Submit 1 Copy To Appropriate District Office
District I – (575) 393-6161
1625 N French Dr, Hobbs, NM 88240
District II – (575) 748-1283
811 S. First St., Artesia, NM 88210
District III – (505) 334-6178
1000 Rio Brazos Rd, Aztec, NM 87410
District IV – (505) 476-3460
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-103
Revised August 1, 2011

WELL API NO. 30-045-24392

5. Indicate Type of Lease STATE ☒ FEE ☐

6. State Oil & Gas Lease No. Fee

SUNDRY NOTICES AND REPORTS ON WELLS
(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR USE "APPLICATION FOR PERMIT" (FORM C-101) FOR SUCH PROPOSALS)

7. Lease Name or Unit Agreement Name: Cardon Com

1. Type of Well: Oil Well ☐ Gas Well ☒ Other Salt water disposal (SWD)

8. Well Number 1

2. Name of Operator Chevron Midcontinent L.P.

9. OGRID Number 241333

3. Address of Operator
Attn: Regulatory Specialist 332 Road 3100 Aztec, New Mexico 87410

10. Pool name or Wildcat
(96162) SWD; Morrison Bluff Entrada

4. Well Location
Unit Letter A : 1120 feet from the North line and 1050 feet from the East line
Section 27 Township 32N Range 13W NMPM County San Juan

11. Elevation *(Show whether DR, RKB, RT, GR, etc.)*

12. Check Appropriate Box to Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:				SUBSEQUENT REPORT OF:			
PERFORM REMEDIAL WORK	☐	PLUG AND ABANDON	☐	REMEDIAL WORK	☐	ALTERING CASING	☐
TEMPORARILY ABANDON	☐	CHANGE PLANS	☐	COMMENCE DRILLING OPNS.	☐	P AND A	☐
PULL OR ALTER CASING	☐	MULTIPLE COMPL	☐	CASING/CEMENT JOB	☐		
DOWNHOLE COMMINGLE	☐						
OTHER: Install cathodic protection	☒			OTHER:	☐		

13. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 19.15.7.14 NMAC. For Multiple Completions: Attach wellbore diagram of proposed completion or recompletion.

Please see attached:
Design report
Site map
System installation details.

* Please review and evaluate the decomposition constituents of the Coke breeze being used in the cathodic well for any issues that could arise as the coke degrades.
* Submit a MSDS for the Coke Breeze being used with the subsequent information for the Cathodic well.

RCVD JUN 5 '12
OIL CONS. DIV.
DIST. 3

Spud Date: 10/14/1980 Rig Release Date:

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNATURE April E Pohl TITLE Regulatory Specialist DATE June 1, 2012

Type or print name April E. Pohl E-mail address: April.Pohl@chevron.com PHONE: 505-333-1941

For State Use Only

ACCEPTED FOR RECORD

APPROVED BY: _____ TITLE _____ DATE _____

ACCEPTED FOR RECORD

Conditions of Approval (if any):

corrpro®
An Aegion™ Company

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Human Energy™

Chevron North America Exploration and Production
Mid-Continent Business Unit
332 ROAD 3100
Aztec, NM 87410

CATHODIC PROTECTION DESIGN REPORT
FOR
SIX (6) PRODUCTION SITES

PREPARED BY

CORRPRO COMPANIES INC.
3900 Monroe Rd.
Farmington, NM 87401

0	1 March 2012	Issued for Comment	BF	SM	SW
Rev.	**Date**	**Description**	**Prepared By**	**Checked By**	**Approved By**

TABLE OF CONTENTS

1.0 INTRODUCTION

This document outlines the design of the cathodic protection system for six facility locations near Aztec, NM. The cathodic protection system will supplement the protective coating system in providing corrosion control to the external surface of the new pipelines, and protect the bottom plates of above ground storage tanks.

In accordance with the project specification, an impressed current cathodic protection system is proposed at each of the five locations, as one of the facilities currently has a cathodic protection system in place.

The cathodic protection design complies with industry standards. This design report includes technical details relative to the cathodic protection system, including:

- Design parameters
- Design calculations
- Technical details on cathodic protection equipment
- Detailed bill of materials
- Detailed design drawings
- Preliminary commissioning recommendations

2.0 REFERENCE DOCUMENTS

2.1 Industry Standards

This cathodic protection design complies with the following international standards:

Specification No.	Title
NACE SP 0169	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE RP 0177	Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems
NACE RP 0572	Design, Installation, Operation and Maintenance of Impressed Current Deep Groundbeds
NACE RP 0286	Electrical Isolation of Cathodically Protected Pipelines
ISO 15589-1	Petroleum and Natural Gas Industries - Cathodic Protection of Pipeline Transportation Systems - Part 1: On-Land Pipelines

2.2 Cathodic Protection Drawings

The following drawings included in Appendix E of this document show the proposed cathodic protection systems:

Drawing No.	Title
340140190-01	General Arrangement of Cathodic Protection Equipment at Cardon Com
340140190-02	General Arrangement of Cathodic Protection Equipment at Indian Creek
340140190-03	General Arrangement of Cathodic Protection Equipment at Rincon Lateral
340140190-04	General Arrangement of Cathodic Protection Equipment at Southern Ute #17
340140190-05	General Arrangement of Cathodic Protection Equipment at Valencia Canyon
340140190-06	Cathodic Protection Equipment Details

2.3 Project Documents

The following project documents are pertinent to this cathodic protection design:

Document No.	Title
CPM-DU-6001 - 6023	Chevron Cathodic Protection Specifications

3.0 CATHODIC PROTECTION DESIGN BASIS

The design parameters used for this cathodic protection system are outlined in the following sub-sections. These parameters meet the project requirements and are in compliance with the internationally accepted standards referenced above in Section 2.0.

3.1 Soil Resistivity Values

Location	Soil Resistivity (Ohm cm)	Design CP Current (amperes)
Cardon Com	1500	20
Indian Creek	3000	10
Rincon Lateral	2000	10
Southern Ute #17	1500	20
State 36-1	N/A	N/A
Valencia Canyon	1500	20

3.2 CP System Type

An impressed current system will be provided for cathodic protection for each facility.

