DOCKETED

Docket Number:	99-AFC-01C
Project Title:	Elk Hills Power Project - Compliance
TN #:	206707
Document Title:	Request for Staff Approved Project Modification
Description:	Elk Hills Power Project - Amendment to Install Vacuum Pump 11-19-2015
Filer:	Mary Dyas
Organization:	Elk Hills Power, LLC
Submitter Role:	Applicant
Submission Date:	11/20/2015 8:21:46 AM
Docketed Date:	11/20/2015

REQUEST FOR STAFF APPROVED PROJECT MODIFICATION

ELK HILLS POWER PLANT

(99-AFC-1C)

By:
ELK HILLS POWER, LLC

CALIFORNIA RESOURCES CORPORATION

Submitted to:

CALIFORNIA ENERGY COMMISSION

November 18, 2015

REQUEST FOR STAFF APPROVED PROJECT MODIFICATION

ELK HILLS POWER PLANT

(99-AFC-1C)

1.0 INTRODUCTION

Elk Hills Power, LLC hereby requests staff approval of an insignificant project modification to the approved Elk Hills Power Project (EHPP). In accordance with Section 1769(a)(2) of the California Energy Commission (CEC) Siting Regulations, the proposed changes do not have the potential to have a significant effect on the environment and will not result in the change or deletion of a condition adopted by the CEC or cause EHPP to not comply with applicable laws, ordinances, regulations, and standards (LORS).

The project owner/operator submitting this application is Elk Hills Power, LLC. The permitted EHP facility is a natural gas-fired combined-cycle, cogeneration power generating plant. The plant is powered by two General Electric (GE) 7FA technology combustion turbine generators (CTGs). Exhaust gas from the CTGs is directed to two supplementary fired heat recovery steam generators (HRSGs) for the generation of high-pressure, intermediate pressure, and low-pressure steam that drives the steam turbine generator (STG). Supplementary firing (duct burner firing) capability is provided in each HRSG to generate additional steam for peak power production. The EHPP facility utilizes Selective Catalytic Reduction (SCR) systems for the control of NOx emissions and oxidation catalysts for the control of CO and VOC emissions. Fuel for the

CTGs and duct burners is exclusively natural gas. A mechanical draft cooling tower provides heat rejection for the steam cycle. The cooling tower is comprised of six cells and is equipped with high efficiency drift eliminators. One diesel-fired internal combustion engine is used to drive a fire water pump.

2.0 DESCRIPTION OF PROPOSED MODIFICATION (Sec. 1769(a)(2))

Elk Hills Power, LLC is requesting to install two 100% capacity vacuum pump skids to replace the present steam-jet based vacuum system. The system replacement would require a minor structural modification including a concrete slab and piping supports, and a building permit from the Kern County Building Department. A professional engineering stamped drawing are provided on Appendix A.

The new electric-motor-driven vacuum pump systems are an upgrade and are a more modern in-line system than current plant technology. This system is more effective at serving the intended function, and virtually trouble-free. The existing steam jet system has deteriorated and reduced operations reliability. The new vacuum pump system will improve operational reliability and reduce operational safety risk. The low maintenance on the new vacuum pump system should significantly reduce repairs and potential down time.

3.0 NECESSITY (Sec. 1769(a)(1)(B))

The proposed change is necessary because the existing vacuum pumps have deteriorated over time with use and due to corrosion/erosion, and have compromised EHPP’s power rating at times. The vacuum pumps will maintain constant vacuum pressure of the condenser, and are easier to troubleshoot, which will sustain reliable operation.

4.0 TIMING (Sec. 1769(a)(1)(C) and (D))

The facility has installed a vacuum system during the licensing proceeding. However, over the years the existing system degraded.

5.0 ANALYSIS OF THE EFFECT OF THE MODIFICATIONS ON THE ENVIRONMENT (Sec. 1769(a)(1)(E))

The changes will not cause any significant changes in the environment requiring mitigation. The changes do not undermine the assumptions, rationale, findings, or other bases of the final decision.

The area of installation is next to the steam turbine area where it was previously disturbed, see attached picture of the area where it will be installed. The concrete slab will be 2 feet deep, see attached drawing CRC-ELK-40-4031, which requires a minimal ground disturbance of the previously disturbed area.

The construction vehicles is approximately 5 vehicles and workers commute is during the normal business hour of 6AM – 4 PM. Approximately 12 workers working on this project for estimated length of three weeks.

The existing conditions on the certification that apply to this project is the VIS-1 to make the color of the equipment to match with the facility color.

6.0 COMPLIANCE WITH LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS) (Sec. 1769(a)(1)(F))

The proposed modification does not have a significant effect with currently applicable LORS.

7.0 POTENTIAL EFFECTS ON PUBLIC AND NEARBY PROPERTY OWNERS (Sec. 1769(a)(1)(G and I))

The proposed equipment change is not anticipated to affect nearby property owners or parties in the application proceedings or the public.

8.0 LIST OF PROPERTY OWNERS (Sec. 1769(a)(1)(H))

A list of property owners 1,000 feet of the plant site has previously been provided to the Commission CPM.

9.0 SUMMARY OF REQUEST

As demonstrated above, the requested changes to the Elk Hills Power's Conditions of Certification is not anticipated to have an adverse effect on the public or the environment. The change will not affect compliance with applicable LORS. Accordingly, Elk Hills Power requests that the Energy Commission Staff expedite review of this petition, and request Commission approval of the proposed modified conditions in accordance with Title 20 CCR Section 1769.

Dated: November 18, 2015

Respectfully Submitted,

Sonnie Pineda
Sr. Environmental Advisor
Elk Hills Power

APPENDIX A

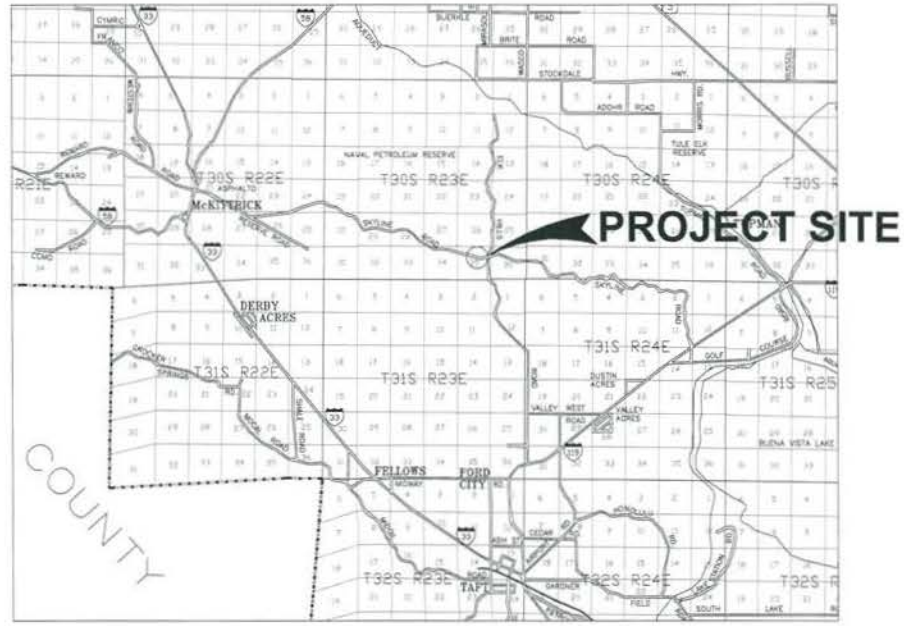
DESIGN PLAN, STRUCTURAL DRAWING AND P&ID

CRC VACUUM PUMP INSTALLATION

OXY ELK HILLS GAS PLANT

GAS PLANT SITE PLAN

N



LOCATION MAP

SCALE: NONE

DRAWING LIST

CAD NO.	DRAWING NO.	REV	DESCRIPTION
CRC-ELKH-40-4000-01	CRC-ELKH-40-4000	A	COVER SHEET & DRAWING INDEX
CRC-ELKH-40-4005-01	CRC-ELKH-40-4005	A	GENERAL NOTES
CRC-ELKH-40-4010-01	CRC-ELKH-40-4010	A	FOUNDATION LOCATION PLAN
CRC-ELKH-40-4031-01	CRC-ELKH-40-4031	A	PIPE SUPPORT DETAILS

