550.0 psig

### Piston and Velocity Data:

	HE	CE	Total
Piston Rod Diameter, in	n/a	2.875	
Piston Area, in <sup>2</sup>	101.62	95.13	
Piston Displacement at 1000 RPM, CFM	396.97	371.61	768.57
API Suct Valve Velocity at 1000 RPM, FPM	4575.60	4283.31	

### Clearance:

		w/Vlvs		w/Vlvs
Normal Clearance, % (in3)	18.95 (129.965)	29.12	21.23 (136.343)	32.10
Non-Std Clearance, % (in3)	0.00 (0.000)		0.00 (0.000)	

### Spacer Data:

	Suction	Discharge	Suction	Discharge
Spacers (Maximum)	2	2	2	2
Spacer Clearance, % (in3)	5.82 (39.900)		6.21 (39.900)	

### Cylinder ADJ Equivalent Area, in<sup>2</sup>

HE	Suction	CE	HE	Discharge	CE
41.110	49.430		41.110	49.430	

Valve Data:	HE	Suction	CE	HE	Discharge	CE
Num valves/Corner:	2	2	2	2	2	2
Nominal Diameter, in:	6.97	6.97	6.97	6.97	6.97	6.97
Model:	158CT	158CT	158CT	158CT	158CT	158CT
Clearance, % (in3):	1.80 (12.320)	1.92 (12.320)	3.29 (22.570)	3.51 (22.570)		
Lift, in (Area, in <sup>2</sup> ):	0.102 (12.493)	0.102 (12.493)	0.102 (12.493)	0.102 (12.493)		
Adj Equivalent, in <sup>2</sup> :	13.351	13.351	13.351	13.351		
Plate Material:	NYX (Low Temp Nylon X)	NYX (Low Temp Nylon X)	NYX (Low Temp Nylon X)	NYX (Low Temp Nylon X)		
Seat Material:	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)		
Guard Material:	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)		
Spring Material(s):	SS 17 - 7PH	SS 17 - 7PH	SS 17 - 7PH	SS 17 - 7PH		
Bolt Material:	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)		

### Variable Volume Clearance Pockets:

----- Minimum -----	----- Pocket -----	Total	Total	Total	Total	Chg per	Chg per	Weight		
in3	%	in3	%	Turns	Stk, in	Pos, in	in, %	turn, %	lbs	
2.05	0.30	481.11	70.14	72.00	9.00	13.88	70.43	7.8	1.0	638.00

### Fixed Volume Clearance Pockets:

	----- Pocket 1 -----				----- Pocket 2 -----				----- Pocket 3 -----			
	----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----
	in3	%	in3	%	in3	%	in3	%	in3	%	in3	%
Selected	35.90	5.23	198.00	28.86								
	35.90	5.23	235.00	34.26								
	35.90	5.23	271.00	39.51								
	35.90	5.23	306.00	44.61								
	35.90	5.23	339.00	49.42								
	73.50	10.71	452.00	65.89								
	73.50	10.71	575.00	83.82								



# Ariel Cylinder Data Sheet



Model: 11-3/8ZM

Bore: 11.375in

MAWP: 1700.0 psig

## Material Specifications:

Body:	Ductile Iron
Piston:	Gray Iron
Piston Rod:	Alloy Steel
Piston Ring:	GMFTFE
Piston Wear Band:	GMFTFE
Rod Packing Case:	Gray Iron
Rod Packing Rings:	CFTFE
Stress Bolt:	Grade 8

## Ariel Spec

14D
12G
13C

## (Reference)

(ASTM A395 Grade 60-40-18)
(ASTM A48 Class 30)
(AISI 4100 Series)
(Glass Moly Filled Teflon)
(Glass Moly Filled Teflon)
(ASTM A278 Class 30)
(Carbon Filled Teflon)
(Grade 8)



# Ariel Cylinder Data Sheet



Model: 12-1/2Z:10

Bore: 12.000in

MAWP: 1700.0 psig

Flange: 8"- 900 FF

Stroke: 6.75 in  
Rated Speed: 1000 RPM

Cyl Assembly Wt: 4800.00 lbs  
Piston/Rod Std Wt: 275.00 lbs

### Pressure Ratings:

MAWP: 1700.0 psig

RDP: 1545.5 psig

HTP: 2550.0 psig

### Piston and Velocity Data:

	HE	CE	Total
Piston Rod Diameter, in	n/a	2.875	
Piston Area, in <sup>2</sup>	113.10	106.61	
Piston Displacement at 1000 RPM, CFM	441.79	416.43	858.21
API Suct Valve Velocity at 1000 RPM, FPM	5901.28	5562.54	

### Clearance:

		w/Vlvs		w/Vlvs
Normal Clearance, % (in3)	11.44 (87.322)	19.91	12.65 (91.032)	21.63
Non-Std Clearance, % (in3)	0.00 (0.000)		0.00 (0.000)	

### Spacer Data:

	Suction	Discharge	Suction	Discharge
Spacers (Maximum)	2	2	2	2
Spacer Clearance, % (in3)	3.51 (26.800)		3.72 (26.800)	

### Cylinder ADJ Equivalent Area, in<sup>2</sup>

	24.176	36.957	24.176	36.957
--	--------	--------	--------	--------

Valve Data:	HE	Suction	CE	HE	Discharge	CE
Num valves/Corner:	2	2	2	2	2	2
Nominal Diameter, in:	7.02	7.02	7.02	7.02	7.02	7.02
Model:	148CT	148CT	148CT	148CT	148CT	148CT
Clearance, % (in3):	1.94 (14.820)	2.06 (14.820)	2.29 (17.500)	2.43 (17.500)		
Lift, in (Area, in <sup>2</sup> ):	0.102 (10.780)	0.102 (10.780)	0.102 (10.780)	0.102 (10.780)		
Adj Equivalent, in <sup>2</sup> :	11.006	11.006	11.006	11.006		
Plate Material:	NYX (Low Temp Nylon X)	NYX (Low Temp Nylon X)	MTX (Med Temp Nylon X)	MTX (Med Temp Nylon X)		
Seat Material:	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)		
Guard Material:	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)		
Spring Material(s):	SS 17 - 7PH	SS 17 - 7PH	SS 17 - 7PH	SS 17 - 7PH		
Bolt Material:	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)	AISI 416 (Mart 400 Series)		

### Variable Volume Clearance Pockets:

----- Minimum -----	----- Pocket -----	Total	Total	Total	Total	Chg per	Chg per	Weight		
in3	%	in3	%	Turns	Stk, in	Pos, in	in, %	turn, %	lbs	
4.86	0.64	283.53	37.14	32.00	4.00	8.63	37.78	9.3	1.2	504.00

### Fixed Volume Clearance Pockets:

	----- Pocket 1 -----				----- Pocket 2 -----				----- Pocket 3 -----			
	----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----	----- Min -----	----- Pocket -----
	in3	%	in3	%	in3	%	in3	%	in3	%	in3	%
Selected	27.20	3.56	194.00	25.41								
	36.40	4.77	227.00	29.74								
	36.40	4.77	255.00	33.40								
	36.40	4.77	290.00	37.99								
	36.40	4.77	322.00	42.18								



# Ariel Cylinder Data Sheet



Model: 12-1/2Z:10

Bore: 12.000in

MAWP: 1700.0 psig

## Material Specifications:

Body: Ductile Iron  
Piston: Gray Iron  
Piston Rod: Alloy Steel  
Piston Ring: GMFTFE  
Piston Wear Band: GMFTFE  
Rod Packing Case: Gray Iron  
Rod Packing Rings: CFTFE  
Stress Bolt: Grade 8

## Ariel Spec

14D  
12G  
13C

## (Reference)

(ASTM A395 Grade 60-40-18)  
(ASTM A48 Class 30)  
(AISI 4100 Series)  
(Glass Moly Filled Teflon)  
(Glass Moly Filled Teflon)  
(ASTM A278 Class 30)  
(Carbon Filled Teflon)  
(Grade 8)





# Ariel Performance



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 2:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

### Compressor Data:

Elevation,ft:	1500.00	Barmtr,psia:	13.906	Ambient,F:	100.00
Frame: <b>(ELP)</b>	KBZ/6	Stroke, in:	6.75	Rod Dia, in:	2.875
Max RL Tot, lbf:	150000	Max RL Tens, lbf:	75000	Max RL Comp, lbf:	80000
Rated RPM:	1000	Rated BHP:	7800.0	Rated PS FPM:	1125.0
Calc RPM:	885.0	BHP:	4244	Calc PS FPM:	995.6

### Driver Data:

Type:	Electric
Mfg:	Toshiba
Model:	4500HP
BHP:	4500
Avail:	4500

### Services

Gas Model

### Service 1

VMG

### Stage Data:

	<b>1</b>	---	---	<b>2</b>	---	---
Target Flow, MMSCFD	50.000	---	---	50.000	---	---
Flow Calc, MMSCFD	42.454	---	---	42.454	---	---
BHP per Stage	1894.4	---	---	2288.8	---	---
Specific Gravity	0.7147	---	---	0.7147	---	---
Ratio of Sp Ht (N)	1.2478	---	---	1.2474	---	---
Comp Suct (Zs)	0.9595	---	---	0.9317	---	---
Comp Disch (Zd)	0.9482	---	---	0.9206	---	---
Pres Suct Line, psig	150.00	---	---	N/A	---	---
Pres Suct Flg, psig	148.36	---	---	336.12	---	---
Pres Disch Flg, psig	343.71	---	---	885.00	---	---
Pres Disch Line, psig	N/A	---	---	875.00	---	---
Pres Ratio F/F	2.204	---	---	2.568	---	---
Temp Suct, F	80.00	---	---	120.00	---	---
Temp Clr Disch, F	120.00	---	---	120.00	---	---

### Cylinder Data:

	<b>Throw 1</b>	<b>Throw 3</b>	<b>Throw 5</b>	<b>Throw 2</b>	<b>Throw 4</b>	<b>Throw 6</b>
Cyl Model	15-7/8Z:10	15-7/8Z:10	15-7/8Z:10	12-1/2Z:10	11-3/8ZM	11-3/8ZM
Cyl Bore, in	15.875	15.875	15.875	12.000	11.375	11.375
Cyl RDP (API), psig	768.2	768.2	768.2	1545.5	1545.5	1545.5
Cyl MAWP, psig	845.0	845.0	845.0	1700.0	1700.0	1700.0
Cyl Action	DBL	DBL	DBL	DBL	DBL	DBL
Cyl Disp, CFM	1346.1	1346.1	1346.1	759.5	680.2	680.2
Pres Suct Intl, psig	140.98	140.98	140.98	319.67	329.14	329.14
Temp Suct Intl, F	86	86	86	126	126	126
Pres Disch Intl, psig	359.19	359.19	359.19	922.14	904.51	904.51
Temp Disch Intl, F	190	190	190	259	252	252
HE Suct Gas Vel, FPM	6585	6585	6585	6918	4518	4518
HE Disch Gas Vel, FPM	5807	5807	5807	5954	4307	4307
HE Spcrs Used/Max	0/6	0/6	0/6	0/4	0/4	0/4
HE Vol Pkt Avail, %	4.24+38.77	4.24+38.77	4.24+38.77	3.56+25.41	5.23+28.86	5.23+28.86
Vol Pkt Used, %	43.02 (F) %	43.02 (F) %	4.24 (F) %	3.56 (F) %	5.23 (F) %	5.23 (F) %
HE Min Clr, %	17.21	17.21	17.21	19.91	29.12	29.12
HE Total Clr, %	60.23	60.23	21.46	23.47	34.35	34.35
CE Suct Gas Vel, FPM	6369	6369	6369	6521	4230	4230
CE Disch Gas Vel, FPM	5616	5616	5616	5612	4032	4032
CE Spcrs Used/Max	0/6	0/6	0/6	0/4	0/4	0/4
CE Min Clr, %	18.26	18.26	18.26	21.63	32.10	32.10
CE Total Clr, %	18.26	18.26	18.26	21.63	32.10	32.10
Suct Vol Eff HE/CE, %	41.3/79.3	41.3/79.3	76.4/79.3	67.7/69.7	55.0/57.5	55.0/57.5
Disch Event HE/CE, ms	9.8/16.2	9.8/16.2	13.9/16.2	12.1/14.1	10.7/12.8	10.7/12.8
Suct Pseudo-Q HE/CE	4.1/3.9	4.1/3.9	4.2/3.9	4.4/3.9	2.4/2.1	2.4/2.1
Gas Rod Ld Comp, %	55.2 C	55.2 C	55.2 C	87.9 C	75.9 C	75.9 C
Gas Rod Ld Tens, %	54.4 T	54.4 T	54.4 T	82.7 T	70.0 T	70.0 T
Gas Rod Ld Total, %	56.6	56.6	56.6	88.3	75.5	75.5
Xhd Pin Deg/%Rvrsl lbf	145/87.4	145/87.4	145/79.6	173/79.6	172/77.4	172/77.4
Flow Calc, MMSCFD	12.873	12.873	16.708	17.209	12.622	12.622
Cyl BHP	574.2	574.2	746.0	956.5	666.2	666.2