3.3 Location of Cathodic Protection System

This design is based on using an impressed current system located at each facility.

Drawing Nos. 340300190-01 to 340300190-05 included in Appendix B of this document show the general arrangement of the cathodic protection equipment.

3.4 Design Life

The cathodic protection system will have a design life of 30 years, which is primarily related to the impressed current anodes.

3.5 CP Current

The cathodic protection current for each facility will be calculated from the field data that was obtained during the current requirement tests. This current is applied to void areas in the coating where the steel is exposed to the soil.

3.6 Capacity of Cathodic Protection

As indicated in Section 4.1.1, each location will require an impressed current system with varying amounts of cathodic protection current. These values include a contingency to account for future additions or changes to the systems.

3.7 Groundbed Type and Location

A deep anode groundbed, which offers superior CP current distribution characteristics, is proposed for each facility.

The groundbed depth will be at a depth of 300 ft, which will position the entire active column of the groundbed below the elevation of the water table.

Details of the deep anode groundbed are shown on Drawing No. 340140190-06 included in Appendix B.

3.8 Anode Type and Quantity

The design for the impressed current cathodic protection system is based on using tubular titanium anodes with a mixed metal oxide (MMO) coating. Titanium / MMO anodes are dimensionally stable and are not subjected to any significant variations in shape or length with use. There is negligible consumption of the

titanium base material, which provides a constant DC output, constant resistance and long life. Titanium / MMO anodes have superior operating characteristics (output and life) over conventional high silicon chromium alloy anodes and have a proven track record.

The groundbed design is based on the installation of MMO anodes. The anode quantity and the length of the active groundbed are critical in estimating the groundbed-to-earth resistance, which is required to determine the DC voltage rating of the rectifier.

3.9 Safety Factors

To standardize the cathodic protection equipment and to allow for future structures at each site, the cathodic protection design will utilize a current output rating higher than what the current demand is. This is shown in section 4.1.1.

3.10 Electrical Isolation Considerations

It is recommended to isolate any structure that should not be included at each facility. The electrical isolation will be accomplished by the installation of isolation flange kits at the facilities.

3.11 Interference Considerations

During commissioning of the cathodic protection system, interference testing will be required to ensure that the operation of the system is not causing any detrimental effects to other pipelines and metallic structures in the area. This testing will be conducted in accordance to internationally accepted standards.

3.12 Criteria for Protection

The facilities CP system shall be designed to polarize the buried portions of the pipeline to a minimum, IR drop free, potential of -0.850 volts, relative to a copper / copper-sulfate ($Cu/CuSO_4$) reference electrode.

The potentials shall not exceed an IR drop free potential of -1.20 volts relative to a copper / copper-sulfate (Cu/CuSO4) reference electrode.

3.13 Soil Resistivity Values

A soil resistivity values have been obtained at each location. The value for each location is listed in section 3.1, and has been used for the impressed current cathodic protection design for the deep anode groundbed at each facility. The soil resistivity value is based on the depth of the anode groundbed, which will be submerged in the water table.

This value is based on field data which is included in Appendix D.

4.0 CP DESIGN BASIS

The following subsections include the calculations used for the cathodic protection design.

4.1 CP Current Requirement

4.1.1 Base CP Current Requirement

A cathodic protection current requirement test was performed at each location. The current required at each location will be based upon the structure-to-soil potentials taken at each location. To achieve the NACE criterion for cathodic protection, the current at each location was achieved during the tests.

The following table summarizes the CP current requirements for the facilities included in the cathodic protection scope:

Location	Test CP Current (amperes)	Design CP Current (amperes)
Cardon Com	6.0	20
Indian Creek	4.64	10
Rincon Lateral	5.72	10
Southern Ute #17	14.24	20
State 36-1	N/A	N/A
Valencia Canyon	8.76	20

4.1.2 Rectifier Current Rating

This design is based on using a rectifier with a DC Output rating of 40 volt / 20 amp or a DC output rating of 20V / 10 A . This will also allow spare capacity for future structures to be added to the cathodic protection system. This also standardizes the rectifiers and allows for spare parts to be the same.

4.2 Anode Quantity for Impressed Current System

The 1-1/4 inch diameter x 48 inch long titanium MMO anodes installed in coke breeze backfill have an output capacity of 340 amp-year. In a deep anode groundbed configuration, the anode must be de-rated to minimize gas generation. The following formula has been used to confirm that the proposed groundbed configuration will provide the 30 year design:

L = (Ia x N) / (Ig x Df)

Where:

L = Design Life (years)
Ia = Anode Current Rating (amp-years)
N = Number of Anodes
Ig = Current Output of the Groundbed (amps)
Df = De-rating Factor

Substituting:

L = 30 years
Ia = 340 amp-years
N = 10
Ig = 20 amp
Df = 5
L = (340 amp-years x 10 anodes) / (20 amps x 5)
L = 34 years

And:

L = 30 years
Ia = 340 amp-years
N = 5
Ig = 10 amp
Df = 5
L = (340 amp-years x 5 anodes) / (10 amps x 5)
L = 34 years

Based on the above, the calculated anode life exceeds the 30 year design life.

4.3 Total Resistance of the Impressed Current System

The total resistance of the DC output circuit of the cathodic protection system must be determined to properly size the DC voltage rating of the rectifier. The following sub-sections include the calculations used to estimate the total circuit resistance for the impressed current system.