DRAWING LIST

CAD NO.	DRAWING NO.	REV	DESCRIPTION

REV No.	DESCRIPTION	DATE	DRAFTER	DSNR/ENG	QC	PROJECT ENG	TEAM LEAD
A	ISSUED FOR PERMIT	[illegible]	VGB	VGB/VRT	–	VRT	VRT

REVISIONS | APPROVALS

VACUUM PUMP INSTALLATION

CALIFORNIA RESOURCES CORPORATION

OXY ELK HILLS
CRC VACUUM PUMP INSTALLATION
COVERSHEET & DRAWING INDEX

DRAWING No.	SHEET	REV.	SCALE
CRC-ELKH-40-4000	01	A	NONE

CRC-ELKH-40-4000-01 1:06 PM 10/22/15

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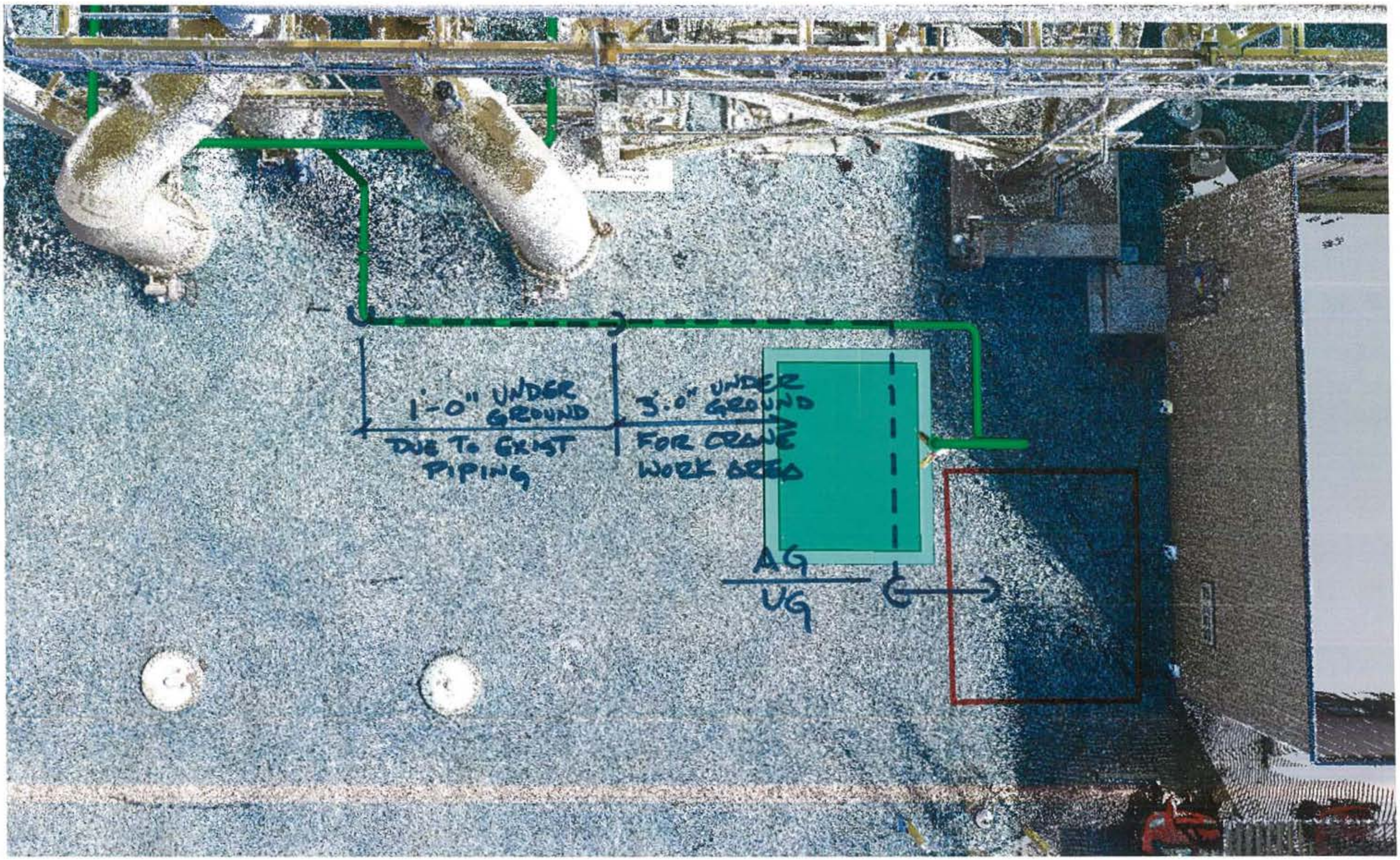
1'-0" UNDER GROUND
DUE TO EXIST PIPING
3'-0" UNDER GROUND
FOR CRANE WORK AREA
AG
UG

ABBREVIATION INDEX

AB	ANCHOR BOLT
BC	BOLT CIRCLE
BOC	BOTTOM OF CONCRETE
BOT	BOTTOM
BO	BOTTOM OF
BOP	BOTTOM OF PLATE
BOS	BOTTOM OF STEEL
CANT	CANTILEVER
C TO C	CENTER TO CENTER
CHKD	CHECKERED
CJP	COMPLETE JOINT PENETRATION
CLR	CLEAR OR CLEARANCE
COL	COLUMN
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS
CORR	CORRUGATED
DIA OR #	DIAMETER
DTI	DIRECT TENSION INDICATOR
DWG	DRAWING
EA	EACH
EL	ELEVATION
EQ	EQUAL OR EQUALLY
FF	FINISHED FLOOR
FIN	FINISHED
FND	FOUNDATION
FS	FAR SIDE
FLG	FLANGE
GALV	GALVANIZED
HORIZ	HORIZONTAL
HR	HANDRAIL
HPFS	HIGH POINT FINISH SURFACE
INCL	INCLUDING
KB	KNEE BRACE
LG	LONG
LOC	LOCATION
MB	MACHINE BOLT
MAX	MAXIMUM
MIN	MINIMUM
MISC	MISCELLANEOUS
NS	NEAR SIDE
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OPNG	OPENING
OPP	OPPOSITE
PL	PLATE
PLATF	PLATFORM
P	PROJECTION
PR	PARTIALLY RESTRAINED
REF	REFERENCE
REINF	REINFORCEMENT
REQD	REQUIRED
SIM	SIMILAR
SQ	SQUARE
STD	STANDARD
STIFF	STIFFENER
SUPT	SUPPORT
THK	THICK
TO	TOP OF
TOC	TOP OF CONCRETE
TOF	TOP OF FLOOR
TO PLATF	TOP OF PLATFORM
TOS	TOP OF STEEL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VERT	VERTICAL
WD	WIDE
W/	WITH
W/O	WITHOUT
WP	WORK POINT

GENERAL NOTES

DESIGN CRITERIA

ALL MATERIAL AND WORKMANSHIP SHALL CONFORM TO THE 2013 CALIFORNIA BUILDING CODE (CBC) AND FEDERAL CODE.
WIND: BASIC WIND SPEED 110 MPH, EXPOSURE "C", IMPORTANCE FACTOR I =1.0
SEISMIC DESIGN CATEGORY: D, SITE CLASS D, IMPORTANCE FACTOR I = 1.0, SITE COEFFICIENT Ss = 1.271, SITE COEFFICIENT S1 = 0.526

DEVIATION / EXISTING CONDITIONS

FABRICATOR / CONSTRUCTOR SHALL NOT DEVIATE FROM THE DESIGN DRAWINGS AND THESE SPECIFICATIONS WITHOUT WRITTEN PERMISSION FROM THE ENGINEER. VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS PRIOR TO FABRICATION OR CONSTRUCTION. VERIFY ANCHOR BOLT LOCATIONS AND PROJECTIONS WITH THE EQUIPMENT PRIOR TO PLACING CONCRETE. REPORT ANY DISCREPANCIES BETWEEN ACTUAL AND ASSUMED CONDITIONS IMMEDIATELY TO THE ENGINEER

SPECIAL INSPECTIONS

INDEPENDENT SPECIAL INSPECTIONS ARE REQUIRED AS PER CHAPTER 17 OF THE CALIFORNIA BUILDING CODE. SITE OBSERVATIONS PERFORMED BY THE ENGINEER OF RECORD DO NOT CONSTITUTE SPECIAL INSPECTIONS. SEE THIS DRAWING FOR SPECIAL INSPECTION REQUIREMENTS.

THE CONTROLLING CONTRACTOR IS REQUIRED TO REVIEW CBC CHAPTER 17 REQUIREMENTS, COORDINATE SPECIAL INSPECTION, AND RETAIN A COPY OF THE INSPECTION RECORDS AT THE JOB SITE. PRIOR TO COMMENCEMENT OF WORK THE CONTRACTOR SHALL SUBMIT A WRITTEN STATEMENT OF RESPONSIBILITY TO THE BUILDING OFFICIAL. SEE CODE SECTION 1706 FOR STATEMENT REQUIREMENTS.

THE INSPECTOR SHALL BE EMPLOYED BY THE OWNER OR THE ENGINEER OF RECORD ACTING AS THE OWNER'S AGENT. THE INSPECTOR SHALL BE APPROVED BY THE BUILDING OFFICIAL A MINIMUM OF 48 HOURS PRIOR TO INITIAL INSPECTION. THE INSPECTOR SHALL VERIFY AND DOCUMENT THE WORK FOR CONFORMANCE WITH THE APPROVED CONTRACT DOCUMENTS. THE INSPECTOR SHALL REPORT TO THE CONTROLLING CONTRACTOR, THE BUILDING OFFICIAL, AND THE ENGINEER OF RECORD. REPORTS SHALL BE SUBMITTED WEEKLY AND A FINAL COMPREHENSIVE REPORT SHALL BE SUBMITTED AT PROJECT COMPLETION.

CONCRETE

CODE:
ALL CONCRETE SHALL BE MIXED, FORMED, FINISHED, CURED, AND PROTECTED IN CONFORMANCE WITH THE RECOMMENDATIONS OF THE PORTLAND CEMENT ASSOCIATION (PCA) AND THE AMERICAN CONCRETE INSTITUTE (ACI). THE CONTRACTOR SHALL KEEP AT LEAST ONE COPY OF ACI 301 "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDING" IN HIS FIELD OFFICE FOR REFERENCE.