# Gas Analysis Data



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 2:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

Services	Service				
Gas Model	VMG				
Gas Type	FIELDGAS				
Stage	# 1	# 1	# 2	Final	Final
Stream	Main	Vapor	Vapor	Liq1	Vapor
Suction Press, psig	150.00	148.36	336.12		875.00
Disch Press, psig		343.71	885.00		875.00
Suction Temp, F	80.00	80.00	120.00		120.00
Disch Temp, F		189.65	254.82		120.00
Flow, MMSCFD	42.454	42.454	42.454	0.039	42.415
Flow, lb/h	96496.1	96496.1	96496.1	77.2	96418.9
Flow, GPM				0.156	
Dropout, %				0.092	
Specific Gravity	0.7147	0.7147	0.7147	0.9865	0.7148
Mole Weight	20.70	20.70	20.70	18.02	20.70
Ratio of Sp Ht (N)		1.2478	1.2474		N/A
Comp Suct (Zs)		0.9595	0.9317		0.8376
Comp Disch (Zd)		0.9482	0.9206		0.8376
Humidity	100.00	100.00			
WATER	0.31176	0.31176	0.31176	99.90795	0.22011
METHANE	77.39690	77.25597	77.25597	0.07508	77.32698
ETHANE	14.75420	14.72733	14.72733	0.01206	14.74087
PROPANE	4.70520	4.69663	4.69663	0.00251	4.70095
ISOBUTANE	0.56700	0.56597	0.56597	0.00006	0.56649
n-BUTANE	1.20410	1.20191	1.20191	0.00039	1.20301
ISOPENTANE	0.28520	0.28468	0.28468	0.00002	0.28494
n-PENTANE	0.29700	0.29646	0.29646	0.00002	0.29673
n-HEXANE	0.17330	0.17298	0.17298		0.17314
CARBON DIOXIDE	0.12490	0.12467	0.12467	0.00168	0.12479
NITROGEN	0.36230	0.36164	0.36164	0.00022	0.36197



# Gas Analysis Data



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 2:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

## Calculated Gas Properties:

### Services

Gas Model VMG  
 Gas Type FIELDGAS

Stage	# 1	# 1	# 2	Final	Final
Stream	Main	Vapor	Vapor	Liq1	Vapor
Comp @ Std (Zstd)		0.9959	0.9959		0.9959
Density @ Std, lb/ft3		0.055	0.055		0.055

### Suction:

Press, psig		148.36	336.12		875.00
Temp, F		80.00	120.00		120.00
Density, lb/ft3		0.604	1.250	61.61	3.534
Enthalpy, Btu/lb		217.64	231.51		211.17
Entropy, Btu/lb-F		2.0247	1.9797		1.8643
Speed of Sound, ft/s		1238.18	1260.89		1217.91
Pseudo-Pc, psig		661.456	661.456		659.136
Pseudo-Tc, F		-57.48	-57.48		-58.18
Cp, Btu/lb-F		0.5131	0.5477		0.6295
Cv, Btu/lb-F		0.3994	0.4172		0.4246
K		1.2847	1.3128		1.4825
Z at Flange		0.9595	0.9317		0.8376
Internal Energy, Btu/lb		167.9810	179.7135		164.6482
JT Coefficient, F/psi		0.0803	0.0677		0.0602
Viscosity, lb/ft-s		7.09e-06	7.62e-06		8.03e-06
Thermal Cond., Btu/ft-h-F		1.94e-02	2.23e-02		2.55e-02
NHV Mass, Btu/lb		20743.63	20743.63		20760.23

### Discharge:

Press, psig		343.71	885.00		875.00
Temp, F		189.65	254.82		120.00
Density, lb/ft3		1.114	2.615		3.534
Enthalpy, Btu/lb		270.02	294.61		211.17
Entropy, Btu/lb-F		2.0405	1.9935		1.8643
Speed of Sound, ft/s		1344.77	1402.34		1217.91
Pseudo-Pc, psig		661.456	661.456		659.136
Pseudo-Tc, F		-57.48	-57.48		-58.18
Cp, Btu/lb-F		0.5666	0.6255		0.6295
Cv, Btu/lb-F		0.4451	0.4774		0.4246
K		1.2729	1.3103		1.4825
Z at Flange		0.9532	0.9275		0.8376
Internal Energy, Btu/lb		210.6587	231.0246		164.6481
JT Coefficient, F/psi		0.0525	0.0372		0.0602
Viscosity, lb/ft-s		8.38e-06	9.34e-06		8.03e-06
Thermal Cond., Btu/ft-h-F		2.56e-02	3.10e-02		2.55e-02
NHV Mass, Btu/lb		20743.63	20743.63		20760.23
Heat Load, BTU/h		3.77e+06	8.10e+06		N/A



# Ariel Performance



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 3:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

### Compressor Data:

Elevation,ft:	1500.00	Barmtr,psia:	13.906	Ambient,F:	100.00
Frame: <b>(ELP)</b>	KBZ/6	Stroke, in:	6.75	Rod Dia, in:	2.875
Max RL Tot, lbf:	150000	Max RL Tens, lbf:	75000	Max RL Comp, lbf:	80000
Rated RPM:	1000	Rated BHP:	7800.0	Rated PS FPM:	1125.0
Calc RPM:	885.0	BHP:	4315	Calc PS FPM:	995.6

### Driver Data:

Type:	Electric
Mfg:	Toshiba
Model:	4500HP
BHP:	4500
Avail:	4500

### Services

Gas Model

### Service 1

VMG

### Stage Data:

	<b>1</b>	---	---	<b>2</b>	---	<b>3</b>
Target Flow, MMSCFD	50.000	---	---	50.000	---	50.000
Flow Calc, MMSCFD	46.463	---	---	46.463	---	46.463
BHP per Stage	2226.8	---	---	1147.0	---	880.6
Specific Gravity	0.7148	---	---	0.7148	---	0.7148
Ratio of Sp Ht (N)	1.2495	---	---	1.2572	---	1.2704
Comp Suct (Zs)	0.9533	---	---	0.9160	---	0.8740
Comp Disch (Zd)	0.9402	---	---	0.9087	---	0.8708
Pres Suct Line, psig	175.00	---	---	N/A	---	N/A
Pres Suct Flg, psig	173.11	---	---	419.68	---	653.86
Pres Disch Flg, psig	425.97	---	---	663.86	---	885.00
Pres Disch Line, psig	N/A	---	---	N/A	---	875.00
Pres Ratio F/F	2.352	---	---	1.563	---	1.346
Temp Suct, F	80.00	---	---	120.00	---	120.00
Temp Clr Disch, F	120.00	---	---	120.00	---	120.00

### Cylinder Data:

	<b>Throw 1</b>	<b>Throw 3</b>	<b>Throw 5</b>	<b>Throw 4</b>	<b>Throw 6</b>	<b>Throw 2</b>
Cyl Model	15-7/8Z:10	15-7/8Z:10	15-7/8Z:10	11-3/8ZM	11-3/8ZM	12-1/2Z:10
Cyl Bore, in	15.875	15.875	15.875	11.375	11.375	12.000
Cyl RDP (API), psig	768.2	768.2	768.2	1545.5	1545.5	1545.5
Cyl MAWP, psig	845.0	845.0	845.0	1700.0	1700.0	1700.0
Cyl Action	DBL	DBL	DBL	DBL	DBL	DBL
Cyl Disp, CFM	1346.1	1346.1	1346.1	680.2	680.2	759.5
Pres Suct Intl, psig	164.55	164.55	164.55	410.85	410.85	620.20
Temp Suct Intl, F	86	86	86	123	123	122
Pres Disch Intl, psig	444.89	444.89	444.89	680.32	680.32	929.56
Temp Disch Intl, F	199	199	199	184	184	174
HE Suct Gas Vel, FPM	6585	6585	6585	4518	4518	6918
HE Disch Gas Vel, FPM	5807	5807	5807	4307	4307	5954
HE Spcrs Used/Max	0/6	0/6	0/6	0/4	0/4	0/4
HE Vol Pkt Avail, %	4.24+38.77	4.24+38.77	4.24+38.77	5.23+28.86	5.23+28.86	3.56+25.41
Vol Pkt Used, %	43.02 (F) %	43.02 (F) %	4.24 (F) %	5.23 (F) %	5.23 (F) %	3.56 (F) %
HE Min Clr, %	17.21	17.21	17.21	29.12	29.12	19.91
HE Total Clr, %	60.23	60.23	21.46	34.35	34.35	23.47
CE Suct Gas Vel, FPM	6369	6369	6369	4230	4230	6521
CE Disch Gas Vel, FPM	5616	5616	5616	4032	4032	5612
CE Spcrs Used/Max	0/6	0/6	0/6	0/4	0/4	0/4
CE Min Clr, %	18.26	18.26	18.26	32.10	32.10	21.63
CE Total Clr, %	18.26	18.26	18.26	32.10	32.10	21.63
Suct Vol Eff HE/CE, %	34.7/77.1	34.7/77.1	73.9/77.1	81.7/82.6	81.7/82.6	91.0/91.4
Disch Event HE/CE, ms	8.7/15.4	8.7/15.4	13.2/15.4	17.5/19.6	17.5/19.6	20.9/22.8
Suct Pseudo-Q HE/CE	3.9/4.0	3.9/4.0	4.2/4.0	2.4/2.1	2.4/2.1	4.7/4.1
Gas Rod Ld Comp, %	70.8 C	70.8 C	70.8 C	37.6 C	37.6 C	48.9 C
Gas Rod Ld Tens, %	70.0 T	70.0 T	70.0 T	30.6 T	30.6 T	38.5 T
Gas Rod Ld Total, %	72.8	72.8	72.8	35.4	35.4	45.3
Xhd Pin Deg/%Rvrsl lbf	168/91.4	168/91.4	163/83.5	162/85.4	162/85.4	166/78.1
Flow Calc, MMSCFD	13.834	13.834	18.795	23.232	23.232	46.463
Cyl BHP	662.7	662.7	901.5	573.5	573.5	880.6