4.3.1 Groundbed-to-Earth Resistance

Calculations developed by H.B. Dwight, have been used to approximate the resistance of a vertical groundbed as follows:

$$Rv = \frac{\rho}{2*\pi*L}\left(\ln\frac{8L}{d} - 1\right)$$

Where:

Rg = Resistance of groundbed to earth (ohm)
ρ = Resistivity of soil (ohm-cm)
L = Length of anode & backfill column (cm)
d = Diameter of anode & backfill column (cm)

Substituting:

Location	Resistance (Ohm)
Cardon Com	.256
Indian Creek	.513
Rincon Lateral	.342
Southern Ute #17	.256
State 36-1	N/A
Valencia Canyon	.256

4.3.2 Cable Resistance

The main CP cables will be either No. 2, or No. 8 AWG as indicated on the drawings. Details of the cable capacity and resistance are as follows:

Cable Size		Approximate DC Ampacity (*)	Resistance	
AWG	mm^2	Amperes	Ohms/ft	Ohms/m
No. 8	10	30	0.00064	0.00210
No. 2	35	115	0.00016	0.00053

*Based on tinned copper cable at 25^0 C per NACE Corrosion Engineers Reference Book.

The DC resistance of the CP cable is calculated using the following formula:

$R_c = R_m \times L$

Where:

R_c = Resistance of cable (ohm)
R_m = Resistance per meter (ohm/m)
L = Length of cable (m)

Main Positive and Negative CP Cables

The approximate lengths of the main cathodic protection cables at each facility are as follows:

No. 2 AWG negative CP cable to the structure: 50 ft
No. 2 AWG positive CP cable to positive junction box: 50 ft

$R_c = (0.00016 \times 50) + (0.00016 \times 50)$
$R_c = 0.016$ ohm

Anode Lead Wires

The No. 8 AWG anode lead wires will have a maximum length of 200 ft. long and will be connected in parallel.

$R_c = (0.00064 \times 200) / 10$
$R_c = 0.013$ ohm

4.3.3 Total Circuit Resistance

The total resistance of the DC output circuit of the CP system must be determined to properly size the DC voltage rating of the rectifier. The following formula has been used to estimate the total DC circuit resistance for each surface anode groundbed:

$$R_t = R_g + R_c$$

Where:

Rt = Total circuit resistance (ohm)
Rg = Groundbed resistance (ohm)
Rc = DC cables resistance (ohm)

Substituting:

Location	Total Resistance (Ohm)
Cardon Com	.285
Indian Creek	.542
Rincon Lateral	.371
Southern Ute #17	.285
State 36-1	N/A

Valencia Canyon	.285

4.4 DC Rectifier Voltage

The total DC voltage rating of the power supply to achieve the desired DC current output may be calculated by the following equation:

$$Et = [(It \times Rt) + Bemf] \times SF$$

Where:

Et = DC output voltage requirement (volt)
It = Total current (ampere)
Rt = Total current resistance (ohm)
Bemf = Back emf (volt)
SF = Safety factor

Substituting:

$$Et = [(20 \ x .285) + 2] \times 1.5 = 11.55$$
$$Et = [(20 \ x .542) + 2] \times 1.5 = 11.13$$
$$Et = [(10 \ x .371) + 2] \times 1.5 = 8.565$$

The transformer rectifier will have a DC output rating of 40 volt / 20 amps or a DC output rating of 20V / 10 amps. This will also allow spare capacity for future piping to be added to the cathodic protection system.

4.5 AC Power Requirement for Rectifiers

The following calculations have been used to estimate the AC current of the 110 volt / 1 phase / 60 Hz power supply for the transformer rectifier unit:

Iac = (Edc x Idc)/(Eac x eff)

Where:

Iac = AC input current (amp)
Eac = AC input voltage (volt)
Idc = DC output current rating of rectifier (amp)
Edc = DC output voltage rating of the rectifier (volt)
eff = Efficiency of rectifier (decimal %)

Substituting:

Eac = 110 AC volt
Edc = 40 DC volt
Idc = 20 DC amp
eff = 75 %

Iac = (40 x 20)/ (110 x 0.75)

Iac = 9.7 amp

5.0 GENERAL DESCRIPTION OF THE CATHODIC PROTECTION SYSTEMS

The cathodic protection design for the facilities will include the installation of a single impressed current system located at each location. The systems will have a DC output capacity of 40 volt / 20 ampere or 20 volt / 10 ampere.

The air cooled transformer rectifier will be located within the manifold area in a non-classified electrical area. The rectifier will require a continuous 110 Volt / 1 phase / 60 Hertz power.

The deep anode groundbed will contain five (5) titanium / MMO anodes or ten (10) titanium / MMO anodes, which will be installed in an 8 inch diameter x 300 foot borehole and backfilled with coke breeze. The anodes will be supplied with factory assembled lead wires. The individual anode lead wires will be terminated in a positive distribution box.

The negative cables will be connected to the structures using the thermite weld process.

6.0 EQUIPMENT SPECIFICATIONS

The impressed current type systems will be installed to provide cathodic protection to the facility. The CP system will basically consist of the following equipment:

- Air cooled transformer rectifier
- Tubular MMO anode
- Anode lead junction box
- Negative structure connection
- Coke breeze backfill
- Permanent reference electrode
- DC cabling
- Thermite weld equipment

Typical catalog sheet of the above cathodic protection equipment are included in Appendix A of this report.

The following sub-sections provide technical details of the cathodic protection equipment proposed for the new pipelines.

6.1 Transformer rectifier Unit

The transformer rectifier unit shall be air cooled, capable of continuous operation in tropical environments with temperatures to 45 degree C and 100% humidity. The rectifier shall operate on 110 VAC / 1 phase / 60 Hertz input power and have a DC output rating of 40 volt / 20 ampere or 20 volt / 10 ampere.

The rectifier shall be housed in a galvanized and painted steel enclosure rated at NEMA 3R. The rectifier shall be installed on a field fabricated support frame. The cabinet shall be constructed of galvanized cold rolled steel. All welds, sharp edges, corners and burrs shall be smoothed prior to galvanizing. After galvanizing, the cabinet shall be coated with a fusion bonded powder coating.

A grounding lug shall be provided on the outside of the cabinet to accommodate a No. 6 AWG conductor.

Provisions for padlocking shall be provided and the cabinet may not be opened by ordinary means when the padlock is in place. Holes, knockouts or threaded hubs shall be conveniently located on the bottom and adequately sized for input and output connectors. All vents shall be screened to prevent insect entry.