MIX:
PORTLAND CEMENT SHALL CONFORM TO ASTM C150, TYPE V
AGGREGATE SIZE SHALL BE 1" NOMINAL AND SHALL CONFORM TO ASTM C33
MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS SHALL BE 4000 PSI UNLESS NOTED OTHERWISE ON DESIGN DRAWINGS.
MAXIMUM SLUMP SHALL BE 4 INCHES
MAXIMUM WATER CEMENT RATIO SHALL BE 0.45
NO STRENGTH ACCELERATING ADDITIVES WITHOUT APPROVAL OF ENGINEER.
A DESIGN MIX PREPARED BY THE CONCRETE SUPPLIER SHALL BE SUBMITTED TO THE OWNER'S CONSTRUCTION SUPERVISOR FOR ENGINEERING APPROVAL 10 DAYS PRIOR TO DELIVERING CONCRETE.

REINFORCEMENT STEEL:
REINFORCING SHALL BE DEFORMED BILLET-STEEL BARS CONFORMING TO ASTM A615, GRADE 60
REINFORCEMENT SHALL BE COLD BENT AND SHALL NOT BE WELDED.
REINFORCEMENT SHALL BE CLEANED SO AS TO BE FREE OF OIL, DIRT, LOOSE MILL SCALE, AND LOOSE RUST OR OTHER COATINGS THAT WOULD DESTROY OR REDUCE THE BOND.
REINFORCEMENT SHALL BE ACCURATELY PLACED AS PER ACI 301 AND SECURELY TIED IN POSITION WITH NO. 16 GA. ANNEALED WIRE.

ANCHOR BOLTS:
ANCHOR BOLTS SHALL CONFORM TO ASTM F1554, GRADE 36, WITH UNC-2A THREADS.
NUTS SHALL CONFORM TO A563, AMERICAN STANDARD, HEAVY HEX WITH UNC-2B THREADS.
ALL BOLTS AND NUTS SHALL BE HOT-DIP GALVANIZED.

EMBEDDED ITEMS:
ALL EMBEDDED ITEMS SHALL BE HOT-DIP GALVANIZED STEEL AND SHALL BE INSTALLED AND SECURELY HELD IN THEIR FINAL POSITIONS PRIOR TO CONCRETE PLACEMENT. ALL EMBEDDED ITEMS SHALL BE CLEANED SO AS TO BE FREE OF OIL, DIRT, LOOSE MILL SCALE, AND LOOSE RUST OR OTHER COATINGS THAT WOULD DESTROY OR REDUCE THE BOND.

REINFORCEMENT COVER:
WHERE DRAWINGS DO NOT SHOW OR SUGGEST COVER REQUIREMENTS. COVER SHALL BE AS FOLLOWS:
CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH – CLEAR COVER SHALL BE 3"
CONCRETE EXPOSED TO EARTH OR WEATHER, #5 BARS AND SMALLER – CLEAR COVER SHALL BE 1.5"
CONCRETE EXPOSED TO EARTH OR WEATHER, #6 BARS AND LARGER – CLEAR COVER SHALL BE 2"

PLACEMENT AND CURE:
PRODUCTION OF CONCRETE SHALL COMPLY WITH CHAPTER 7 OF ACI 301. PLACEMENT OF CONCRETE SHALL BE IN ACCORDANCE WITH CHAPTER 8 OF ACI 301. DURING HOT WEATHER, THE TEMPERATURE OF PLASTIC CONCRETE, AS PLACED, SHALL NOT EXCEED 90 F. HOT AND COLD WEATHER CONCRETE PLACEMENT SHALL BE IN ACCORDANCE WITH ACI 305 AND ACI 306. ALL CONCRETE SHALL BE PROPERLY COMPACTED BY MEANS OF AN INTERNAL VIBRATOR. A MINIMUM OF TWO WORKING VIBRATORS SHALL BE ON SITE AT THE TIME OF ANY CONCRETE PLACEMENT.
FRESHLY DEPOSITED CONCRETE SHALL BE PROTECTED FROM PREMATURE DRYING AND EXCESSIVELY HOT OR COLD TEMPERATURES AND SHALL BE MAINTAINED WITH MINIMAL MOISTURE LOSS AT A RELATIVELY CONSTANT TEMPERATURE FOR THE PERIOD OF TIME NECESSARY FOR THE HYDRATION OF THE CEMENT AND PROPER HARDENING OF THE CONCRETE. ALL NEWLY PLACED CONCRETE SHALL BE KEPT MOIST FOR A MINIMUM OF 7 DAYS. CURING SHALL CONFORM TO THE REQUIREMENTS IN CHAPTER 12, ACI 301.

FINISHING:
ALL EXPOSED EDGES SHALL HAVE A MINIMUM 3/4" CHAMFER.
TIE HOLES, HONEYCOMBS, AND OTHER CONCRETE SURFACE DEFECTS SHALL BE REPAIRED IN ACCORDANCE WITH CHAPTER 9 OF ACI 301 AS SOON AS PRACTICABLE AFTER FORM REMOVAL. THE REPAIR SHALL BE PERFORMED IN SUCH A MANNER AS TO NOT DELAY, INTERFERE WITH, OR IMPAIR THE PROPER CURING OF THE FRESH CONCRETE.

GROUT:
NON-SHRINK CEMENT BASED GROUT (FIVE STAR GROUT OR EQUAL) SHALL BE USED ON ALL FOUNDATIONS EXCEPT FOR ROTATING MACHINERY FOUNDATIONS AND AS NOTED ON THE DESIGN DRAWINGS. NON-SHRINK EPOXY BASED GROUT (FIVE STAR HP EPOXY GROUT OR EQUAL) SHALL BE USED FOR ROTATING MACHINERY.
PRIOR TO GROUT BEING PLACED, MECHANICALLY ROUGHEN ALL CONCRETE SURFACES THAT WILL BE IN CONTACT WITH GROUT SUCH THAT SOUND AGGREGATE (AGGREGATE FRACTURES RATHER THAN POPS OUT) IS EXPOSED. CLEAN ALL SURFACES THAT WILL BE IN CONTACT WITH GROUT INCLUDING THE STEEL BEARING PLATE.
PRIOR TO PLACING CEMENT-BASED GROUT APPLY A BONDING AGENT TO THE CONCRETE SURFACE.

TESTING AND INSPECTION:
TESTING SHALL BE DONE BY AN APPROVED LABORATORY THAT IS EQUIPPED AND EXPERIENCED IN THE TESTING OF CONCRETE. THE LABORATORY SHALL BE SELECTED AND EMPLOYED BY THE OWNER.
THREE (3) CYLINDERS OF CONCRETE SHALL BE MADE FOR EACH 100 CUBIC YARDS OF (EACH TYPE OF) CONCRETE OR FRACTION THEREOF BEING PLACED ON A GIVEN DAY. ONE (1) CYLINDER IS FOR 7 DAY TEST INFORMATION AND TWO (2) CYLINDERS ARE 28 DAY STRENGTH TEST. TEST CYLINDERS SHALL BE MADE IN ACCORDANCE WITH ASTM C31 AND STORED IN ACCORDANCE WITH ASTM C39. CONCRETE CYLINDERS SHALL REACH THEIR DESIGN STRENGTH IN 28 DAYS AND 50 PERCENT OF THEIR DESIGN STRENGTH IN 7 DAYS. A COPY OF THE TEST RESULTS SHALL BE FORWARDED TO THE DESIGN ENGINEER PRIOR TO PLACING LOAD ON CONCRETE.

STRUCTURAL STEEL

CODE:
DESIGN, FABRICATION, AND ERECTION SHALL CONFORM TO THE LATEST EDITION OF THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (A.I.S.C.) SPECIFICATION.
ALL WELDING SHALL BE DONE IN ACCORDANCE WITH THE LATEST EDITION OF AMERICAN WELDING SOCIETY (A.W.S.) STRUCTURAL WELDING CODE AWS. D.1.1

MATERIAL:
W SHAPES SHALL CONFORM TO ASTM A992
PLATES SHALL CONFORM TO ASTM A36
CHANNELS AND ANGLES SHALL CONFORM TO ASTM A36.
RECTANGULAR AND SQUARE HSS SECTIONS SHALL CONFORM TO ASTM A500, GRADE B(Fy=46 KSI).
PIPES SHALL CONFORM TO ASTM A53, TYPE E OR S, GRADE B
ALL IRON CASTINGS GRATES, GRATING, COVERS, LIDS, STEPS AND OTHER IRON CASTINGS SHALL BE GALVANIZED STEEL AND SHALL CONFORM TO ASTM A48, UNLESS NOTED OTHERWISE.
CONNECTION BOLTS SHALL BE ASTM A325 (TYPE N) HIGH STRENGTH BOLTS.
NUTS FOR HIGH STRENGTH BOLTS SHALL CONFORM TO ASTM A563, GRADE DH
HARDENED ROUND WASHERS SHALL CONFORM TO ASTM F436
ALL BOLTS, HARDENED WASHERS AND NUTS SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH ASTM SPECIFICATION A153, CLASS C.
WELDING ELECTRODES SHALL BE AWS E70 SERIES

PAINTING & GALVANIZING:
SEE OWNER'S SPECIFICATIONS FOR FINISH PAINTING AND GALVANIZING. IF GALVANIZING IS REQUIRED, STRUCTURAL STEEL SHAPES AND PLATES SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH ASTM A123

BOLTED CONNECTIONS:
ALL BOLTS SHALL BE 3/4" DIAMETER HIGH STRENGTH BOLTS UNLESS SPECIFIED OTHERWISE.
ALL BOLTED CONNECTIONS ARE BEARING TYPE.
USE THE MAXIMUM NUMBER OF ROWS OF BOLTS FOR EACH BEAM DEPTH.
BOLT HOLES SHALL BE DRILLED OR PUNCHED (NOT TORCH CUT) AND SHALL BE 1/16" LARGER IN DIAMETER THAN THE BOLT UNLESS SPECIFIED OTHERWISE.
BOLT SPACING AND EDGE DISTANCES NOT SHOWN SHALL BE AS PER AISC.
UNLESS DETAILED OTHERWISE ALL BOLTED BEAM CONNECTIONS SHALL BE DOUBLE CLIP ANGLE SHOP WELDED TO THE BEAMS AND FIELD BOLTED TO THE SUPPORTING MEMBERS.