# Gas Analysis Data



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 3:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

Services	Service					
Gas Model	VMG					
Gas Type	FIELDGAS					
Stage	# 1	# 1	# 2	# 3	Final	Final
Stream	Main	Vapor	Vapor	Vapor	Liq1	Vapor
Suction Press, psig	175.00	173.11	419.68	653.86		875.00
Disch Press, psig		425.97	663.86	885.00		875.00
Suction Temp, F	80.00	80.00	120.00	120.00		120.00
Disch Temp, F		199.34	184.35	173.75		120.00
Flow, MMSCFD	46.463	46.463	46.463	46.463	0.024	46.439
Flow, lb/h	105615.0	105615.0	105615.2	105614.9	47.8	105567.2
Flow, GPM					0.097	
Dropout, %					0.052	
Specific Gravity	0.7148	0.7148	0.7148	0.7148	0.9865	0.7148
Mole Weight	20.70	20.70	20.70	20.70	18.02	20.70
Ratio of Sp Ht (N)		1.2495	1.2572	1.2704		N/A
Comp Suct (Zs)		0.9533	0.9160	0.8740		0.8376
Comp Disch (Zd)		0.9402	0.9087	0.8708		0.8376
Humidity	100.00	100.00				
WATER	0.27191	0.27191	0.27191	0.27191	99.90795	0.22011
METHANE	77.39690	77.28685	77.28685	77.28685	0.07508	77.32699
ETHANE	14.75420	14.73322	14.73322	14.73322	0.01206	14.74087
PROPANE	4.70520	4.69851	4.69851	4.69851	0.00251	4.70095
ISOBUTANE	0.56700	0.56619	0.56619	0.56619	0.00006	0.56649
n-BUTANE	1.20410	1.20239	1.20239	1.20239	0.00039	1.20301
ISOPENTANE	0.28520	0.28479	0.28479	0.28479	0.00002	0.28494
n-PENTANE	0.29700	0.29658	0.29658	0.29658	0.00002	0.29673
n-HEXANE	0.17330	0.17305	0.17305	0.17305		0.17314
CARBON DIOXIDE	0.12490	0.12472	0.12472	0.12472	0.00168	0.12479
NITROGEN	0.36230	0.36178	0.36178	0.36178	0.00022	0.36197



# Gas Analysis Data



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 3:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

## Calculated Gas Properties:

### Services

### Service

Gas Model VMG  
 Gas Type FIELDGAS

Stage	# 1	# 1	# 2	# 3	Final	Final
Stream	Main	Vapor	Vapor	Vapor	Liq1	Vapor
Comp @ Std (Zstd)		0.9959	0.9959	0.9959		0.9959
Density @ Std, lb/ft3		0.055	0.055	0.055		0.055

### Suction:

Press, psig		173.11	419.68	653.86		875.00
Temp, F		80.00	120.00	120.00		120.00
Density, lb/ft3		0.701	1.575	2.543	61.61	3.534
Enthalpy, Btu/lb		216.61	228.39	219.57		211.17
Entropy, Btu/lb-F		2.0094	1.9550	1.9027		1.8643
Speed of Sound, ft/s		1233.72	1251.24	1229.74		1217.91
Pseudo-Pc, psig		660.447	660.447	660.447		659.136
Pseudo-Tc, F		-57.79	-57.79	-57.79		-58.18
Cp, Btu/lb-F		0.5165	0.5586	0.5928		0.6295
Cv, Btu/lb-F		0.3998	0.4183	0.4215		0.4246
K		1.2920	1.3355	1.4065		1.4825
Z at Flange		0.9533	0.9160	0.8740		0.8376
Interal Energy, Btu/lb		167.2735	177.4720	171.0004		164.6482
JT Coefficient, F/psi		0.0802	0.0669	0.0639		0.0602
Viscosity, lb/ft-s		7.10e-06	7.67e-06	7.92e-06		8.03e-06
Thermal Cond., Btu/ft-h-F		1.96e-02	2.27e-02	2.41e-02		2.55e-02
NHV Mass, Btu/lb		20750.85	20750.85	20750.85		20760.23

### Discharge:

Press, psig		425.97	663.86	885.00		875.00
Temp, F		199.34	184.35	173.75		120.00
Density, lb/ft3		1.360	2.222	3.101		3.534
Enthalpy, Btu/lb		273.15	257.39	244.30		211.17
Entropy, Btu/lb-F		2.0261	1.9633	1.9184		1.8643
Speed of Sound, ft/s		1350.24	1319.31	1298.40		1217.91
Pseudo-Pc, psig		660.447	660.447	660.447		659.136
Pseudo-Tc, F		-57.79	-57.79	-57.79		-58.18
Cp, Btu/lb-F		0.5766	0.5957	0.6188		0.6295
Cv, Btu/lb-F		0.4500	0.4464	0.4447		0.4246
K		1.2814	1.3344	1.3915		1.4825
Z at Flange		0.9462	0.9134	0.8827		0.8376
Interal Energy, Btu/lb		213.3435	200.9771	190.6835		164.6481
JT Coefficient, F/psi		0.0500	0.0501	0.0492		0.0602
Viscosity, lb/ft-s		8.51e-06	8.49e-06	8.57e-06		8.03e-06
Thermal Cond., Btu/ft-h-F		2.64e-02	2.68e-02	2.75e-02		2.55e-02
NHV Mass, Btu/lb		20750.85	20750.85	20750.85		20760.23
Heat Load, BTU/h		4.79e+06	4.04e+06	3.52e+06		N/A



# Ariel Performance



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 4:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

### Compressor Data:

Elevation,ft:	1500.00	Barmtr,psia:	13.906	Ambient,F:	100.00
Frame: <b>(ELP)</b>	KBZ/6	Stroke, in:	6.75	Rod Dia, in:	2.875
Max RL Tot, lbf:	150000	Max RL Tens, lbf:	75000	Max RL Comp, lbf:	80000
Rated RPM:	1000	Rated BHP:	7800.0	Rated PS FPM:	1125.0
Calc RPM:	885.0	BHP:	4251	Calc PS FPM:	995.6

### Driver Data:

Type:	Electric
Mfg:	Toshiba
Model:	4500HP
BHP:	4500
Avail:	4500

### Services

Gas Model

### Service 1

VMG

### Stage Data:

	1	---	---	2	---	3
Target Flow, MMSCFD	50.000	---	---	50.000	---	50.000
Flow Calc, MMSCFD	53.128	---	---	53.127	---	53.128
BHP per Stage	2188.8	---	---	1247.1	---	754.3
Specific Gravity	0.7148	---	---	0.7148	---	0.7148
Ratio of Sp Ht (N)	1.2550	---	---	1.2603	---	1.2742
Comp Suct (Zs)	0.9410	---	---	0.9064	---	0.8627
Comp Disch (Zd)	0.9280	---	---	0.8998	---	0.8607
Pres Suct Line, psig	225.00	---	---	N/A	---	N/A
Pres Suct Flg, psig	222.61	---	---	471.62	---	720.61
Pres Disch Flg, psig	478.98	---	---	730.61	---	885.00
Pres Disch Line, psig	N/A	---	---	N/A	---	875.00
Pres Ratio F/F	2.084	---	---	1.533	---	1.224
Temp Suct, F	80.00	---	---	120.00	---	120.00
Temp Clr Disch, F	120.00	---	---	120.00	---	120.00

### Cylinder Data:

	Throw 1	Throw 3	Throw 5	Throw 4	Throw 6	Throw 2
Cyl Model	15-7/8Z:10	15-7/8Z:10	15-7/8Z:10	11-3/8ZM	11-3/8ZM	12-1/2Z:10
Cyl Bore, in	15.875	15.875	15.875	11.375	11.375	12.000
Cyl RDP (API), psig	768.2	768.2	768.2	1545.5	1545.5	1545.5
Cyl MAWP, psig	845.0	845.0	845.0	1700.0	1700.0	1700.0
Cyl Action	<u>CE(HEVR)</u>	DBL	DBL	DBL	DBL	DBL
Cyl Disp, CFM	661.8	1346.1	1346.1	680.2	680.2	759.5
Pres Suct Intl, psig	212.03	211.63	211.63	461.63	461.63	683.05
Temp Suct Intl, F	87	85	85	123	123	122
Pres Disch Intl, psig	500.15	500.94	500.94	748.93	748.93	931.00
Temp Disch Intl, F	187	185	185	182	182	161
HE Suct Gas Vel, FPM	N/A	6585	6585	4518	4518	6918
HE Disch Gas Vel, FPM	N/A	5807	5807	4307	4307	5954
HE Sprcs Used/Max	N/A	0/6	0/6	0/4	0/4	0/4
HE Vol Pkt Avail, %	N/A	4.24+38.77	4.24+38.77	5.23+28.86	5.23+28.86	3.56+25.41
Vol Pkt Used, %	N/A %	43.02 (F) %	43.02 (F) %	5.23 (F) %	5.23 (F) %	3.56 (F) %
HE Min Clr, %	N/A	17.21	17.21	29.12	29.12	19.91
HE Total Clr, %	N/A	60.23	60.23	34.35	34.35	23.47
CE Suct Gas Vel, FPM	6369	6369	6369	4230	4230	6521
CE Disch Gas Vel, FPM	5616	5616	5616	4032	4032	5612
CE Sprcs Used/Max	0/6	0/6	0/6	0/4	0/4	0/4
CE Min Clr, %	18.26	18.26	18.26	32.10	32.10	21.63
CE Total Clr, %	18.26	18.26	18.26	32.10	32.10	21.63
Suct Vol Eff HE/CE, %	N/A/81.1	46.7/81.1	46.7/81.1	82.6/83.5	82.6/83.5	93.4/93.7
Disch Event HE/CE, ms	N/A/16.9	10.7/16.9	10.7/16.9	17.9/20.0	17.9/20.0	23.0/24.7
Suct Pseudo-Q HE/CE	N/A/4.0	4.2/4.0	4.2/4.0	2.5/2.2	2.5/2.2	4.7/4.2
Gas Rod Ld Comp, %	4.8 C	73.4 C	73.4 C	40.3 C	40.3 C	40.7 C
Gas Rod Ld Tens, %	69.2 T	71.9 T	71.9 T	32.4 T	32.4 T	29.3 T
Gas Rod Ld Total, %	37.2	75.1	75.1	37.7	37.7	36.3
Xhd Pin Deg/%Rvrsl lbf	86/62.6	173/80.8	173/80.8	163/81.4	163/81.4	162/80.9
Flow Calc, MMSCFD	12.548	20.290	20.290	26.564	26.564	53.128
Cyl BHP	528.7	830.1	830.1	623.6	623.6	754.3





# Gas Analysis Data



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 4:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