The DC output voltage shall be adjustable by means of not less than 25 equal steps, from approximately 5 percent of rated voltage to 120 percent of full rated output voltage. The rectifier shall be capable of operating continuously at rated output current and any output voltage from 0 to 100 percent without damage to any rectifier components. The rectifier shall supply rated DC output with the input voltage varying +/- 5 percent.

The rectifier stacks shall be silicon or SCR full wave bridge circuit, with adequate heat sinks to ensure that their temperature rise at rated capacity will not exceed NEMA requirements.

Molded case circuit breakers shall be provided on the AC supply and fuses or circuit breakers on the DC output. Lightning protection shall be provided for both the AC input and the DC output terminals. A panel mounted shunt shall be provided for measuring the DC output current.

Analog panel meters shall be provided for DC output current and voltage. The meters shall have a 4-inch scale and 2 percent accuracy. The voltmeters shall be 1000 ohms per volt, minimum.

The internal components of the rectifiers shall include fungus proofing. This generally entails the use of non-hygroscopic insulation and the spraying of wires and components with a clear, moisture-resistant varnish after assembly. In addition, paint and all insulation materials shall be inorganic or otherwise mildew-resistant.

A Plexiglas safety panel will be provided to cover the tap change adjustments and DC output terminals from accidental contact by personnel.

General details on the transformer rectifier unit are as follows:

- Quantity of rectifiers : 3 no.
- Cooling : Air
- DC output current : 20 ampere
- DC output voltage : 40 volt
- AC input : 110/220 Volt / 1 phase / 60 Hz
- Output control : Manual link/tap control (25 settings)
- Rectification : SCR – Full wave rectification
- AC circuit breaker : Molded case type
- Surge arrestors : Provided for AC and DC
- Mounting : Frame, wall or post mounting
- Nema rating : NEMA 3R (non-explosion proof)
- DC meters : Separate voltmeter and ammeter
- Cabinet construction : Galvanized steel
- Cabinet paint : Fusion bonded powder coated (white)
- Ambient temperature : 0-40 degree C
- Front safety panel : Plexiglas
- O & M manual : Provided with rectifier

- Quantity of rectifiers : 2 no.
- Cooling : Air
- DC output current : 10 ampere
- DC output voltage : 20 volt
- AC input : 110/220 Volt / 1 phase / 60 Hz
- Output control : Manual link/tap control (25 settings)
- Rectification : SCR – Full wave rectification
- AC circuit breaker : Molded case type
- Surge arrestors : Provided for AC and DC

- Mounting : Frame, wall or post mounting
- Nema rating : NEMA 3R (non-explosion proof)
- DC meters : Separate voltmeter and ammeter
- Cabinet construction : Galvanized steel
- Cabinet paint : Fusion bonded powder coated (white)
- Ambient temperature : 0-40 degree C
- Front safety panel : Plexiglas
- O & M manual : Provided with rectifier

Details of the transformer rectifier are shown on Drawing No. 340140190-06 included in Appendix B of this report.

6.2 Impressed Current Anodes

The impressed current anodes shall be tubular titanium construction with a mixed metal oxide (MMO) coating. The anodes shall be 1-1/4 inch diameter x 48 inch long and supplied with a factory assembled center-connected lead wire. The anodes shall be backfilled with coke breeze and installed in a deep anode groundbed configuration. As indicated on drawing No. 340140190-06.

The anode substrate shall be Grade 2 Titanium per ASTM B-338. The substrate shall be cleaned and the surface roughened. The cleaning shall remove all organic materials such as cutting oils, which could interfere with coating adhesion. Surface roughness shall be achieved by chemically etching the substrate as a minimum. Blasting the substrate may be used in addition to chemical etching, but not as a substitute. An anti-passivation layer shall be applied to the substrate prior to application of the mixed metal oxide (MMO) coating.

The prepared titanium substrate shall have an electrocatalytic coating applied. Coating composition shall be iridium oxide and tantalum oxide. Total coating loading requirements shall be coordinated with the manufacturer's proprietary information to achieve the required performance.

The coating loading shall be measured using an X-ray gauge, which is calibrated at least once per shift for the specific coating type. This test directly measures precious metal loading. Simple weight gain is not an acceptable measure. Adhesion of the catalytic coating shall be tested according to ASTM D 3359-83. The manufacturer shall certify conformance with the requirements.

6.2.1 Anode Lead Wire

Each anode shall be supplied with a factory assembled lead wire of sufficient length to avoid field splices. The anode lead wire shall be attached internally in the longitudinal center of the tubular anode by use of a brass, wedge connector. Each end of the tube should be filled with

sealing compound and the end with the lead wire shall have a heat shrink seal.

The resistance of the finished connection shall not exceed 0.001 ohms. The pull-out strength of the connection shall not be less than the breaking of the strength of the No. 8 AWG wire or 520 pounds.

The anodes for the deep anode groundbed shall be packaged in a set of 10 anodes. The end of each anode lead wire shall have a shipping label with length of the cable.

The anode lead wires shall be single core, stranded, copper with a Halar (fluorocopolymer) primary insulation and a high molecular weight polyethylene jacket (HMWPE). Details on the anode lead wire are as follows:

- Anode cable size : No. 8 AWG
- Conductor : 1 core stranded copper
- No. of strands : 7
- Halar insulation thickness : 0.508 mm
- HMWPE jacket thickness : 1.651 mm
- Outside diameter : 10.92 mm

The anode lead cable shall be attached internally in the longitudinal center of the tubular anode by means of a two-piece connector, consisting of a matching pair of wedge shaped inserts. The maximum resistance of the finished connection shall not exceed 0.004 ohms. The finished connection shall be sealed with a high density, slow-cure two-part epoxy resin.