WELDED CONNECTIONS:
ALL WELDERS SHALL BE AWS CERTIFIED.

SPECIAL INSPECTION REQUIREMENTS		
STEEL	INSPECT FABRICATOR'S FABRICATION & QC PROCESSES	CBC SEC 1704.2.5
	INSPECTION TASKS PRIOR TO WELDING	AISC TABLE N5.4-1
	INSPECTION TASKS DURING WELDING	AISC TABLE N5.4-2
	INSPECTION TASKS AFTER WELDING	AISC TABLE N5.4-3
	INSPECTION TASKS BEFORE BOLTING	AISC TABLE N5.6-1
	INSPECTION TASKS DURING BOLTING	AISC TABLE N5.6-2
	INSPECTION TASKS AFTER BOLTING	AISC TABLE N5.6-3
AUGER DRILLED PIERS	OBSERVE DRILLING OPERATIONS	CBC TABLE 1705.8
	LOCATIONS & DIMENSIONS	CBC TABLE 1705.8
CONCRETE	STEEL REINFORCING	CBC TABLE 1705.3
	ANCHOR BOLTS	CBC TABLE 1705.3
	DESIGN MIX	CBC TABLE 1705.3
	PLACEMENT	CBC TABLE 1705.3
	SAMPLING	CBC TABLE 1705.3
	CURING	CBC TABLE 1705.3
SOILS	VERIFY MATERIALS BELOW FOUNDATION	CBC TABLE 1705.6
	CLASSIFICATION/TESTING OF FILL MATERIALS	CBC TABLE 1705.6
	VERIFY LIFT THICKNESS AND DENSITY FOR FILL WORK	CBC TABLE 1705.6

NOTE: SPECIAL INSPECTIONS ARE NOT REQUIRED FOR WELDING PERFORMED IN A BUILDING DEPARTMENT REGISTERED AND APPROVED FABRICATION SHOP.

REGISTERED PROFESSIONAL ENGINEER
THOMAS T. HWANG
NO. S-2297
Exp. 12-31-15
STRUCTURAL
STATE OF CALIFORNIA

CRC-ELKH-40-4005-01 9:02 AM 10/20/15

REV No.	DESCRIPTION	DATE	DRAFTER	DSNR/ENG	QC	PROJECT ENG	TEAM LEAD
A	ISSUED FOR PERMIT	9/2/15	LDB	LFD/CC	–	VRT	VRT

REVISIONS | APPROVALS

VACUUM PUMP INSTALLATION

CALIFORNIA RESOURCES CORPORATION

OXY ELK HILLS
CRC VACUUM PUMP INSTALLATION
—
GENERAL NOTES

DRAWING No.	SHEET	REV.	SCALE
CRC-ELKH-40-4005	01	A	NOTED

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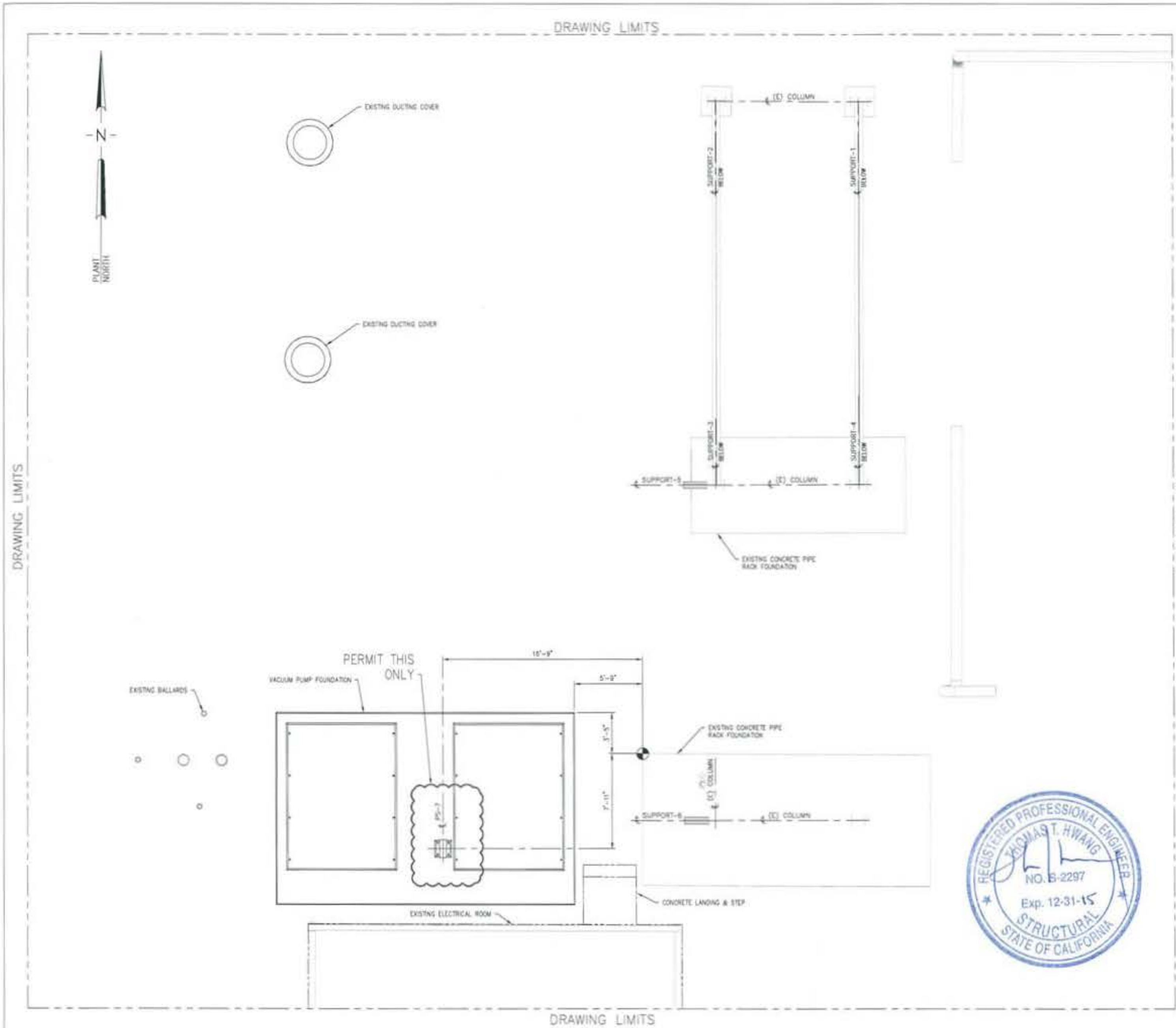

0 2' 4' 8' 16'

SCALE: 1/4"=1'-0"

LEGEND:

S-2 = SLEEPER

= PLANT BENCHMARK (CORNER OF EXISTING PIPE RACK FOUNDATION)

NOTES:

1. FOR GENERAL NOTES SEE DRAWING CRC-ELKH-40-4005 SHT. 01.
2. CONTRACTOR SHALL VERIFY SITE CONDITION AND DIMENSIONS WITH DRAWINGS PRIOR TO CONSTRUCTION. DISCREPANCIES SHALL BE REPORTED TO OWNER REPRESENTATIVE FOR FURTHER INSTRUCTION BEFORE PROCEEDING WITH THE WORK.
3. CONTRACTOR TO VERIFY LOCATION, ORIENTATION, DIMENSIONS AND ELEVATIONS OF EQUIPMENT WITH MECHANICAL PRIOR TO ORDERING MATERIALS AND START OF CONSTRUCTION.