Services	Service				
Gas Model	VMG				
Gas Type	FIELDGAS				
Stage	# 1	# 1	# 2	# 3	Final
Stream	Main	Vapor	Vapor	Vapor	Vapor
Suction Press, psig	225.00	222.61	471.62	720.61	875.00
Disch Press, psig		478.98	730.61	885.00	875.00
Suction Temp, F	80.00	80.00	120.00	120.00	120.00
Disch Temp, F		185.31	182.38	161.19	120.00
Flow, MMSCFD	53.128	53.128	53.127	53.128	53.128
Flow, lb/h	120772.7	120772.7	120772.0	120772.4	120772.4
Flow, GPM					
Dropout, %					
Specific Gravity	0.7148	0.7148	0.7148	0.7148	0.7148
Mole Weight	20.70	20.70	20.70	20.70	20.70
Ratio of Sp Ht (N)		1.2550	1.2603	1.2742	N/A
Comp Suct (Zs)		0.9410	0.9064	0.8627	0.8376
Comp Disch (Zd)		0.9280	0.8998	0.8607	0.8376
Humidity	100.00	100.00			
WATER	0.21725	0.21725	0.21725	0.21725	0.21725
METHANE	77.39690	77.32920	77.32920	77.32920	77.32920
ETHANE	14.75420	14.74130	14.74130	14.74130	14.74130
PROPANE	4.70520	4.70108	4.70108	4.70108	4.70108
ISOBUTANE	0.56700	0.56650	0.56650	0.56650	0.56650
n-BUTANE	1.20410	1.20305	1.20305	1.20305	1.20305
ISOPENTANE	0.28520	0.28495	0.28495	0.28495	0.28495
n-PENTANE	0.29700	0.29674	0.29674	0.29674	0.29674
n-HEXANE	0.17330	0.17315	0.17315	0.17315	0.17315
CARBON DIOXIDE	0.12490	0.12479	0.12479	0.12479	0.12479
NITROGEN	0.36230	0.36198	0.36198	0.36198	0.36198





# Gas Analysis Data



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 4:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

## Calculated Gas Properties:

### Services

### Service

Gas Model VMG  
 Gas Type FIELDGAS

Stage	# 1	# 1	# 2	# 3	Final
Stream	Main	Vapor	Vapor	Vapor	Vapor
Comp @ Std (Zstd)		0.9959	0.9959	0.9959	0.9959
Density @ Std, lb/ft3		0.055	0.055	0.055	0.055

### Suction:

Press, psig	222.61	471.62	720.61	875.00
Temp, F	80.00	120.00	120.00	120.00
Density, lb/ft3	0.898	1.782	2.834	3.534
Enthalpy, Btu/lb	214.54	226.44	217.03	211.17
Entropy, Btu/lb-F	1.9839	1.9414	1.8900	1.8643
Speed of Sound, ft/s	1225.02	1245.68	1225.17	1217.90
Pseudo-Pc, psig	659.064	659.064	659.064	659.064
Pseudo-Tc, F	-58.21	-58.21	-58.21	-58.21
Cp, Btu/lb-F	0.5235	0.5658	0.6035	0.6295
Cv, Btu/lb-F	0.4005	0.4190	0.4224	0.4246
K	1.3072	1.3503	1.4286	1.4825
Z at Flange	0.9410	0.9064	0.8627	0.8376
Internal Energy, Btu/lb	165.8428	176.0568	169.1007	164.6478
JT Coefficient, F/psi	0.0800	0.0663	0.0629	0.0602
Viscosity, lb/ft-s	7.12e-06	7.70e-06	7.87e-06	8.03e-06
Thermal Cond., Btu/ft-h-F	1.98e-02	2.30e-02	2.45e-02	2.55e-02
NHV Mass, Btu/lb	20760.75	20760.75	20760.75	20760.75

### Discharge:

Press, psig	478.98	730.61	885.00	875.00
Temp, F	185.31	182.38	161.19	120.00
Density, lb/ft3	1.576	2.471	3.198	3.534
Enthalpy, Btu/lb	263.49	254.21	236.51	211.17
Entropy, Btu/lb-F	2.0006	1.9497	1.9056	1.8643
Speed of Sound, ft/s	1330.16	1314.10	1280.49	1217.90
Pseudo-Pc, psig	659.064	659.064	659.064	659.064
Pseudo-Tc, F	-58.21	-58.21	-58.21	-58.21
Cp, Btu/lb-F	0.5778	0.6023	0.6200	0.6295
Cv, Btu/lb-F	0.4448	0.4464	0.4399	0.4246
K	1.2990	1.3493	1.4094	1.4825
Z at Flange	0.9353	0.9049	0.8734	0.8376
Internal Energy, Btu/lb	205.6336	198.4978	184.5256	164.6478
JT Coefficient, F/psi	0.0520	0.0497	0.0514	0.0602
Viscosity, lb/ft-s	8.39e-06	8.52e-06	8.46e-06	8.03e-06
Thermal Cond., Btu/ft-h-F	2.60e-02	2.71e-02	2.70e-02	2.55e-02
NHV Mass, Btu/lb	20760.75	20760.75	20760.75	20760.75

Heat Load, BTU/h 4.53e+06 4.53e+06 3.10e+06 N/A



# Ariel Performance



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 5:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

### Compressor Data:

Elevation,ft:	1500.00	Barmtr,psia:	13.906	Ambient,F:	100.00
Frame: <b>(ELP)</b>	KBZ/6	Stroke, in:	6.75	Rod Dia, in:	2.875
Max RL Tot, lbf:	150000	Max RL Tens, lbf:	75000	Max RL Comp, lbf:	80000
Rated RPM:	1000	Rated BHP:	7800.0	Rated PS FPM:	1125.0
Calc RPM:	885.0	BHP:	4429	Calc PS FPM:	995.6

### Driver Data:

Type:	Electric
Mfg:	Toshiba
Model:	4500HP
BHP:	4500
Avail:	4500

### Services

Gas Model

### Service 1

VMG

### Stage Data:

	1	---	---	2	---	3
Target Flow, MMSCFD	50.000	---	---	50.000	---	50.000
Flow Calc, MMSCFD	59.393	---	---	59.393	---	59.393
BHP per Stage	2415.2	---	---	1338.2	---	614.8
Specific Gravity	0.7148	---	---	0.7148	---	0.7148
Ratio of Sp Ht (N)	1.2571	---	---	1.2629	---	1.2774
Comp Suct (Zs)	0.9349	---	---	0.8977	---	0.8525
Comp Disch (Zd)	0.9215	---	---	0.8918	---	0.8515
Pres Suct Line, psig	250.00	---	---	N/A	---	N/A
Pres Suct Flg, psig	247.36	---	---	519.42	---	781.89
Pres Disch Flg, psig	527.28	---	---	791.89	---	885.00
Pres Disch Line, psig	N/A	---	---	N/A	---	875.00
Pres Ratio F/F	2.071	---	---	1.511	---	1.130
Temp Suct, F	80.00	---	---	120.00	---	120.00
Temp Clr Disch, F	120.00	---	---	120.00	---	120.00

### Cylinder Data:

	Throw 1	Throw 3	Throw 5	Throw 4	Throw 6	Throw 2
Cyl Model	15-7/8Z:10	15-7/8Z:10	15-7/8Z:10	11-3/8ZM	11-3/8ZM	12-1/2Z:10
Cyl Bore, in	15.875	15.875	15.875	11.375	11.375	12.000
Cyl RDP (API), psig	768.2	768.2	768.2	1545.5	1545.5	1545.5
Cyl MAWP, psig	845.0	845.0	845.0	1700.0	1700.0	1700.0
Cyl Action	<u>CE(HEVR)</u>	DBL	DBL	DBL	DBL	DBL
Cyl Disp, CFM	661.8	1346.1	1346.1	680.2	680.2	759.5
Pres Suct Intl, psig	235.60	235.15	235.15	508.33	508.33	740.69
Temp Suct Intl, F	87	85	85	123	123	121
Pres Disch Intl, psig	550.69	551.57	551.57	811.94	811.94	932.30
Temp Disch Intl, F	187	185	185	181	181	151
HE Suct Gas Vel, FPM	N/A	6585	6585	4518	4518	6918
HE Disch Gas Vel, FPM	N/A	5807	5807	4307	4307	5954
HE Spcrs Used/Max	N/A	0/6	0/6	0/4	0/4	0/4
HE Vol Pkt Avail, %	N/A	4.24+38.77	4.24+38.77	5.23+28.86	5.23+28.86	3.56+25.41
Vol Pkt Used, %	N/A %	43.02 (F) %	43.02 (F) %	5.23 (F) %	5.23 (F) %	3.56 (F) %
HE Min Clr, %	N/A	17.21	17.21	29.12	29.12	19.91
HE Total Clr, %	N/A	60.23	60.23	34.35	34.35	23.47
CE Suct Gas Vel, FPM	6369	6369	6369	4230	4230	6521
CE Disch Gas Vel, FPM	5616	5616	5616	4032	4032	5612
CE Spcrs Used/Max	0/6	0/6	0/6	0/4	0/4	0/4
CE Min Clr, %	18.26	18.26	18.26	32.10	32.10	21.63
CE Total Clr, %	18.26	18.26	18.26	32.10	32.10	21.63
Suct Vol Eff HE/CE, %	N/A/81.3	47.3/81.3	47.3/81.3	83.3/84.1	83.3/84.1	95.3/95.5
Disch Event HE/CE, ms	N/A/16.9	10.9/16.9	10.9/16.9	18.1/20.2	18.1/20.2	25.0/26.6
Suct Pseudo-Q HE/CE	N/A/4.0	4.3/4.0	4.3/4.0	2.5/2.2	2.5/2.2	4.8/4.3
Gas Rod Ld Comp, %	5.3 C	80.3 C	80.3 C	42.8 C	42.8 C	33.2 C
Gas Rod Ld Tens, %	75.7 T	78.6 T	78.6 T	34.0 T	34.0 T	20.8 T
Gas Rod Ld Total, %	40.7	82.1	82.1	39.8	39.8	28.1
Xhd Pin Deg/%Rvrsl lbf	84/60.4	179/80.8	179/80.8	163/78.0	163/78.0	159/85.0
Flow Calc, MMSCFD	13.986	22.703	22.703	29.697	29.697	59.393
Cyl BHP	581.8	916.7	916.7	669.1	669.1	614.8



# Gas Analysis Data



Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 5:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4

7.7.4.0

Services	Service				
Gas Model	VMG				
Gas Type	FIELDGAS				
<b>Stage</b>	<b># 1</b>	<b># 1</b>	<b># 2</b>	<b># 3</b>	<b>Final</b>
<b>Stream</b>	<b>Main</b>	<b>Vapor</b>	<b>Vapor</b>	<b>Vapor</b>	<b>Vapor</b>
Suction Press, psig	250.00	247.36	519.42	781.89	875.00
Disch Press, psig		527.28	791.89	885.00	875.00
Suction Temp, F	80.00	80.00	120.00	120.00	120.00
Disch Temp, F		185.32	180.90	150.64	120.00
Flow, MMSCFD	59.393	59.393	59.393	59.393	59.393
Flow, lb/h	135018.7	135018.7	135019.0	135018.7	135018.7
Flow, GPM					
Dropout, %					
Specific Gravity	0.7148	0.7148	0.7148	0.7148	0.7148
Mole Weight	20.70	20.70	20.70	20.70	20.70
Ratio of Sp Ht (N)		1.2571	1.2629	1.2774	N/A
Comp Suct (Zs)		0.9349	0.8977	0.8525	0.8376
Comp Disch (Zd)		0.9215	0.8918	0.8515	0.8376
Humidity	100.00	100.00			
WATER	0.19770	0.19770	0.19770	0.19770	0.19770
METHANE	77.39690	77.34436	77.34436	77.34435	77.34435
ETHANE	14.75420	14.74418	14.74418	14.74418	14.74418
PROPANE	4.70520	4.70201	4.70201	4.70201	4.70201
ISOBUTANE	0.56700	0.56662	0.56662	0.56662	0.56662
n-BUTANE	1.20410	1.20328	1.20328	1.20328	1.20328
ISOPENTANE	0.28520	0.28501	0.28501	0.28501	0.28501
n-PENTANE	0.29700	0.29680	0.29680	0.29680	0.29680
n-HEXANE	0.17330	0.17318	0.17318	0.17318	0.17318
CARBON DIOXIDE	0.12490	0.12482	0.12482	0.12482	0.12482
NITROGEN	0.36230	0.36205	0.36205	0.36205	0.36205