6.3 Groundbed Equipment

6.3.1 Coke Breeze Backfill Material

The coke breeze shall be calcined petroleum grade and processed for use in cathodic protection groundbed applications. The coke breeze shall be dust free, blended, sized and shall conform to the following chemical and physical analysis:

Chemical Analysis	Composition %
• Fixed carbon	99.35 (min)
• Ash	0.6 (max)
• Volatile matter	0 (950^0 C)
• Moisture	0.05 (max)

Physical Analysis

- Bulk density 74 lb/ft^3 (1188 kg/m^3)
- Max. particle size 1.0 mm

6.3.2 Groundbed Surface Casing and Vent Pipe

A surface casing shall be provided to facilitate drilling the borehole for the deep anode groundbed. The casing shall be 12 inch diameter schedule 80 PVC pipe installed to a minimum depth of 20 feet. The surface casing shall be supplied by the drilling contractor.

A vent pipe shall be installed from the bottom of the groundbed borehole to the surface for dissipating gases to the atmosphere. The PVC vent pipe shall be 1-inch diameter slotted piping (AllVent™).

The vent pipe above the coke breeze shall not be perforated. The plastic vent pipe shall extend above grade through the cap of the surface casing and fitted with two 90 degree elbows.

6.4 Anode Junction Box for the Impressed Current System

The impressed current system will include a positive distribution box to connect the individual anode lead wires to the main positive cable. The positive distribution boxes shall have multiple circuits connected to a common copper bus bar. Each circuit shall have a Holloway Type SS / 0.001 ohm shunt to allow the DC output current of the individual anodes to be measured.

The internal components of the junction box including the copper bus bar, shunts, terminals and cable lugs shall be mounted on an insulated panel constructed of 6 mm thick bakelite. The panel shall be engraved to identify the anode number and positive terminal of the DC power cable.

The enclosure shall be constructed of fiber reinforced polymer (FRP) and be weatherproof and corrosion resistance in accordance with NEMA 4X. The enclosures shall have a lockable hinged door. The hinged door and body of the enclosure shall be sealed using neoprene or polyurethane foam gaskets.

The anode distribution boxes will be mounted on a field fabricated support frame constructed of a galvanized channel or angle. The support frame will be anchored with a concrete footing.

Details of the anode lead junction box are:

- Construction of enclosure: Fiber Reinforced Polymer (FRP)
- Electrical classification: Non-Explosion Proof

- NEMA rating: NEMA 4X
- Number of anode circuits: 10
- Shunt rating: 0.001 ohm - Type SS
- Anode terminal lug size: No. 8 AWG stranded copper cable
- Common terminal lug size: No. 2 AWG stranded copper cable

Details on the anode lead junction box are shown on Drawing No. 340140190-06 included in Appendix B of this report.

6.5 Permanent Reference Electrodes

A permanent copper / copper sulfate reference electrodes will be installed at each of the potential test stations. Details on the reference electrodes are:

- Type : Copper / Copper Sulfate
- Model : Permacell Plus
- Backfill : Gypsum/bentonite/sodium sulfate (75/20/5%)
- Packaged Dimension : 5" (127 mm) dia. x 15" (381 mm) long
- Packaged Weight : 24 lb (10.8 kg)
- Cable type : No. 14 AWG single core stranded copper
- Cable length : 15 ft.
- Cable insulation : High molecular weight polyethylene

Details on the permanent reference electrode are shown on Drawing No. 340140190-06 included in Appendix B of this report.

6.6 DC Cables

The main positive and negative CP cables will be single conductor stranded copper with high molecular weight polyethylene (HMWPE) insulation, in accordance with ASTM D-1248.

The negative terminal of the transformer rectifier unit will be connected to the pipelines. The positive terminal of the rectifier will be connected to the anode distribution box.

6.7 Cable to Structure Connections

Cable connections to the pipelines shall be made using the thermite weld process. The thermite weld equipment will consist of welders, weld metal, igniters and thermite weld caps. In all cases, only proper size charges and welders will be used in accordance with the Manufacturer's recommendations.

The cable connections will be made upstream of the insulating flange sets at the facilities. Drawings No. 340140190-01 – 340140190-05 included in Appendix B of this report shows details for the cable-to-structure connections.

7.0 BILL OF MATERIALS

The following subsections identify the major components of the impressed current cathodic protection system:

7.1 Corrpro Supplied Equipment

Item	Description	Qty
1.	Transformer Rectifier: Air cooled, frame / wall mounted, 110 volt / 1 phase / 60 Hz AC input, 40 volt / 20 amp DC output, with manual 25 step control, AC/DC surge arrestors, DC meters, galvanized steel cabinet with a fusion bonded powder coating (white), NEMA 3R rating with equipment nameplate tag.	3 ea.
2.	Transformer Rectifier: Air cooled, frame / wall mounted, 110 volt / 1 phase / 60 Hz AC input, 20 volt / 10 amp DC output, with manual 25 step control, AC/DC surge arrestors, DC meters, galvanized steel cabinet with a fusion bonded powder coating (white), NEMA 3R rating with equipment nameplate tag.	2 ea.
3.	Impressed Current Anode: Tubular titanium construction with MMO coating, 1.25 inch dia. x 48 inch long supplied with factory connected No. 8 AWG Halar / HMWPE lead wires as follows: • Anode No. 1 300 ft. • Anode No. 2 290 ft. • Anode No. 3 280 ft. • Anode No. 4 270 ft. • Anode No. 5 260 ft. • Anode No. 6 250 ft. • Anode No. 7 240 ft. • Anode No. 8 230 ft. • Anode No. 9 220 ft. • Anode No. 10 210 ft.	3 sets
4.	Impressed Current Anode: Tubular titanium construction with MMO coating, 1.25 inch dia. x 48 inch long supplied with factory connected No. 8 AWG Halar / HMWPE lead wires as follows:	2 sets