REV No.	DESCRIPTION	DATE	DRAFTER	DSNR/ENG	QC	PROJECT ENG	TEAM LEAD
A	ISSUED FOR PERMIT	10/22/15	LDB	LPG/GG	–	VRT	VRT

REVISIONS | APPROVALS

CRC-ELKH-40-4010-01 1:17 PM 10/22/15

VACUUM PUMP INSTALLATION

CALIFORNIA RESOURCES CORPORATION

OXY ELK HILLS
CRC VACUUM PUMP INSTALLATION
–
FOUNDATION LOCATION PLAN

DRAWING No.	SHEET	REV.	SCALE
CRC-ELKH-40-4010	01	A	1/4"=1'-0"

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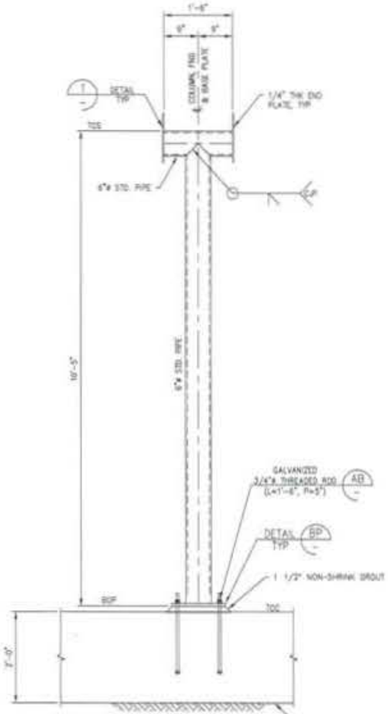
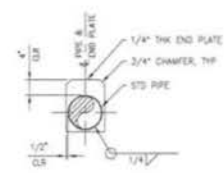


PS-7
SCALE: 1 1/2"=1'-0"



1 DETAIL
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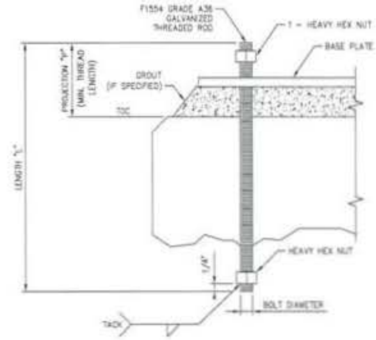
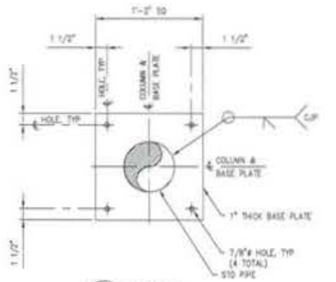


AB DETAIL
SCALE: NONE



BP DETAIL
SCALE: 1 1/2"=1'-0"

NOTES:

1. CONTRACTOR SHALL VERIFY EXISTING SITE CONDITION AND DIMENSIONS WITH DRAWINGS PRIOR TO ORDERING MATERIALS AND START OF CONSTRUCTION. DISCREPANCIES SHALL BE REPORTED IMMEDIATELY TO OWNER'S REPRESENTATIVE OR TO THE ENGINEER FOR FURTHER INSTRUCTION BEFORE PROCEEDING WITH THE WORK. DEVIATION FROM THE DRAWING IS NOT ALLOWED WITHOUT THE APPROVAL FROM THE ENGINEER.
2. FOR GENERAL NOTES SEE DRAWING CRC-ELKH-40-4005 SHT. 01.

CRC-ELKH-40-4031-01 4:42 PM 10/22/15

REV No.	DESCRIPTION	DATE	DRAFTER	DSNR/ENG	QC	PROJECT ENG	TEAM LEAD
A	ISSUED FOR PERMIT	9/30/15	LSB	LPO/DD	–	VRT	VRT

REVISIONS | APPROVALS

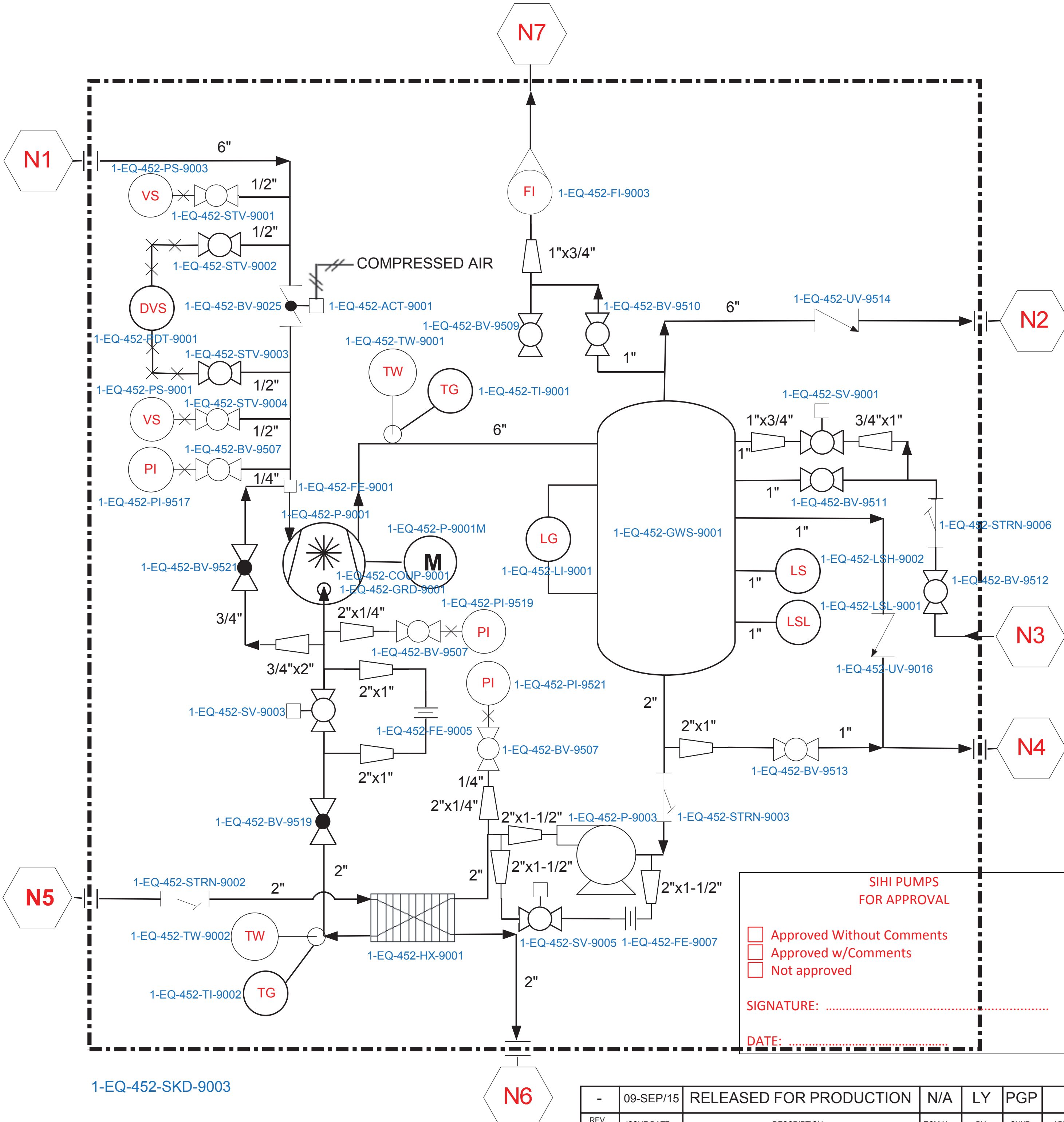
VACUUM PUMP INSTALLATION

CALIFORNIA RESOURCES CORPORATION

OXY ELK HILLS
CRC VACUUM PUMP INSTALLATION
PIPE SUPPORTS
DETAILS

DRAWING No.	SHEET	REV.	SCALE
CRC-ELKH-40-4031	01	A	NOTED

SAVED: 10/22/15 4:42 PM



SIHI PUMPS
FOR APPROVAL

- [ ] Approved Without Comments
- [ ] Approved w/Comments
- [ ] Not approved

SIGNATURE: ....

DATE: ....

1-EQ-452-SKD-9003

Nozzle:	Size:	Type:	Serive:
N1	6"	150# RF	Suction
N2	6"	150# RF	Vent
N3	1"	FNPT	Make-up
N4	1"	150# RF	Drain
N5	2"	150# RF	Cooling Water Supply
N6	2"	150# RF	Cooling Water Return
N7	3/4"	FNPT	Discharge to Atmosphere

REV. NO.	ISSUE DATE	DESCRIPTION	ECM No.	BY	CHKD	APP
-	09-SEP/15	RELEASED FOR PRODUCTION	N/A	LY	PGP	

TITLE
CONDENSER EXHAUST SYSTEM P&ID - SKID 1

CUSTOMER	CUSTOMER P.O.
CALIFORNIA RESOURCES	51000035207

SCALE	JOB No.	DRAWING NUMBER
N/A	4000039873	PI2002741

PROPOSAL NUMBER	REV
01-107671 REV 3	-

SIHI Pumps Ltd.
225 Speedvale Ave. West
Guelph, ON, Canada, N1H6L8

SHEET
1 OF 1

NOZZLE SCHEDULE			
NOZZLE	SIZE	DESCRIPTION	SERVICE
N1	6"	150# RF	SUCTION
N2	6"	150# RF	VENT
N3	1"	FNPT	MAKE UP
N4	1"	150# RF	DRAIN
N5	2"	150# RF	COOLING WATER SUPPLY
N6	2"	150# RF	COOLING WATER RETURN
N7	3/4"	FNPT	DISCHARGE TO ATM.