# Gas Analysis Data

Company: Dearing Compressor & Pump  
 Quote: 17-0915A-R0  
 Case 5:

Customer: Cone Gathering (CNX Gas Co)  
 Inquiry: Nathan Horne  
 Project: Majorsville #4



## Calculated Gas Properties:

Services	Service	# 1	# 2	# 3	Final
Gas Model	VMG				
Gas Type	FIELDGAS				
<b>Stage</b>	<b># 1</b>	<b># 1</b>	<b># 2</b>	<b># 3</b>	<b>Final</b>
<b>Stream</b>	<b>Main</b>	<b>Vapor</b>	<b>Vapor</b>	<b>Vapor</b>	<b>Vapor</b>
Comp @ Std (Zstd)		0.9959	0.9959	0.9959	0.9959
Density @ Std, lb/ft3		0.055	0.055	0.055	0.055

## Suction:

Press, psig	247.36	519.42	781.89	875.00
Temp, F	80.00	120.00	120.00	120.00
Density, lb/ft3	0.999	1.977	3.108	3.534
Enthalpy, Btu/lb	213.50	224.64	214.70	211.16
Entropy, Btu/lb-F	1.9728	1.9300	1.8792	1.8641
Speed of Sound, ft/s	1220.79	1240.95	1221.72	1217.88
Pseudo-Pc, psig	658.569	658.569	658.569	658.569
Pseudo-Tc, F	-58.36	-58.36	-58.36	-58.36
Cp, Btu/lb-F	0.5272	0.5726	0.6136	0.6295
Cv, Btu/lb-F	0.4009	0.4197	0.4233	0.4246
K	1.3151	1.3644	1.4496	1.4825
Z at Flange	0.9349	0.8977	0.8525	0.8376
Interal Energy, Btu/lb	165.1194	174.7439	167.3421	164.6454
JT Coefficient, F/psi	0.0798	0.0658	0.0619	0.0602
Viscosity, lb/ft-s	7.13e-06	7.74e-06	7.93e-06	8.03e-06
Thermal Cond., Btu/ft-h-F	2.00e-02	2.33e-02	2.49e-02	2.55e-02
NHV Mass, Btu/lb	20764.28	20764.28	20764.28	20764.28

## Discharge:

Press, psig	527.28	791.89	885.00	875.00
Temp, F	185.32	180.90	150.64	120.00
Density, lb/ft3	1.741	2.703	3.286	3.534
Enthalpy, Btu/lb	262.05	251.48	229.96	211.16
Entropy, Btu/lb-F	1.9898	1.9385	1.8948	1.8641
Speed of Sound, ft/s	1327.24	1310.19	1265.02	1217.88
Pseudo-Pc, psig	658.569	658.569	658.569	658.569
Pseudo-Tc, F	-58.36	-58.36	-58.36	-58.36
Cp, Btu/lb-F	0.5825	0.6087	0.6217	0.6295
Cv, Btu/lb-F	0.4454	0.4465	0.4360	0.4246
K	1.3078	1.3632	1.4260	1.4825
Z at Flange	0.9295	0.8974	0.8649	0.8376
Interal Energy, Btu/lb	204.5486	196.3610	179.3605	164.6454
JT Coefficient, F/psi	0.0515	0.0492	0.0535	0.0602
Viscosity, lb/ft-s	8.42e-06	8.55e-06	8.37e-06	8.03e-06
Thermal Cond., Btu/ft-h-F	2.62e-02	2.73e-02	2.66e-02	2.55e-02
NHV Mass, Btu/lb	20764.28	20764.28	20764.28	20764.28
Heat Load, BTU/h	5.11e+06	5.00e+06	2.59e+06	N/A

**TOSHIBA INTERNATIONAL CORPORATION**

INDUSTRIAL DIVISION  
13131 WEST LITTLE YORK ROAD      HOUSTON, TX 77041  
PHONE: (713) 466-0277                (800) 231-1412  
FACSIMILE: (713) 466-8773

**QUOTATION (MEDIUM VOLTAGE MOTORS)**

**To:** Dearing  
**Cc:** Jeff Williams  
**Date:** 9/11/2017  
**Quote #:** 1027793  
**Engineering Ref #:**

**General Scope**

<b>Item</b>	<b>1</b>
<b>Mounting</b>	Horizontal
<b>Quantity</b>	1
<b>HP Rating</b>	4500 HP
<b>Speed</b>	900 RPM
<b>Phase-Hz-Volts</b>	3-60-4000 V
<b>Enclosure</b>	WP11
<b>Estimated Frame Size</b>	560-2000
<b>Service Factor</b>	1.15
<b>Bearing Construction</b>	Sleeve
<b>Rotor Construction</b>	Copper
<b>Insulation Class</b>	Class F - Epoxy resin
<b>Ambient Temperature</b>	40 deg C
<b>Temperature Rise</b>	B @ 1.0 SF by RM
<b>Altitude</b>	<= 3300 ft asl
<b>Coupling Method</b>	Direct Coupled
<b>Load Inertia</b>	125.7 lb-ft <sup>2</sup>
<b>Rotation</b>	Bi-dir (CW from NDE)
<b>Starting Method</b>	VFD Start Only with Bypass
<b>Hazardous Area</b>	Class 1 Div 2 Group B, C, D, T3
<b>Applicable Standards</b>	NEMA MG1 / IEEE112

**Price/Unit**  
**Total (Each Item)**

**Features (All motors, Unless otherwise indicated)**

Functional Duplicate of TIC 717845 / Dearing 418224  
Non-Witnessed Routine Test

**Delivery/Freight**

33 Weeks AAO  
Delivered Duty Paid First US Destination  
Incoterms 2010

AAO = After Acceptance of Order  
Title and Risk of Loss transfer at delivering point.

**Comments**

Motor quoted from basic description (no spec supplied).  
Toshiba routine testing quoted.  
All other specifications are not considered.  
No Wk2 was specified, less than NEMA inertia load quoted for all ratings.

Spare parts and special tools are not included in this quotation.  
We would re-quote when some new requirements come after this proposal.  
Customer to supply accurate load data in order to determine motor suitability for the application.  
Quote subject to change after this information is provided.

**Commercial Terms**

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Price valid for orders placed within 60 days from date of Quotation.  
All orders subject to acceptance by TIC.  
Payment terms subject to credit approval.  
See Project Deliverables Schedule for an explanation of the project time line.  
Progress payments may be required.  
Lead times for motors and documentation are AAO and subject to engineering and plant loading at time of order.  
Orders cancelled after 10 days from TIC's receipt of order are subject to cancellation charges.  
TIC Standard Terms and Conditions of Sale apply unless otherwise provided on the face of this document. Any additional or contrary terms and any standard or pre-printed terms and conditions in customer order documents are rejected and shall be null and void and of no force and effect. TIC's Standard Terms and Conditions of Sale are available at [www.toshiba.com/ind](http://www.toshiba.com/ind) or by calling 1-800-231-1412.  
All certified submittals will be provided in TIC standard format, 8 weeks after acceptance of an order.  
Standard 12/18 months warranty (from install/shipment) applies unless otherwise stated on this document.  
Extended warranty is available for extra cost.

**Proposed Progress Payments where applicable - Ref ONLY**

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20% due upon issuance of general assembly drawings.  
60% due upon completion of motor testing.  
15% due upon transfer of title.  
5% due upon acceptance of final vendor data package, not to exceed 180 days from invoice date.

**Cancellation Schedule (After order acceptance) - Ref ONLY**

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0-8 weeks: 5%  
9-12 weeks: 30%  
13-18 weeks: 50%  
19-24 weeks: 80%  
25+ weeks: 100%

## ***Project Deliverables Schedule***

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### **Order Review and Acceptance**

TIC will address any concerns within 1 week after receipt of technically and commercially clear purchase order (Order). TIC requires all concerns to be resolved by Customer prior to TIC's acceptance of Order.

It is TIC's recommendation for Customer to be involved with pre-award activities or kick-off meetings in order to better understand the project requirements and to meet the project schedule.

### **Approval Drawings**

6 to 8 weeks after acceptance of Order, TIC will provide customer with certified general arrangement drawings for approval.

Delivery time of additional approval documents must be separately agreed upon by TIC.

### **Review Cycle (If Required)**

TIC allows two weeks for Customer to review and return marked-up approval drawings. "Release to Manufacture" is required in order for delivery schedule to be adhered to.

### **Re-submittal**

If resubmittals of drawings are required, TIC will submit the revised drawings after 4 weeks from the technical and commercial acceptance of the changes requested.

### **Design Freeze**

Design freeze will be in effect after receipt of "Release to Manufacture."

Subsequent changes after design freeze will result in both commercial and delivery impact.

### **Equipment Delivery**

Based on current plant loading, TIC has offered the delivery time quoted above, which will begin after design freeze.

Lead time is subject to confirmation at the time of order (dependent on prior sales).

TIC will acknowledge the estimated ship date at the time that the Order is received or at notice of award. TIC will make every effort to honor the lead time quoted, given there is no significant change related to the plant loading during the approval process.

### **Equipment or Information Supplied by Client**

If applicable, any information required or materials supplied by customer are required to be received in full at least 6 weeks prior to shipment date.

Failure to receive this data / material may result in delays of shipment.

### **Client Inspection and Witness Test**

If required, this will extend the lead time and will be scheduled 1 to 2 weeks prior to the shipment date.

Any changes requested during acceptance test will result in commercial and schedule impacts.

### **Project / Product Documentation**

One operating manual and test report will ship with the motor.

Additional documentation per project scope of supply and Order requirement will be provided 4 weeks after shipment of equipment-Submittals will be submitted electronically.

### **Changes After Manufacturing Completion or Shipment**

Changes requested after manufacturing completion / shipment will be subject to TIC Field Service Rates and TIC Field Service Terms and Conditions.