	• Anode No. 1 300 ft. • Anode No. 2 290 ft. • Anode No. 3 280 ft. • Anode No. 4 270 ft. • Anode No. 5 260 ft.	
5.	Anode centralizers: Ventralizer Type, for 1-1/4 inch anode in 8 inch diameter borehole	40 ea.
6.	Anode Backfill: Coke Breeze Backfill: Calcined petroleum grade, 99% carbon content, small particle size, Loresco SC-3	19,400 lbs
7.	Bentonite Seal: Corrpro Aquaplug type	400 bags
8.	Vent Pipe: Perforated PVC, 1 inch diameter All-Vent	1000 ft.
9.	Vent Pipe: Solid PVC, 1 inch diameter All Vent	500 ft.
10.	Cap: PVC 1" diameter	5 ea.
11.	Elbow: PVC 1" diameter, 90 degree	10 ea.
12.	Glue: For PVC vent pipe	3 quart
13.	Solvent / cleaner: for PVC vent pipe	3 quart
14.	Junction Box: Positive / anode lead type, 10 circuits, each circuit with a Type SS, 0.001 ohm shunt and cable lugs, FRP enclosure rated at NEMA 3R with equipment nameplate tag.	5 ea.
15.	Reference Electrode: Permanent type, copper / copper sulfate, prepackaged with 15 ft. of No. 14 AWG lead wire with HMWPE insulation.	5 ea.
16.	Cable: No. 2 AWG, single conductor stranded copper with HMWPE insulation	500 ft.
17.	Cable: No. 12 AWG, single conductor stranded copper with TW insulation	250 ft.
18.	Warning Tape: PVC, 4 inch wide, non-detectable type	4,000 ft.
19.	Thermite Weld Mold: For connecting a No. 2 AWG copper cable to 8-12" diameter horizontal steel pipeline	1 ea.
20.	Thermite Weld Charges: 25 gram for copper cable to steel pipeline connections	20 ea.
21.	Thermite weld caps: Royston Handycap type IP	10 ea.
22.	Cable Ties: Nylon, 10" long, heavy duty (for securing anode bundle)	100 ea.
23.	Support structures and for transformer rectifiers, junction boxes and cable transition assemblies	1 lot
24.	Electrical cables, conduits, cable trays cable glands and electrical fittings	1 lot
25.	Equipment to extend AC power to the transformer rectifier	As req'd

26.	Surface Casing and cap: 8 inch dia. schedule 80 PVC with PVC cleaner and glue	20 ft.
27.	Cable markers and cable tiles	1 lot
28.	Commissioning spare parts (with RSPL form)	1 lot

8.0 COMMISSIONING REQUIREMENTS

After the equipment has been installed, the cathodic protection system shall be commissioned in accordance with NACE SP 0169 and applicable project specifications. Details commissioning procedures shall be prepared and approved.

All testing and adjusting the cathodic protection system shall be performed by an experienced CP Technician/Engineer, under the direction of a NACE Accredited Corrosion / Cathodic protection Specialist or Professional Engineer.

The following sub-sections outline the minimum requirements for pre-commissioning and commissioning of the cathodic protection system.

8.1 Pre-commissioning

After the cathodic protection equipment has been completed, the following pre-commissioning actives shall be done by a qualified CP technician prior to energizing the system:

- Inspect the equipment to ensure proper installation
- Measure native pipe-to-soil potential at each test station and other representative locations

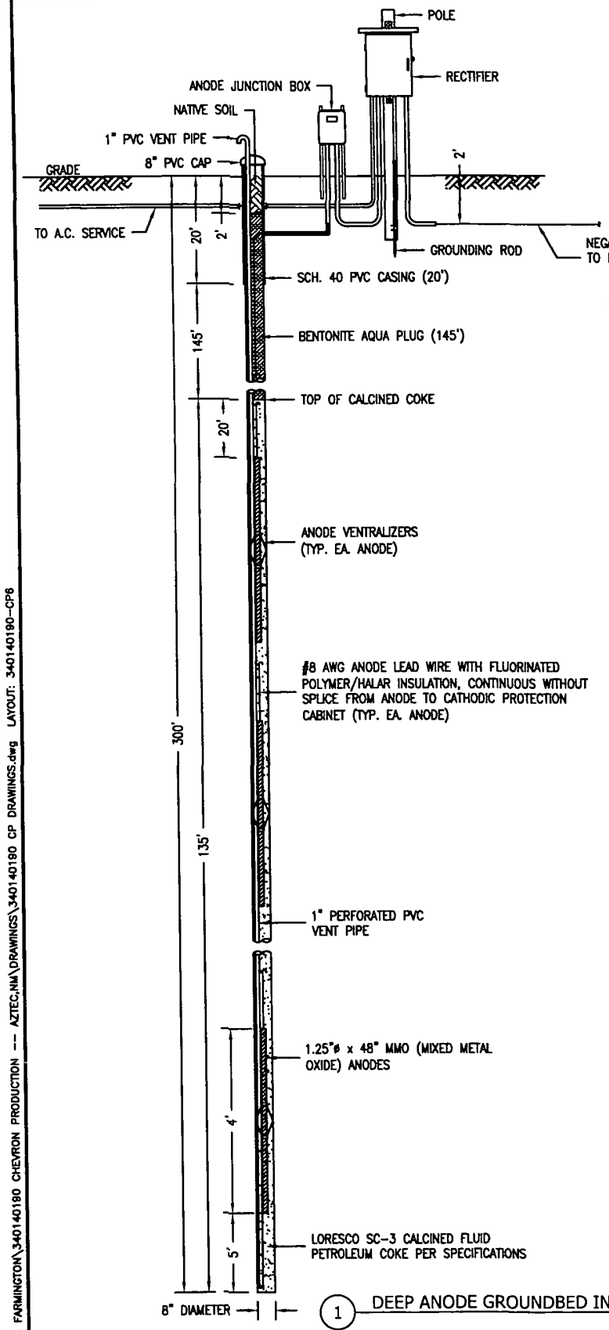
8.2 Commissioning

Commissioning of the cathodic protection system will include the following minimum activities:

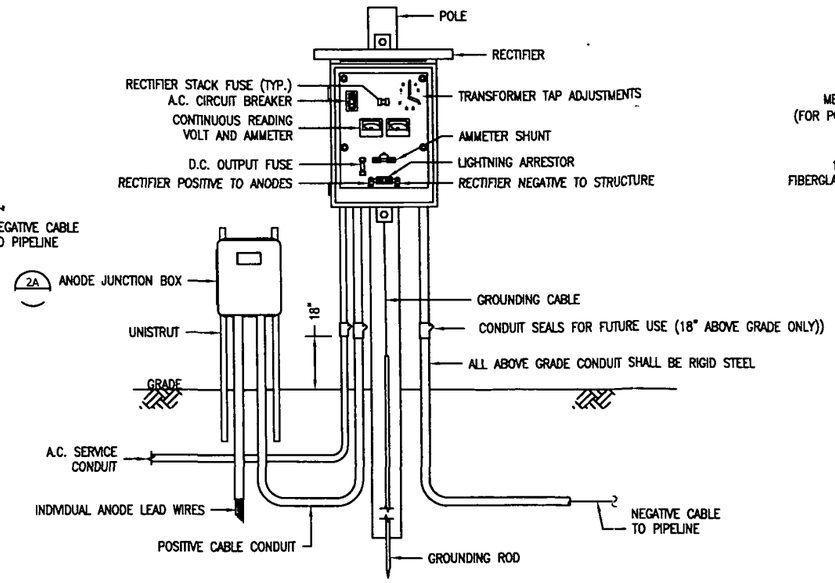
- Energize and test the operation of the transformer rectifier unit
- Measure initial "on" P/S potentials at each test station and adjust the DC output of the rectifier as necessary
- Measure the current output of each anode
- Test the integrity of the insulating flange sets
- Interference testing on secondary structures (as required)
- Re-test the P/S potentials after the pipelines have polarized
- Adjust the output of the rectifiers as required
- Balance the output of the new CP systems
- Conduct close interval potential survey (CIPS), if required

Upon completion of the final commissioning work, the Contractor shall prepare and submit the following documents for the cathodic protection systems:

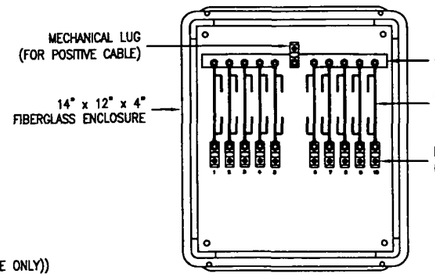
- As-built drawings of the cathodic protection equipment
- Tabulation of all commissioning data
- Operation and maintenance recommendations
- Documentation of any deficiencies which may have been discovered during the post installation testing