SIHI PUMPS
DRAWING APPROVAL

☐ Approved without Comments, Proceed with Manufacturing

☑ Approved with Comments, Proceed with Manufacturing, resubmit for Final Record

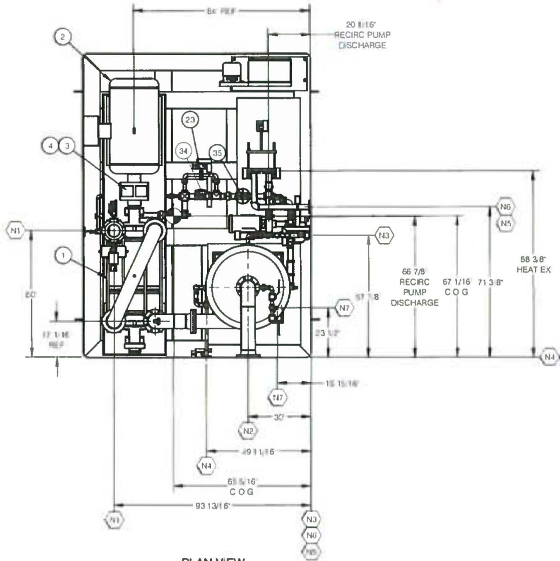
☐ Not Approved with Comments. DO NOT PROCEED with manufacturing, Resubmit for approval.

Date: 09/01/2015 Signature: [signature]

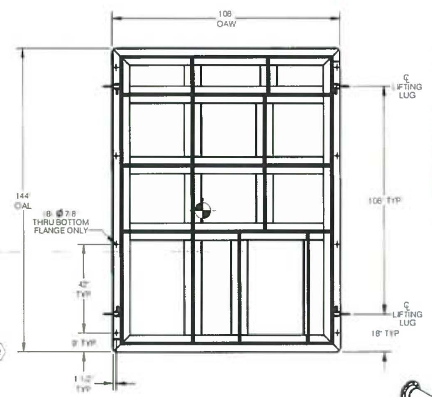
ITEM NO.	QTY.	DESCRIPTION
1	1	VACUUM PUMP: 85353 0B
2	1	NIDEC US MOTOR: 449T, F1
3	1	COUPLING: FALK 90T10
4	1	COUPLING GUARD: MCG25
5	1	BASEPLATE
6	1	SEPARATOR TANK
7	1	RECIRCULATION PUMP
8	1	HEAT EXCHANGER: APV SR2 M-12
9	1	UNITED ELECTRIC VACUUM SWITCH: 1/2" NPT
10	4	SWAGELOK TUBING VALVE: 1/2" NPT
11	1	UNITED ELECTRIC DIFF PRESSURE TRANSMITTER: 1/2" NPT
12	1	KEYSTONE BUTTERFLY VALVE: 6" 150# RF
13	1	MORIN BUTTERFLY VALVE ACTUATOR
14	1	WINTER VACUUM GAUGE: 2 1/2" DIAL, 0/30in HG, 1/4" NPT
15	3	FLO TITE BALL VALVE: 1/4" NPT
16	1	FULLJET SPRAY NOZZLE
17	1	WINTER COMPOUND GAUGE: 2 1/2" DIAL, 30in Hg/0/ 30PSI, 1/4" NPT
18	1	WINTER PRESSURE GAUGE: 2 1/2" DIAL, 0/100 PSI, 1/4" NPT
19	2	IFC Y-STRAINER: 2" NPT
20	2	ASHCROFT TEMPERATURE GAUGE: 3" DIAL, 0/250°F, 1/2" NPT
21	2	ASHCROFT THERMOWELL: 3/4" NPT x 1/2" NPT
22	1	FLO-CORP FLOW INDICATOR: 3/4" NPT
23	1	FLOW ORIFICE ASSEMBLY: 1", 300#RF
24	5	FLO TITE BALL VALVE: 1" NPT
25	1	FNW CHECK VALVE: 6" WAFER
26	2	GEMS LEVEL SWITCH: 1" NPT
27	1	CONBRACO LEVEL GAUGE: 24" C TO C, 1/2" NPT
28	1	JEFFERSON SOLENOID VALVE: 3/4" NPT
29	1	IFC Y-STRAINER: 1" NPT
30	1	CHECKALL SERVICE LIQUID CHECK VALVE: 1" NPT
31	1	HAMMOND ELECTRICAL ENCLOSURE
32	7	GASKET: 6", NEOPRENE
33	1	CHROMALOX HEAT TRACE PANEL
34	1	ASCO SOLENOID VALVE: 2" NPT
35	1	WALWORTH GLOBE VALVE: 2" NPT
36	1	ASCO SOLENOID VALVE: 1-1/2" NPT
37	1	FLOW ORIFICE ASSEMBLY: 1-1/2", 300#RF
38	1	VELAN GLOBE VALVE: 3/4" NPT
39	1	ALLAN BRADLEY VACUUM SWITCH: 1/4" FNPT

NOTES

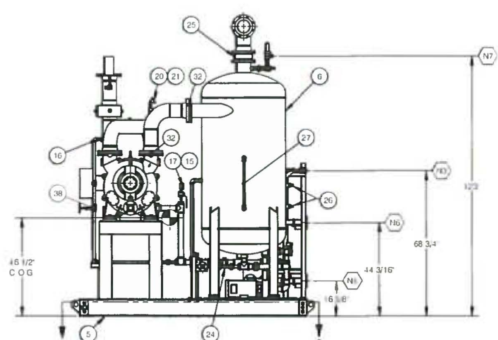
1. A TEMPORARY CONICAL STRAINER (200% OPEN AREA) SHALL BE INSTALLED IN PUMP SUCTION LINE AT SYSTEM START-UP. (STRAINER BY OTHERS)
2. ALL PIPING SHALL BE CARBON STEEL, SCH 40, THREADED 2" AND SMALLER, WELDED ABOVE 2", PER ANSI B31.1 POWER PIPING.
3. ALL PIPING AND INSTRUMENTATION SHALL BE PROPERLY SUPPORTED DURING SHOP ASSEMBLY.
4. THE SYSTEM SHALL BE COMPLETELY ASSEMBLED TO ENSURE PROPER FIT OF THE COMPONENTS. SOME DISASSEMBLY MAY BE REQUIRED TO FACILITATE STANDARD SHIPPING PROCEDURES.
5. THE SKID ASSEMBLY IS NOT DESIGNED TO BE SELF-SUPPORTING. FOUNDATION MUST BE DESIGNED TO PREVENT SKID DEFLECTION.
6. THE SYSTEM SHALL BE PAINTED PER SIHI PROCEDURE No. OP 9.7 (BLUE ENAMEL FINISH).
7. ESTIMATED DRY WEIGHT (SINGLE SKID): 13 085 Lbs
8. ESTIMATED OPERATING WEIGHT (SINGLE SKID): 13 221 Lbs