# air-x-limited

2230 East 49th Street Tulsa, Oklahoma 74105  
PHONE: (918) 743-6111 FAX: (918) 742-7039  
E-mail: [bnopper@airxlimited.com](mailto:bnopper@airxlimited.com)

<b>Purchaser:</b> DEARING COMPRESSOR	<b>From:</b> BRIAN NOPPER
<b>To:</b> JOHN MENTZER	<b>Date:</b> September 2, 2017
<b>PO #:</b> DUP 147773	<b>End User:</b> CNX GAS COMPANY
<b>Proposal #:</b> 177774	<b>Destination:</b> CONE GATHERING MAJORSVILLE #4
<b>No. Pages:</b> 2	<b>Reference:</b> EM-KBZ6 4500HP @1000RPM

## PROPOSAL

In response to subject inquiry, we propose the following design in accordance with specification sheet: **177774**

Dated: **9/2/2017**

Comments: *Exact duplicate of existing job #147773. Designed in accordance with AXH Air-Coolers Design & Manufacturing Standards unless otherwise specified. Exception is taken to all other specifications.*

**(1) Model: 156-2ZF Est. Overall Size, Ft 44'L x 16'W**

V-BELT DRIVE BY (2) 50HP, 1800RPM, 460/60/3, TEFC, VFD COMP. MOTOR

Extended lube lines

(3) sets standard manual discharge shutters over gas

**CLO Service – Mounted underneath gas sections**

SA214 Tubing

**Gas Services -**

SA214 Tubing

1/16" Corrosion Allowance

1" Coupling opposite gas outlet

100% UT / X-Ray of nozzle butt welds

Galvanized structure with painted side frames and headers

**Fan(s):** (2) MOORE-10K-48VE EC  
Dia, In / # Blades: 156 / 6

Tip speed (fpm): 10,087  
Est. Noise Data: 82 dBA @1m, 66 dBA @ 15m

**Net price\* (USD):** FOB AXH Plant, Claremore, OK

each \$

*based on an order of 1 or more units*

Est. Shipment\* 18-20 Weeks

*\*Shipment is based not only on receipt of order but also on approval and a release to build. Please be aware that any changes made after a release for fabrication will result in a delay as well as having an impact on cost. The quoted price is firm for 30 days. Please confirm price and availability at time of order.*





**AXH air-coolers**  
air-x-limited

401 E. Lowry Road Phone (918) 283-9200  
Claremore, OK 74017 Fax (918) 283-9229  
[info@axh.com](mailto:info@axh.com) [www.axh.com](http://www.axh.com)

**Job No.** 177774

Date 9/2/2017

Page 1 OF 1

1	Purchaser	DEARING COMPRESSOR	Ultimate User	CNX GAS COMPANY
2	PO#	DUP 147773	Destination	CONE GATHERING MAJORSVILLE #4
3	# Units	1	Model	156-2ZF
4	Assembly	PACKAGED	Draft	FORCED
			Reference	EM-KBZ6 4500HP @1000RPM
			Est. Overall Size, Ft	44'L x 16'W
			Est. Wt.	LBS

**THERMAL & MECHANICAL DESIGN**

5	<b>Service</b>	IC-1*	IC-2*	AC*	CLO
6	Flow	64.7MMSCFD	64.7MMSCFD	50.6MMSCFD	113GPM
7	Fluid	.7148SPGR	.7148SPGR	.7148SPGR	SAE40
8	Temp. In / Out, °F	188.0 / 130.0	191.0 / 130.0	183.0 / 117.0	190.0 / 180.0
9	Pressure, PSI	534PSIG	802PSIG	875PSIG	
10	Pressure Drop, PSI	5.7	7.4	3.8	5.4
11	Heat Load, BTU/HR	4888410	5427000	4703783	314084
12	True LMTD	32.4	34.7	28.9	78.1
13	Overall Rate, U	89.3	102.6	92.0	27.9
14	Fouling Factor	.0020	.0020	.0020	.0010
15	Surface, Tube / Total, Sq Ft	1689 / 31579	1544 / 30569	1817 / 35979	144 / 2857
16	<b>Sections, #</b>	(1)	(1)	(1)	(1)
17	Design Temp, °F Max / Min	350 / -20	350 / -20	350 / -20	350 / -20
18	MWP / Test Press, PSIG	645 / 839	1138 / 1480	1440 / 1872	150 / 195
19	Pass Arrangement	CROSSFLOW	CROSSFLOW	CROSSFLOW	CROSSFLOW
20	# Tube Rows	5	5	5	1
21	# Tube Passes	2	2	2	2
22	<b>Tubes, OD x BWG</b>	1-1/2X16	1-1/4X16	1-1/4X14	1-1/4X16
23	Material	SA214 STEEL	SA214 STEEL	SA214 STEEL	SA214 STEEL
24	# Per Section / Length, Ft	103 / 42	113 / 42	133 / 42	28 / 16
25	Turbulators				SPIRAL
26	Accelerators				
27	<b>Fins, Type</b>	HI-EFF	HI-EFF	HI-EFF	HI-EFF
28	Material	AL	AL	AL	AL
29	<b>Nozzles, Rating / Type</b>	300RF	600RF	900RF	150RF
30	Material	SA105	SA105	SA105	SA105
31	# Inlets / Size In	(1) 10	(1) 10	(1) 8	(1) 3
32	# Outlets / Size In	(1) 10	(1) 10	(1) 8	(1) 3
33	<b>Headers, Type</b>	BOX	BOX	BOX	REC TUBE
34	Material	SA516-70	SA516-70	SA516-70	A500
35	Corrosion Allow, In	.0625	NONE	.0625	.0625
36	Grooved Tubesheet	DBL	DBL	DBL	SGL
37	Plugs, Type	SHOULDER	SHOULDER	SHOULDER	SHOULDER
38	Plugs Material	A105 STEEL	A105 STEEL	A105 STEEL	A105 STEEL
39	PWHT				
40	ASME Code & Nat'l Board	YES	YES	YES	
41	CRN				
42	<b>Add'l Specs &amp; Options</b>				
43	API				
44	Louvers / Hail Screen	MAN /	MAN /	MAN /	
45	<b>Inspection / NDT</b>	BX, UT	BX, UT	BX, UT	

**FX=** 100% X-Ray of all header seam, attachment & nozzle butt welds. **SX=** Spot X-Ray of 1 long seam & 1 end closure, per header  
**BX=** 100% X-Ray of all nozzle butt welds. **UT =** 100% UT of all header seam, attachment & nozzle butt welds. **H =** Hardness testing.

AIR-SIDE PERFORMANCE		FAN DATA		DRIVER DATA		STRUCTURAL	
46	Ambient Air Temp, In °F	95	Fan(s)	MOORE-10K-48VE EC	Type	Guards	FAN GUARD
47	Elevation, Ft	1500	Blade Material	ALUMINUM	V-BELT DRIVE BY (2) 50HP,		
48	Air Flow, SCFM	298,125	HP / Fan	32	1800RPM, 460/60/3, TEFC, VFD		
49	Outlet Air Temp, °F	140.9	Dia, In / # Blades	156 / 6	COMP. MOTOR		
50	Min Air Temp, °F	-20	RPM	247			
51			Tipspeed, FPM	10087			
52	<b>Est. Noise Data:</b>	82 dBA @1m, 66 dBA @ 15m	Pitch, Deg	7.8			

53 **Additional Info.** \* INCLUDES 10% EXCESS FLOWRATE AND HEATLOAD



# Sliding Stem Valve Specification

Customer: <b>DEARING COMPRESSOR AND PUMP CO</b>	Equipment & Controls Inc.	
Contact:	Contact: <b>Mark Abate</b>	
Customer Reference:	Sales Office Reference:	Lead Time:
Item: <b>10</b>	Quote: <b>004-MA-170908-0141537</b>	Rev: <b>A</b>
Rev:	Qty: <b>1</b>	
Tags:	Date Last Modified: <b>09/11/2017</b>	
Description: <b>NPS 3 HPT 667 Size 45i DVC6200 TopWorx Switches Factory Mtgs DVC6200/DVC2000</b>		
Service Description:		

<b>Service:</b> <b>Size and Type: NPS 3 HPT</b> <b>Body Style: Globe</b> Design Temp: <b>120 deg F</b> Design Press: <b>1250 psig</b> End Connect/In/Out: <b>3 CL900/RF Flg/RF Flg</b> Material: <b>WCC Steel</b> Ports: <b>1</b> Flow Direction: <b>Up</b>	<b>Positioner Type: DVC6200,HART Communicating-HC</b> Input Signal: <b>4 to 20 mA dc</b> Access: <b>67CFR Filter/Regulator</b> Gauges: <b>0-60 psig/0-4 bar</b> Action: <b>Direct</b> Certification: <b>Explosion Proof/Intrinsic Safe/Nonincendive,FM</b>
Trim Number: <b>207A</b> Cage Matl: <b>S17400 SST</b> Retainer Matl: Bushing Matl: Seat Ring Matl: <b>S41600 SST</b> <b>VALVE PLUG</b> Material: <b>S41600 SST</b> Guiding: <b>Cage</b> Balance: <b>Balanced</b> Shutoff Class: <b>ANSI CL IV</b> Port Size: <b>2 7/8 Inch</b> Characteristic: <b>Whisper III, Level A1</b> Stem Material: <b>S20910 SST</b> Stem Size: <b>1/2 Inch</b>	Controller Type: Action: Measure Element: Range: Output: Mounting: Airset: Mounting:
<b>Bonnet Style: Plain</b> Boss Size: <b>2 13/16</b> Packing: <b>Single PTFE</b> Access: Bolt, Bonnet: <b>SA-193-B7 Studs/2H Nuts NCF2</b> PackFlg/Bltg: <b>SST Pkg Flg, SST Studs &amp; Nuts</b>	Transducer: Input Signal: Output Signal: Action: Mounting: Airset: Certifications:
<b>Actuator: Spring &amp; Diaphragm</b> Type/Size: <b>667/45i</b> Travel: <b>2 Inch</b> Bench Set: <b>6-30 psi</b> Push Down To: <b>PDTC</b> Supply: <b>Air</b> To Actuator: <b>0 to 33 psig</b> Fails Valve: <b>Close</b> Handwheel: <b>None</b>	Line In: <b>3 in, SCH STD</b> Line Out: <b>3 in, SCH STD</b> Insulation: Service Cond: Process Fluid: <b>NATURAL GAS (0.60 SG)</b> Critical Pressure: <b>656.310 psig</b> Shutoff Drop: <b>1250 psi</b> Max Rated Cv: <b>111.0</b>

Variable Name	Unit	1	2	3	4
Volumetric Flow Rate Gas (Qg)	MMscfd	30.541	52.571	30.132	42.603
Inlet Pressure (P1)	psig	875.000	875.000	1250.000	1250.000
Outlet Pressure (P2)	psig	100.000	200.000	100.000	200.000
Inlet Temperature (T1)	deg F	120.000	120.000	120.000	120.000
M / Gg	SG	0.600	0.600	0.600	0.600
Specific heats ratio (gamma)		1.300	1.300	1.300	1.300
Kinematic Viscosity (Nu)	cSt	0.000	0.000	0.000	0.000
Sizing Coefficient (Cv)		38.949	67.164	25.503	37.633
% Open		28	45	21	28
Valve LpA(LpAeValve1m)	dB(A)	105	100	108	101

NOTES:



# Product Specification

Customer: <b>DEARING COMPRESSOR AND PUMP CO</b>	Equipment & Controls Inc.		
Contact:	Contact: <b>Mark Abate</b>		
Customer Reference:	Sales Office Reference:		Lead Time:
Item: <b>20</b>	Rev:	Qty: <b>1</b>	Quote: <b>004-MA-170908-0141537</b>
Tags:			Date Last Modified: <b>09/11/2017</b>
Description: <b>NPS 2 D4</b>			Rev: <b>A</b>
Service Description:			

Sliding Stem Valves: **D4-1596-52653**  
Valve Size: **NPS 2**  
NACE: **No**  
Body Material: **LCC Steel 20B101**  
End Connection: **RF Flg**  
Rating: **CL1500**  
Trim Style/Characteristic: **Micro-Form (Eq Pct)**  
Port Diameter: **1 1/4 Inch**  
Trim Material: **Standard**  
Bonnet O-Ring Material: **NBR**  
Actuator Type: **D4**  
Action: **Reverse (Fail Down)**  
Operating Range/Voltage: **0-30, 0-33, 0-35, 0-50 or 6-30 psig**  
Spring: **Heavy Rate**  
Body Style: **Globe**  
BWE Schedule: **Not App**  
Ports: **1**  
Flow: **Up**  
Guiding: **Post**  
Valve Plug Material: **S41000 SST/S41600 SST HT**  
Seat Ring Material: **S17400 SST DBL H1150**