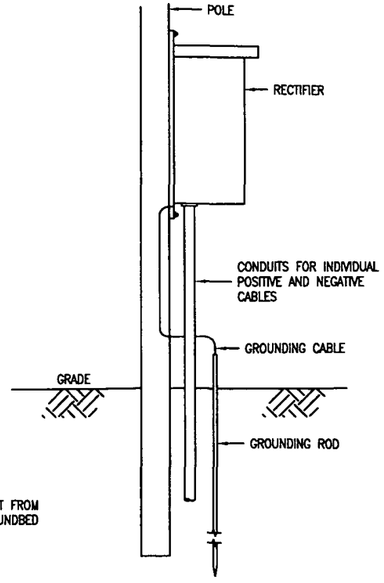
1 DEEP ANODE GROUNDBED INSTALLATION



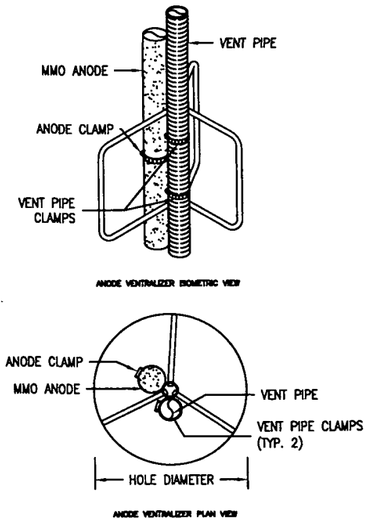
2 RECTIFIER & JUNCTION BOX-FRONT VIEW



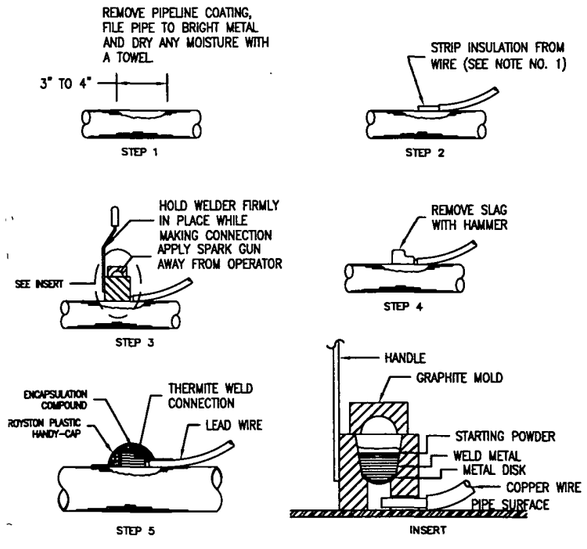
2A ANODE JUNCTION BOX



3 RECTIFIER & JUNCTION BOX-SIDE VIEW



4 ANODE VENTRALIZER



5 THERMITE WELD PROCEDURE

GENERAL PROCEDURE

1. WHEN USING NO. 10 TO NO. 14 AWG SOLID OR STRANDED WIRE, IT WILL BE NECESSARY TO INSTALL A COPPER SLEEVE OF ADEQUATE SIZE OVER THE BARE END OF THE WIRE AND CRIMP IN PLACE BEFORE ATTEMPTING TO MAKE THE CONNECTION. THE WIRE SHOULD PROTRUDE AT LEAST 1/8" FROM THE END OF THE SLEEVE.
2. INSERT THE CONDUCTOR INTO THE MOLD NOTING ANY SPECIAL INFORMATION UNDER "POSITIONING" FOR APPLICATION TYPE IN THE MANUFACTURERS INSTRUCTIONS PACKAGED WITH THE WELDER.
3. INSERT STEEL DISK IN BOTTOM OF CAVITY INSIDE MOLD. POUR THE WELD METAL INTO MOLD BEING CAREFUL NOT TO UPSET THE STEEL DISK. SQUEEZE THE BOTTOM OF THE TUBE TO LOOSEN ALL THE STARTING POWDER AND SPREAD IT EVENLY OVER THE WELD METAL. PLACE A SMALL AMOUNT OF STARTING POWDER ON THE TOP EDGE OF THE MOLD UNDER THE COVER OPENING FOR EASY IGNITION.
4. CLOSE COVER AND IGNITE WITH THE FLINT GUN. MOVE THE FLINT GUN AWAY QUICKLY TO PREVENT FOULING. IF FLINT GUN SHOULD BECOME FOULED, SOAK IT IN HOUSEHOLD AMMONIA.
5. AFTER IGNITION HOLD THE WELDER IN PLACE FOR A MOMENT TO ALLOW THE WELD TO SOLIDIFY. AFTER THE WELD HAS COOLED, REMOVE THE SLAG WITH A CHIPPING HAMMER OR WIRE BRUSH.
6. COAT CONNECTION AND THE ENTIRE PREPARED SURFACE.
7. CLEAN THE COVER EVERY 6 TO 10 WELDS.
8. WET OR DAMP MOLDS WILL PRODUCE POROUS WELDS. MOLDS MUST BE DRIED OUT BEFORE ATTEMPTING TO WELD.
9. CONNECTIONS ARE TO BE PLACED A MINIMUM OF 3" APART. UNSUCCESSFUL WELDS ARE TO BE ABANDONED AND MOVED TO ANOTHER PREPARED SURFACE NOT LESS THAN 3" AWAY.

REVISED NO.	DATE	REVISIONS	REV.	CHK.	APP.
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2					
3					
4					

corrpro
An Aegion Company

DRAWN BY	FMoreno
DESIGNED BY	BFitzherbert
DATE	2-29-12
SCALE	N.T.S.
JOB NO.	340140190
DWG. NO.	340140190-CP6

CHEVRON PRODUCTION

CATHODIC PROTECTION SYSTEM INSTALLATION DETAILS

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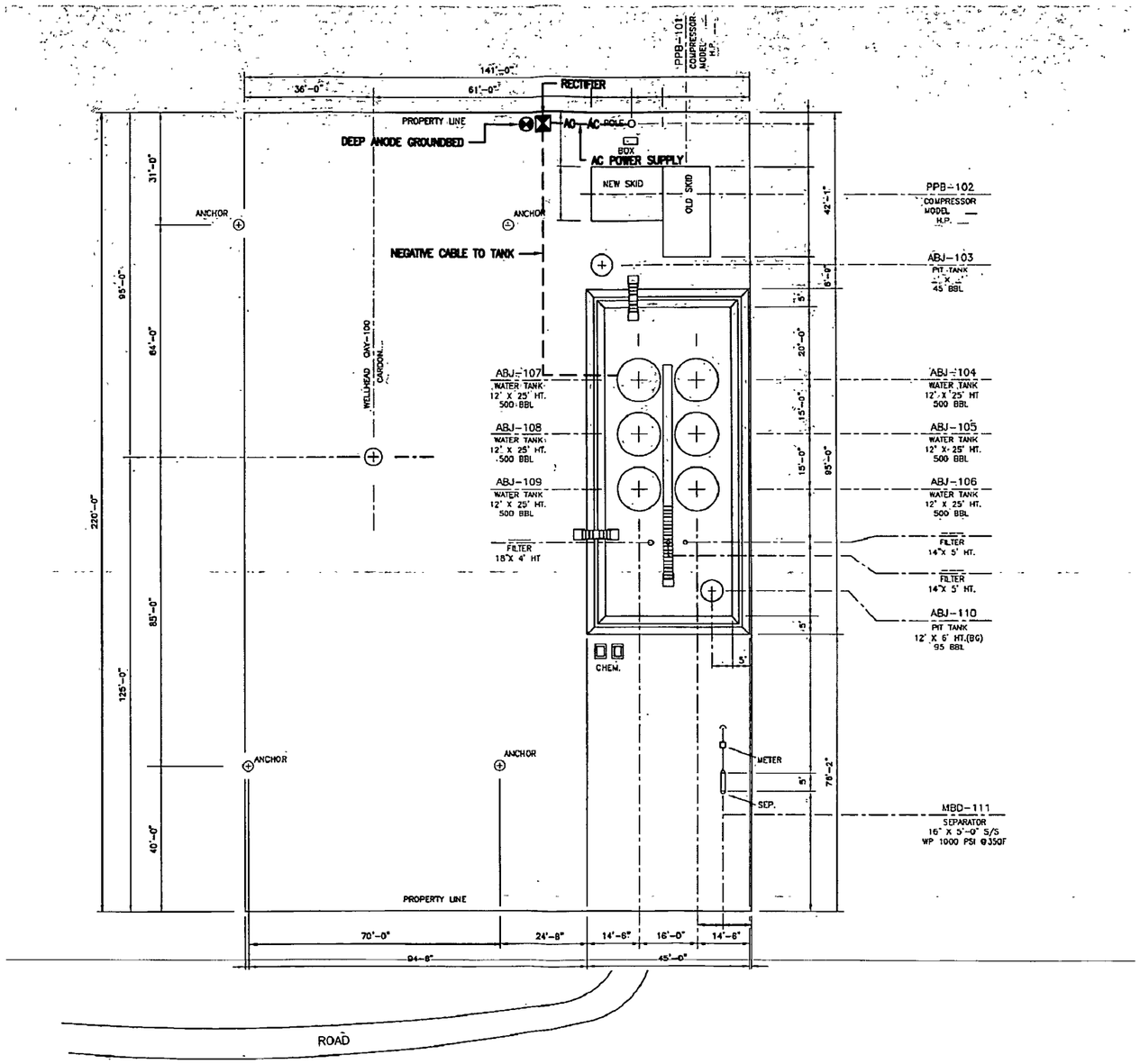

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DWG. NO.	340140190-CP1

CHEVRON PRODUCTION

LAPLATA FIELD
SAN JUAN COUNTY, NEW MEXICO
CARDON COM #1
CATHODIC PROTECTION SYSTEM
INSTALLATION LAYOUT-PLAN

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