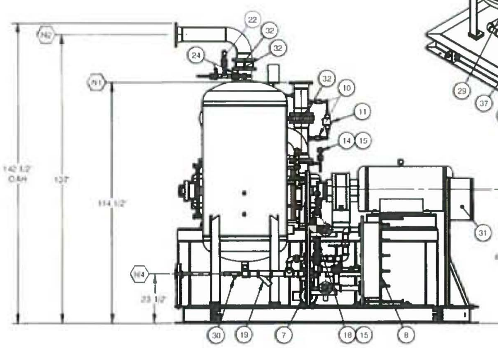
PLAN VIEW



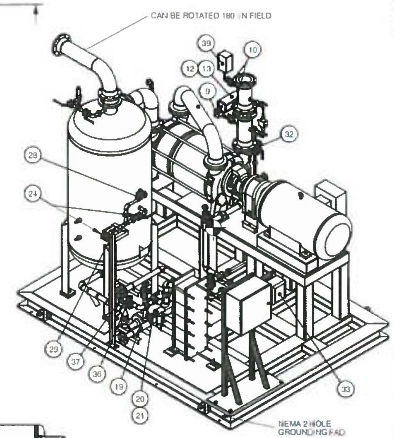
ANCHOR BOLT DETAIL
SECTION A-A



ELEVATION VIEW



SIDE ELEVATION VIEW



ISOMETRIC VIEW

-	19-AUG/15	RELEASE FOR APPROVAL	N/A	LY	DT	
REV. NO.	ISSUE DATE	DESCRIPTION	ECN NO.	BY	CHKD	APP

TITLE
CONDENSOR EVACUATION SYSTEM CES 8128

CUSTOMER	CUSTOMER P.O.
CALIFORNIA RESOURCES	51000035207

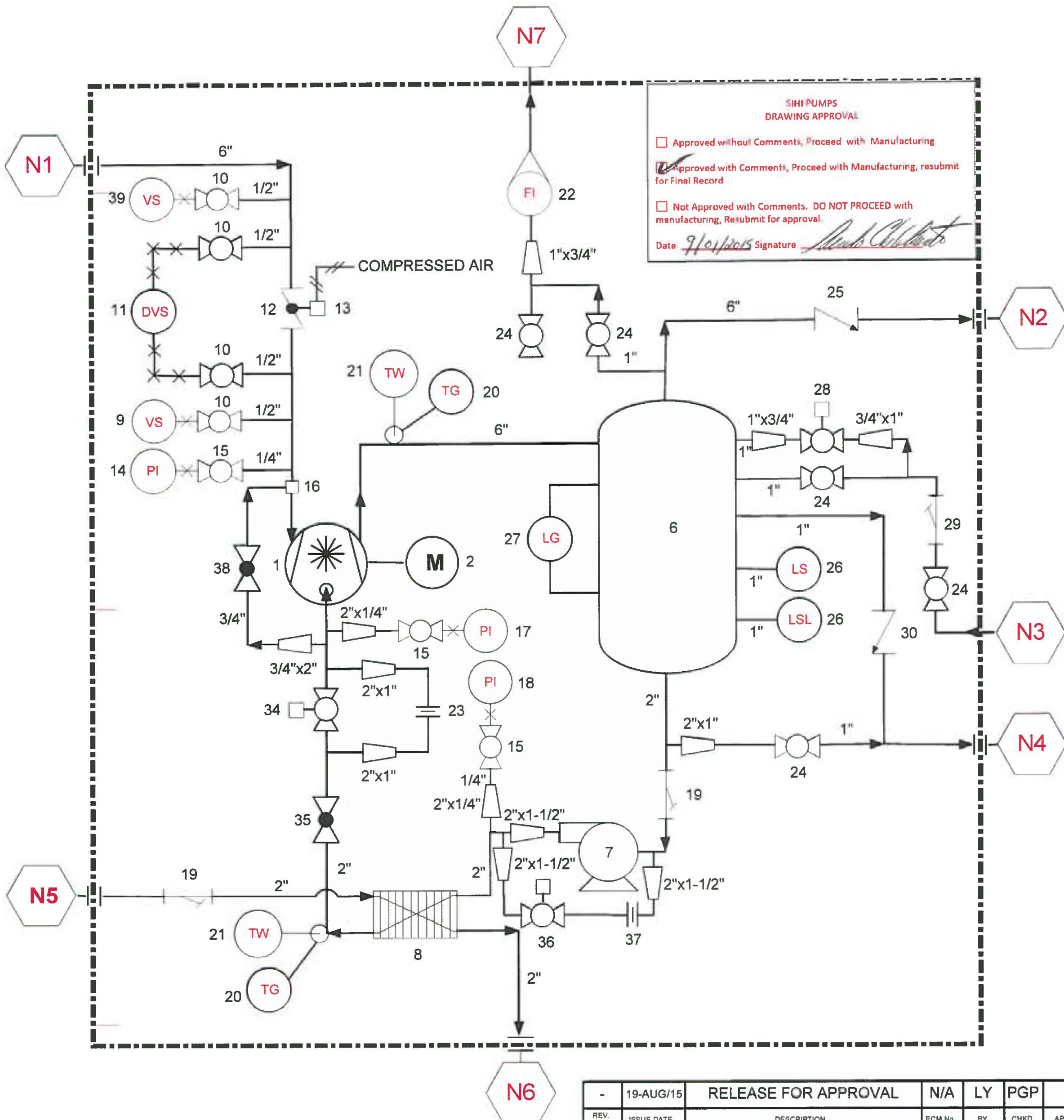
SCALE	JOB No.	DRAWING NUMBER	REV
1:24	4000038873	SV2002740	-

SIHI Pumps Ltd.
225 Speedvale Ave. West
Guelph, ON Canada N1H1M8
PH: 519-824-4600 FX: 519-824-7250
www.sihi-pumps.com
An ISO 9001-2008 Registered Company

SAP MATERIAL MASTER NO.
30013191

DIMENSIONAL TOLERANCES
0" - 36" - ±1/8"
37"-72" - ±1/4"
73" AND LARGER - ±1/2"

SHEET 1 OF 1



Nozzle:	Size:	Type:	Serive:
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REV. NO.	ISSUE DATE	DESCRIPTION	ECM No.	BY	CHKD	APP
-	19-AUG/15	RELEASE FOR APPROVAL	N/A	LY	PGP	

TITLE
CONDENSER EXHAUST SYSTEM P&ID

CUSTOMER	CUSTOMER P.O
CALIFORNIA RESOURCES	51000035207

SCALE	JOB No	DRAWING NUMBER
N/A	4000039873	PI2002741

PROPOSAL NUMBER	REV
01-107671 REV 3	-

SIHI

SIHI Pumps Ltd.
225 Speedvale Ave. West
Guelph, ON, Canada, N1H6L8

SHEET
1 OF 1

Condenser Exhauster System (CES)

(1) SYSTEM DESCRIPTION

Each vacuum system will include the following main components;

- Liquid ring vacuum pump
- Recirculation pump
- Separator
- Plate & frame heat exchanger

(2) INITIAL VACUUM PUMP START

Liquid-ring vacuum pumps require a prime of water such that the liquid level in the pump casing is at shaft center-line. This prime of liquid sets up the liquid-ring seal through centrifugal action in the machine, so that compression can occur. Upon start-up of a dry system, the vacuum pump casing must first be filled with water to the shaft centerline.

(3) SUCTION LINE

The suction line consists of a pneumatic actuated butterfly valve which will allow compressible gas to flow to the liquid ring vacuum pump. The valve will have a limit switch to indicate an open or closed position. There is a differential vacuum switch used to control when the valve is opened or closed. Two vacuum switches are also mounted on the suction line to control the liquid ring pump motor and a solenoid valve in the service liquid line.

The final component in the suction line is a pressure indictor. The pressure indicator will monitor the vacuum level of the vacuum pump.

(4) DISCHARGE SEPARATOR TANK

(a) General:
The separator tank is of a 2-phase design. The two phases consist of: 1.) Process Gas, 2.) Liquid Water. Separation is achieved through baffling, and centrifugal action.

(b) Water Level:
The reservoir of each tank is equipped with a liquid level sight glass.

(c) Level Switches:
High and low level switch will be used to monitor the liquid level in the separator. If the water level falls below the low level switch a signal will be sent to the DCS to open the make-up solenoid valve. If the water level rises above the high level switch, a signal will be sent to the DCS to close the make-up valve.

(d) Pressure:
The tank is designed to operate near atmospheric pressure.

(e) Discharge Check Valve:
A discharge check valve is located downstream of the silencer. The check valve is held in place by two flange connections (customer to supply a flange connection to mate with the flange on the separator). The check valve will have a manual lever arm which will allow an operator to manually close the valve off. By doing this, the discharged air flow will be redirected to the air flowmeter. It is important that a manual ball valve is opened before closing the manual check valve.

(f) Air Flowmeter:
An air flowmeter is used to check the amount of air leakage within the entire condenser exhauster system. Moisture can accumulate inside the air flowmeter. It is important to drain the liquid out by opening up a manual valve at the bottom of the flowmeter.

(5) SERVICE LIQUID LINE

The complete service liquid line runs from the bottom of each separator tank up to the service water supply connection on the vacuum pump. A recirculation pump will be used to move the liquid from the separator tank through the plate and frame heat exchanger and eventually to the liquid ring vacuum pump. When the vacuum pump motor starts, there is a delay of 3 seconds before the recirculation pump starts. This will prevent any over filling of the liquid ring vacuum pump during startup. A pressure indicator with isolation valve will be located downstream of the recirculation pump to monitor the pressure level discharging from the pump. A manual ball valve will be used to control the amount of flow moving to the liquid ring vacuum pump.

Downstream of the heat exchanger will be a temperature indicator. The temperature indicator will monitor the temperature of the service liquid coming out of the heat exchanger.

Depending on the vacuum level of the liquid ring vacuum pump, the amount of service liquid flowrate must be controlled. To achieve this, orifice plates will be used to dictate the required amount of flow. Service liquid flow will be re-directed through orifice two by closing an actuated pneumatic solenoid valve. When vacuum levels fall below 5” Hg abs, vacuum switch mounted on the suction line will send a signal to the customer’s DCS to open the service liquid solenoid actuated pneumatic ball valve. An orifice plate will control the flowrate through this line. Service liquid flow will now be at its maximum flowrate (flowing through both orifice plates). When the vacuum level increases to 5.6” Hg abs, the vacuum switch will close the service liquid solenoid actuated pneumatic ball valve. This will reduce the service liquid flowrate to the original flow conditions.

(6) MAKE-UP LINE

The make-up line can be used to “prime” the pump during initial fill-up. Two manual ball valves are used to open or close this port pending on the usage. The make-up line can also be use to keep a steady level of service liquid in the separator tank. A y-strainer is added to this line to keep any large foreign particles out of the vacuum system which can cause damage to the system components.

(7) SPRAY LINE

Also part of the service liquid line is a spray line. The spray nozzle is located at the suction line upstream of the vacuum pump. A spray nozzle is used to condense and cool the vapor (inlet stream).

(8) START-UP

Hogging:

The initial startup of both vacuum pumps will be required to evacuate the condenser. There will be one primary pump and one secondary pump. The primary pump will be on all the time. The secondary pump will auto start once the primary pump trips.

When the vacuum pump starts, there is a slight delay (< 2 sec) before the pneumatic actuated butterfly valves will open allowing vacuum to be pulled in the condenser. The delay is caused by the differential vacuum switch which requires a delta P of <1” Hg to trip (causing the associated butterfly valve to open). The condenser pressure will go from atmospheric pressure (29.92” Hg abs) to deep vacuum. Once the vacuum pressure reaches the set pressure, the secondary pump vacuum switch will send a signal to the customer’s DCS to shutdown the motor for the secondary pump. The shutdown of the motor will close the associated pneumatic butterfly valve. The customer’s DCS must incorporate this interlock between the LRVP motor and the associated butterfly valve during the shutdown of the motor only (this shutdown should not occur during startup). Only the primary pump (Pump 1) will be on.