Stem Material: **S20910 SST**  
Shutoff: **ANSI CL IV**  
Bonnet Style: **Standard**  
Packing: **Live Loaded PTFE**  
Actuator Casing/Enclosure Matrl: **Steel**  
Diaphragm Material: **CR/NYL**  
Effective Diaphragm Area: **69 sq in**  
Signal Connections: **1/4 NPT**  
Max Casing Pressure: **50 psig**  
Actuator Size: **40**  
Valve Action: **PDTC**  
Fails Valve: **Close**  
Travel: **3/4 Inch**  
Supplemental Attribute: **Not App**  
Pressure:  
Temperature:  
Type: **D4**  
Manufacturer: **Fisher**  
Flowing Drop:  
Shutoff Drop:

Special\_Services: **PSPL-695-4536545**  
C of C ASME B31: **No**  
C of C NACE: **No**  
Fisher Weld Documentation: **No**  
CMTR Weld Filler Material: **N/A**  
Hardness Test Results: **No**  
CSP Processing Required: **No**  
CMTR Plug/Disc, Seat, Stem/Shaft: **No**  
CMTR Plug/Disc, Seat, Cage, Stem/Shaft: **No**  
CMTR Pressure Bolting: **No**  
Declaration of Incorporation: **No**  
Hazardous Area C of C: **No**  
Enter Note on Order: **None Required**  
Canadian Registration Number(CRN): **No**  
Pressure Equipment Directive PED: **No**  
PMI Test Prior To Assy: **No**  
PMI Pressure Boundry SST Bolting: **No**  
Hydrostatic Test: **Standard, Unassembled**  
Valvelink/Flows scanner Test: **No**  
Tape Seal Wood End Covers: **No**  
Extended Storage Packaging: **No**  
Subject To Inspection: **No**  
Witness Seat Leak: **No**  
Witness Operational Test: **No**  
Inspect Boxing & Marking: **No**  
Witness Hydrostatic Test: **No**  
Subject to Inspect - India Boiler Regs(IBR): **No**

Witness PMI Test: **No**  
Mag Particle/Liquid Penetrant Trim: **No**  
Sanitary Valve Certification: **No**  
Radiographic Acceptance Criteria: **N/A**  
Min Wall Thickness Verification: **No**  
Lloyds Register Marine Type Approval Cert: **No**  
Mag Particle/Liquid Penetrant: **No**  
Standard Processing: **Yes**  
C of C & Trim Material Spec: **Metal Trim Parts**  
Certified Material Test Report(CMTR): **Pressure Boundary Parts**  
Assembly Test Results: **Yes**  
C of C & Manufacturer Data Report: **ASME Sec VIII**  
Requires Note Identifying: **Not App**  
Customer Data Sheets Required: **Not App**  
Process Level: **3**  
Steam Conditioning Valve Type: **Not App**  
Level-Trol Type: **Not App**  
Valve Type: **Sliding Stem**  
Diffuser Type: **Not App**  
Valve Size: **NPS 2**  
ANSI Class: **CL900 & Greater**  
Radiography: **No**  
Powder Coat or Wet Spray Paint: **Not App**  
Supplemental Attribute: **Not App**  
World Area Selections: **North America**

Sliding Stem Position Indicating Devices: **TOPW-1851-4487419S**  
Model Series: **D Series**  
Model Number: **DXP-M21GNEB**  
GO Switch Action: **Not App**  
D/T Series Switch Desc.: **(2) SPDT Mechanical**  
Mounting Parts: **Yes**  
Factory Mounted: **Yes**  
Actuator Type: **D4**  
Actuator Size: **D4**  
Actuator Max Travel: **4 Inch**  
Side Mounted Handwheel: **No**

Accessory Mounting Position: **Yoke 1**  
DVC Controller/Positioner: **No**  
Pilot Valve: **No**  
Type: **TopWorx**  
TXP Enclosure Type: **Not App**  
Approval Agency: **UL, ATEX, IEC Ex**  
Approval/Construction: **Explosion Proof/Flameproof**  
Supplemental Attribute: **Not App**  
Manufacturer: **Topworx**  
World Area Selections: **North America**

TO: John Mentzer  
COMPANY: Dearing Compressor and Pump

DATE: 09/05/2017  
APPLICATION: Motor Driven Compressor

PHONE: 330-599-5763  
MOBILE:  
FAX: 330-599-5724  
EMAIL: [john@dearingcomp.com](mailto:john@dearingcomp.com)

CUSTOMER REF: 52-30-10244  
END USER: CNX Gas  
PROJECT NAME: Majorsville  
PLATFORM: **A-B ControlLogix**  
QUANTITY: 1

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[css-solutions@fwmurphy.com](mailto:css-solutions@fwmurphy.com)

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### 1.0 PANEL OVERVIEW:

- THE PLC CONTROL SYSTEM WILL BE HOUSED IN ONE **60" H X 60" W X 18" D** 304 STAINLESS STEEL ENCLOSURE (DOUBLE DOOR) WITH **12" H** MATERIAL MATCHING STAND
- THE PLC CONTROL SYSTEM ENCLOSURE IS NEMA/TYPE **4X** RATED (IP66).
- THE OPERATION INTERFACE WILL BE **SCHNEIDER ELECTRIC MAGELIS 15"** COLOR TOUCH SCREEN. THE SCREENS WILL DISPLAY SYSTEM STATUS, PROCESS VARIABLE READOUTS, AND ALARM/SHUTDOWN MESSAGES. THE OPERATOR WOULD HAVE ABILITY TO CHANGE THE SHUTDOWN SET POINTS FROM THE SCREEN (NOTE: SETPOINTS WILL BE USERNAME AND PASSWORD PROTECTED).
- PLC CONTROLLER WILL BE **ALLEN-BRADLEY CONTROLLOGIX L71** PROCESSOR WITH 2MB MEMORY

### 2.0 AREA CLASSIFICATION:

- **cCSA<sub>US</sub>** LISTED - CLASS I, DIVISION 2, GROUPS C & D HAZARDOUS AREA.

### 3.0 PANEL POWER:

- THE PANEL IS TO BE POWERED BY CUSTOMER SUPPLIED **100-130VAC / 1 PH / 50-60HZ**. A POWER SUPPLY WILL BE PROVIDED TO STEP DOWN THE VOLTAGE FROM **100-130VAC TO 24VDC**.

### 4.0 COMMUNICATIONS:

- COMMUNICATION PROVIDED IS DF1 (RS232), MANAGED ETHERNET (COPPER AND FIBER).
- FIBER OPTIC CONNECTIONS PROVIDED ARE TYPE SC / MULTI-MODE.

### 5.0 AMBIENT TEMPERATURE:

- AMBIENT TEMPERATURE RANGE (OPERATIONAL): **0 °F ~ 115 °F** W/ HEATING AND COOLING APPARATUS IN OPERATION.
- THERMOSTAT CONTROLLED HEATERS WILL BE MOUNTED INSIDE THE CONTROL PANEL TO BRING PANEL INTERNAL TEMPERATURE ABOVE THE MINIMUM ALLOWABLE COMPONENT OPERATING TEMPERATURE.
- AIR TO AIR HEAT EXCHANGER (COOLER) WILL BE MOUNTED TO THE SIDE OF THE CONTROL PANEL TO BRING PANEL INTERNAL TEMPERATURE BELOW THE MAXIMUM ALLOWABLE COMPONENT OPERATING TEMPERATURE.

**6.0 RECOMMENDED SOLUTION:**

**6.1 CONTROL PANEL I/O LIST**

SEE DRAWING 52-30-10244 FOR DETAILS.

**6.2 CONTROL PANEL LIST OF MAJOR PARTS**

QTY	DESCRIPTION	MANUFACTURER	MFG. PART NO.
	<b>HMI</b>		
1	MAGELIS, 15" COLOR HMI W/ TOUCH, 1 SERIAL (232/422/485) AND 1 ETHERNET PORT, 24VDC	SCHNEIDER ELECTRIC	XBTGT7340
	<b>PLC</b>		
1	17 SLOT CONTROLLOGIX CHASSIS	ALLEN-BRADLEY	1756-A17
1	19.2 - 32V DC POWER SUPPLY (5V @ 13A)	ALLEN-BRADLEY	1756-PB75
1	CONTROLLOGIX5571 CONTROLLER WITH 2 MBYTE MEMORY	ALLEN-BRADLEY	1756-L71
1	CLX ETHERNET/IP 10/100 BRIDGE MODULE - TWISTED PR	ALLEN-BRADLEY	1756-ENBT
3	10-31 VDC INPUT 16 PTS (20 PIN) (TBNH/TBSH)	ALLEN-BRADLEY	1756-IB16
3	N.O. ISOLATED RELAY OUTPUT 16 PTS (36 PIN) (TBCH/TBS6H)	ALLEN-BRADLEY	1756-OW16I
4	ANALOG INPUT - CURRENT/VOLTAGE 16 PTS (36 PIN) (TBCH/TBS6H)	ALLEN-BRADLEY	1756-IF16
2	ANALOG OUTPUT - CURRENT/VOLTAGE 8 PTS (20 PIN) (TBNH/TBSH)	ALLEN-BRADLEY	1756-OF8
3	20 POSITION NEMA SCREW CLAMP BLOCK	ALLEN-BRADLEY	1756-TBNH
5	36 PIN SCREW CLAMP BLOCK WITH STANDARD HOUSING	ALLEN-BRADLEY	1756-TBCH
7	EMPTY SLOT FILLER CARD (ONE FILLER PER PACKAGE)	ALLEN-BRADLEY	1756-N2
1	JUMPER COMB FOR TBCH (PACK OF 25)	ALLEN-BRADLEY	1756-JMPR
	<b>COMMUNICATIONS</b>		
1	MANAGED ETHERNET SWITCH WITH 6 10/100 BASETX PORTS AND 2 MULTI-MODE FIBER (SC) PORTS	HIRSCHMANN	RSB20-0800M2M2TAAB
2	ETHERNET PATCH CABLE, RJ45 CAT 5E ; 10 FT LENGTH	A-TEL	AT1510EVBV
	<b>PB, SW, RELAY,LIGHT,ETC.</b>		
2	SELECTOR SWITCH, 2 POS/MAINTAINED, 10A CONTACTS, NEMA 4X, 1NO/1NC, CLD2	C3CONTROLS	HSS02/CBFSR/SHWE
1	PUSH/PULL BUTTON (E-STOP), NEMA 4X, PUSH-PULL, 1NO/1NC	C3CONTROLS	HPBO-HPPMCRD-CBFS
1	LOCKING RING,CC,TTW,	C3CONTROLS	TTW
1	PUSHBUTTON GUARD	C3CONTROLS	PPGD
1	CONTACT BLOCK, SEALED, 1NO 1NC	C3CONTROLS	CBFS
3	PUSHBUTTON, BLACK CAP, 10A, 1NO/1NC, CLASS I DIV 2	C3CONTROLS	HPBO-FCBK-CBFS
1	PUSHBUTTON, RED CAP, 10A, 1NO/1NC, CLASS I DIV 2	C3CONTROLS	HPBO-FCRD-CBFS
1	PUSHBUTTON, GREEN CAP, 10A, 1NO/1NC, CLASS I DIV 2	C3CONTROLS	HPBO-FCGN-CBFS
1	WHITE LIGHT	C3CONTROLS	PLLWT
1	GREEN LIGHT	C3CONTROLS	PLLGN
1	RED LIGHT	C3CONTROLS	PLLRD
1	AMBER LIGHT	C3CONTROLS	PLLAM
1	LIGHT BASE, NEMA 4X - 120V WITH BULB FITTED	C3CONTROLS	HFVLU120
3	LIGHT BASE, NEMA 4X - 24V WITH BULB FITTED	C3CONTROLS	HFVLU24
2	BULB, 28V (SPARES)	GE OR SYLVANIA	1829
2	BULB, 120V (SPARES)	GE OR SYLVANIA	120MB
2	10 AMP AIRPAX BREAKER INSTALLED IN DIN RAIL W/ SCREW TERMINAL (100-130VAC)	CURRIER & ROSER	CRIAPBM10-FM-AC

20	ELECTRONIC CIRCUIT BREAKER, 4 A, N/O SIGNAL CONTACT, 24VDC, UL C1D2 (AUX OPEN ON TRIP)	PHOENIX CONTACT	0903026 (EC-E1 4A)
1	CONTINUOUS PLUG-IN BRIDGE FOR LINE+ AND 0 V, INSULATED WITH GRAY, 500 MM	PHOENIX CONTACT	901028 (FBST 500 TMC-NGY)
29	RELAY, DPDT, 24VDC, 6A, W/SOCKET	PHOENIX CONTACT	PLC-RSC-24DC/21-21 ATEX
1	RELAY, HERMETICALLY SEALED, 120VAC, 12 AMP	C3CONTROLS	HGPRS-P2C12D
1	RELAY SOCKET, 8 PIN	IDEC	SR2P06
20	SINGLE TERMINAL (PRIMARY/INCOMING POWER)	PHOENIX CONTACT	UT10
9	SINGLE TERMINAL END SECTION	PHOENIX CONTACT	D-UT 2,5/10
540	SINGLE TERMINAL	PHOENIX CONTACT	UT6-TG
320	KNIFE EDGE / ISOLATING PLUG FOR UT6-TG TERMINALS (3036783)	PHOENIX CONTACT	P-DI
20	CONNECTOR,W/BLOWN FUSE 110 - 250 V AC/DC, 1 X 1 1/4	PHOENIX CONTACT	P-FU 6,3X32 LA 250
213	FUSE CONNECTOR ( 1 X 1 1/4 FUSES) FOR UT6-TG TERMINALS W/ BLOWN FUSE INDICATOR	PHOENIX CONTACT	P-FU 6,3X32 LED 24
60	FUSE, 0.25A, 5MMX20MM - FAST ACTING, CERAMIC SAND FILLED (DI, AI, AO)	BUSSMAN	GDA-250MA
84	FUSE, 1/8A, 1/4"X1-1/4", FAST-ACTING, CERAMIC	GOULD	GAB-0.125
100	FUSE, 2A, 5MMX20MM - FAST ACTING, CERAMIC SAND FILLED (DO)	BUSSMAN	GDA-2A
5	FUSE, 3A, 1/4"X1-1/4", FAST-ACTING, CERAMIC	GOULD	GAB-3
9	PLUG-IN JUMPER BAR FOR UT10 (2 POINT)	PHOENIX CONTACT	FBS 2-10
69	PLUG-IN JUMPER BAR FOR UT6 (10 POINT)	PHOENIX CONTACT	FBS 10-8
1	TERMINAL LABELS AS NEED	PHOENIX CONTACT	ZB08/ZB10
20	GROUP MARKER	PHOENIX CONTACT	UBED
39	END STOP	PHOENIX CONTACT	E-NS 35 N
20	ISOLATOR STAND-OFF'S (USED TO ISOLATE ANALOG DIN RAILS WHEN GND FOOT IS USED)	STORM COPPER	1100-A1
ENCLOSURE			
1	WINDOW KIT, 18X24X4, NEMA 4X, 316 STAINLESS STEEL	MURPHY	
1	ENCLOSURE, NEMA 4X, 60"X60"X18", 316SST	SAGINAW	SCE-60EL6018SS6LPPL
1	SUBPLATE, 56"X56"	SAGINAW	SCE-60P60
2	GROUND BUS BAR, ISOLATED 1 1/4" X 7" (TIN PLATED COPPER) W/24 SCREWS	STORM COPPER	FWM-IGB
2	GROUND STRAP (8X1), W/ 5/16" HOLE		
POWER SUPPLY			
1	POWER SUPPLY, 100-240VAC/DC IN, 24VDC OUT, 10A, CID2 (QUINT-PS/1AC/24DC/10)	PHOENIX CONTACT	2866763
1	QUINT-UPS/24DC/24DC/20 - C1D2 LISTED (UL FILE E199827)	PHOENIX CONTACT	2320238
1	UPS-BAT/VRLA/ 24DC/12AH - C1D2 LISTED (UL FILE E199827)	PHOENIX CONTACT	2320322
SPECIAL ITEMS			
1	12" 24VDC LED LIGHTING FIXTURE (GSLEDIP-12CW-WF-BLK-24VDC-C1D2), T3	LEVITON	GS152-221
1	CLOSE LOOP AIR EXCHANGER, COMPACT, 1446 BTU, 12 WATTS/DEG F (22W/DEG C), 24VDC (0.8A), N4X, C1D2, 160 DEG F (16HX11WX3.5D)	ISC	A2AC080D244X-XJ
2	THERMOSTAT, HERM SEALED, CLASS I, DIV 2	UNITED EL	B117-120
2	HEATER, PLATE (24"X7")	MURPHY	
2	HEATER, 6" X 24", 360 WATTS; 120VAC	BRISKHEAT	SRX06243601P4A

## **7.0 CONTROL PANEL PRICE**

### **7.1 SUBSEQUENT EXACT DUPLICATE ORDERS OF 52-30-10244**

**\*\*CONTROL PANEL PRICE IS BASED ON THE ORDER OF SUBSEQUENT EXACT DUPLICATE CONTROL SYSTEM(S). THESE EXACT DUPLICATE PANELS WILL INCLUDE THE EXACT HARDWARE, DRAWINGS, AND PROGRAMS OF ABOVE OFFERED INITIAL PANEL (52-30-10244).**

## **8.0 EXCEPTIONS:**

- 8.1 CAUSE AND EFFECT CHARTS (SAFE CHARTS) NOT PROVIDED (PROVIDED BY OTHERS IF REQUIRED). THESE MAYBE PROVIDED UPON REQUEST AT AN ADDITIONAL CHARGE.
- 8.2 LOGIC BLOCK DIAGRAMS NOT PROVIDED (PROVIDED BY OTHERS IF REQUIRED). THESE MAYBE PROVIDED UPON REQUEST AT AN ADDITIONAL CHARGE.
- 8.3 LOGIC BINARY (BOOLEAN) DIAGRAMS NOT PROVIDED (PROVIDED BY OTHERS IF REQUIRED).
- 8.4 LOOP DIAGRAMS ARE NOT PROVIDED (PROVIDED BY OTHERS IF REQUIRED).
- 8.5 NO OTHER DOCUMENTS ARE PROVIDED UNLESS EXPRESSLY LISTED IN THIS QUOTATION (I.E. SEQUENCE OF OPERATION AND DRAWINGS).

## **9.0 CLARIFICATIONS:**

- 9.1 "SPECIAL" NON-STANDARD FW MURPHY PRODUCTION CONTROLS INSTRUMENTS OR OUTSIDE PURCHASED INSTRUMENTS ARE NON-RETURNABLE/NON-REFUNDABLE.
- 9.2 THE CLIENT IS REQUIRED TO COME TO OUR SHOP FOR A WITNESS TEST / INSPECTION (A.K.A. FACTORY ACCEPTANCE TEST OR FAT.). ALL TRAVEL EXPENSES FOR THE VISITING PERSONNEL WILL NOT BE THE RESPONSIBILITY FW MURPHY PRODUCTION CONTROLS. A \$100/HR ENGINEER LABOR RATE WILL BE CHARGED TO THE CLIENT IF THE TEST TIME EXCEEDS 8 HOURS PER SYSTEM. IF THE CLIENT CANNOT COME FOR A WITNESS TEST / INSPECTION OR FAT, THEY MUST PROVIDE A WRITTEN WAIVER THAT THEY WILL ACCEPT OUR INTERPRETATION OF THE DRAWINGS AND CONTROL SEQUENCE OF OPERATIONS.
- 9.3 CONTROL PANEL PRICE AND DESIGN ARE SUBJECT TO CHANGE UPON RECEIPT OF ORDER AFTER A FULL ENGINEERING REVIEW.
- 9.4 THIS QUOTATION IS INTENDED FOR THE ABOVE MENTIONED CUSTOMER WITHIN DOCUMENT HEADING AND FW MURPHY PRODUCTION CONTROLS EMPLOYEES.
- 9.5 NO END DEVICES AND FIELD INSTALLATION ARE PROVIDED UNLESS OTHERWISE STATED.
- 9.6 THERE MUST BE AN APPROVAL CYCLE OF DRAWINGS AND WRITTEN CONTROL SEQUENCE OF OPERATIONS.
- 9.7 APPROVAL DRAWING PACKAGE WILL BE PROVIDED WITHIN 10-15 WORKING DAYS ARO.
- 9.8 UPON RECEIPT OF CUSTOMER WRITTEN APPROVAL OF DRAWING PACKAGE, PRELIMINARY CONTROL SEQUENCE OF OPERATIONS (CUSTOMER TO PROVIDE ACTUAL CONTROL PROCESS REQUIREMENTS) WILL BE PROVIDED WITHIN 10 WORKING DAYS.



- 9.9 UPON CUSTOMER WRITTEN APPROVAL OF CONTROL SEQUENCE OF OPERATIONS, PROGRAMMING AND TESTING WILL COMMENCE BASED ON THE APPROVED DRAWING PACKAGE AND CONTROL SEQUENCE OF OPERATIONS.
- 9.10 UPON THESE APPROVALS, CUSTOMER FAT OR PANEL(S) SHIPMENT WILL BE WITHIN 3-4 WEEKS.
- 9.11 OVERALL, PANEL(S) SHIPMENT/ DELIVERY WILL NORMALLY BE 8-12 WEEKS ARO, DEPENDENT ON PREVIOUSLY MENTIONED APPROVALS OF DRAWINGS AND CONTROL SEQUENCE OF OPERATIONS.
- 9.12 TYPICAL PANEL(S) SHIPMENT/ DELIVERY MAY BE AFFECTED BY OUTSIDE SOURCED ITEMS AND PRODUCTION LOAD AT THE TIME OF ORDER; HOWEVER, EVERY EFFORT WILL BE MADE TO MEET CUSTOMER'S SHIPMENT REQUIREMENTS.
- 9.13 QUOTATION CURRENTLY PROVIDED IS THE PROPOSED FW MURPHY PRODUCTION CONTROLS OFFERING. ANY ITEMS OUTSIDE OF THIS PROPOSED QUOTATION ARE NOT PROVIDED AT THIS TIME.
- 9.14 WHEN PROGRAMMING IS INCLUDED AS PART OF THIS QUOTATION, FW MURPHY PRODUCTION CONTROLS STANDARD PLC PROGRAMMING AND HMI IMPLEMENTATION ARE UTILIZED UNLESS EXPRESSLY DETAILED OTHERWISE.