Holding:

To maintain the vacuum level only one pump is required. If there is a leak within the condenser and the vacuum level starts to increase (moving towards atmospheric), the vacuum switch will send a signal to the customer’s DCS to start the secondary vacuum pump. With the secondary pump motor in operation, the associated pneumatic actuated butterfly valve will not automatically open. A differential vacuum switch will monitor the vacuum level upstream and downstream of the butterfly valve. To open the butterfly valve, a differential upstream and downstream of the valve must be less than 1” Hg abs. Once that is achieved, the differential vacuum switch will send a signal to the customer’s DCS to open the pneumatic actuated butterfly valve. The vacuum level will now move deeper in vacuum. Once the set point of the vacuum switch is reached, the vacuum switch will trip sending a signal back to the customer’s DCS to shutdown the secondary pump motor.

It is important to know that the secondary pump was on during the holding operation. SIHI recommends an alarm signal in the customer’s DCS to inform that an issue has occurred which caused the vacuum level to change. Further investigation by a technician on where the leak is coming from must be performed.

(9) LRVP – TRB SYSTEM

SIHI's TRB (Total Recirculation System) is designed to conserve the use of liquid used for utilities. Fluid that is discharged from the LRVP will collect in the separator and recycled back to the LRVP service liquid port. A plate and frame heat exchanger will be required to maintain an appropriate service liquid temperature. Adequate cooling liquid flow and temperature will prevent any issues with the system process and with the pump (refer to proposal for temperatures and flow).

(10) SHUTDOWN

To shutdown the vacuum system during operation, the vacuum pressure must return back to atmospheric pressure (when operating in deep vacuum). The vacuum pump must be power down to allow the pressure of the system to return back to atmospheric pressure. Make sure the manual ball a valve in the make-up line is closed along with the pneumatic actuated ball valve. Open the manual ball valve in the drain line to dispose of any service liquid in the system (if required).

Stantec

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DOCUMENT NO.	S-01		
BY	CCG	DATE	10/22/15
CHKD. BY		DATE	

CALIFORNIA RESOURCES COMPANY

VACUUM PUMPS INSTALLATION

ELK HILLS, CALIFORNIA

STRUCTURAL CALCULATIONS

FOR

PIPE SUPPORT FOUNDATIONS

(NON-ANCHOR SUPPORT)

REGISTERED PROFESSIONAL ENGINEER
THOMAS T. HWANG
NO. S-2297
Exp. 12-31-15
STRUCTURAL
STATE OF CALIFORNIA

Table of Contents

GOVERNING CODES & DESIGN CRITERIA

California Building Code (CBC), 2013 edition
International Building Code (IBC), 2012 edition
ASCE / SEI 7-10

SEISMIC COEFFICIENTS

Non-Building Structure: Pipe Support

MCE Spectral Response Accelerations, SRA				S_s =	1.271
				S_1 =	0.526
Risk Cathegory:	II	(All Other Facilities)		I =	1.00
Site Soil Classification:		D			
Site Coefficients:				Fa =	1.000
				Fv =	1.500
Adjusted SRA Parameters:		S_{MS} = Fa Ss		S_{MS} =	1.271
		S_{M1} = Fv S1		S_{M1} =	0.789
Design SRA Parameters:		$S_{DS} = 2\ S_{MS} / 3$		S_{DS} =	0.85
		$S_{D1} = 2\ S_{M1} / 3$		S_{D1} =	0.53
Seismic Design Category:		D			
Structure Type:		Inverted Pendulum Type Structure		R =	2.00
Table 15.4-2, ASCE 7-05				Ω_o =	2.00
				Cd =	2.00
Period of the Structure:		$T = 2\,\pi\,(m / k)^{0.5}$		T =	0.063 sec
		Weight,	W = 2.04 kips	Flexible, > 0.06 sec	
		Stiffness,	k = 52.48 kip / in		
Design Response Spectrum:					
		$T_o = 0.2\ S_{D1} / S_{DS}$		T_o =	0.12 sec
		$Ts = S_{D1} / S_{DS}$		Ts =	0.62 sec
				T_L =	12.00 sec
Seismic Response Coefficient:		$Cs = S_{DS} / (R / I)$		Cs =	0.424
$T \leq TL$,		Max. Cs = SD1 / T (R / I)		Cs =	4.170
		Min. Cs		Cs =	0.030
Strength Level Base Shear:		**V = Cs W**	LRFD	V =	0.42 W
			ASD	**V =**	**0.30 W**
Vertical Component		**$Ev = 0.20\ S_{DS}\ W$**	LRFD	Ev =	0.17 W
			ASD	**Use E_v =**	**0.12 W**

WIND LOAD: Pipe Supports

Risk Category:	II		
Basic Wind Speed:		V =	110 mph
Exposure Category:	C		
Height of Structure from Grade, z:	10.4 ft.		
Velocity Pressure Exposure Coefficient:		K_z =	0.85
Topographic Factor:		K_{zt} =	1.00
Directionality Factor:		K_d =	0.95

WIND LOAD: Pipe Supports (Continued)

Gust Effect Factor:		$G =$	0.85
Velocity Pressure:	$q_z = 0.00256\ K_z\ K_{zt}\ K_d\ V^2$	$q_z =$	25.0 psf
Force Coefficients:	Pipe Support	$C_f =$	1.20
Strength Level Wind Pressure:	**$f = q_z\ G\ C_f$**	**$f =$**	**26 psf**

By Inspection, Seismic Load Governs

FOUNDATION & SOIL INFORMATION

Concrete Strength fc':	4000 psi
Reinforcement Strength fy:	60000 psi
Unit weight of concrete, γ_C =	150 pcf
Unit weight of Soil, γ_s =	110 pcf

Foundation Type:

Footing

Allowable Soil Pressure	1500 psf	DL + LL
Min Pipe Load, P_p =	40 psf	Gravity Pipe Load

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CHKD. BY	0	DATE	1/0/00

CALIFORNIA RESOURCES COMPANY

VACUUM PUMPS INSTALLATION

T-TYPE SUPPORT **TYPE II**

LOADING CRITERIA

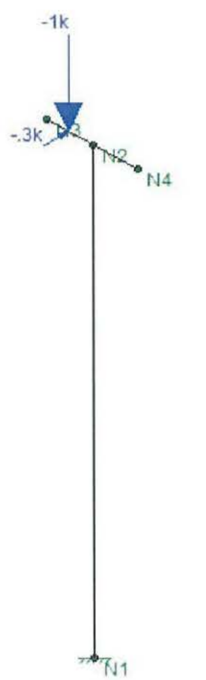
Thermal load is applied as 0.3 times the pipe gravity load on support

Transverse seismic load is applied considering a guide spacing of 60 feet maximum

Non- Anchor pipe support, operating or seismic

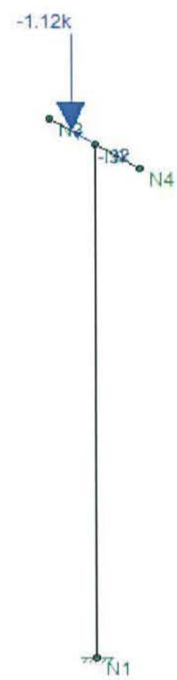
H_{trans} = 0.30 W pipe Seismic transverse load ASD Level load
= 0.68 kips

Consider a 6" load eccentricity with respect to centerline of column



Hydrotest Load

Operating Load



Dead + Seismic Transverse (Guide)

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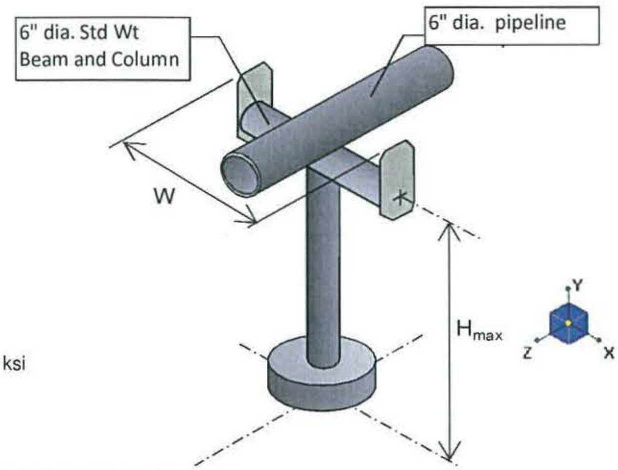
CHKD. BY	
DATE	

CALIFORNIA RESOURCES COMPANY

VACUUM PUMPS INSTALLATION

PS-7

Design Load: GRAVITY LOAD + THERMAL (OPERATING)



Steel Pipe Support

H_{max} = 10.40 ft

Support Width, W = 2.00 ft max

Distance between supports, S = 20.00 ft

Posts Diam., Ø = 6.00 in

Thickness, t_{po} = 0.28 Std.

Øe = 6.63 in Øi = 6.07 in

$S_x = S_y$ = 8.50 in³ Weight= 19.0 lb/ft

Metal Area, A = 5.58 in² Fy = 35.00 ksi

Steel/Steel Friction Factor, μ = 0.30

Min. Supported Pipes Loads

	Ø or Width (in)	#	Weight (lb/ft or psf) Pipe/Tray	Content	Total (k)	V (k)	Ve (k)
SCH 40	6.00 in	1	18.3	20.1	0.768	0.230	0.173
					0.768		

Code Check Column and Beam ASD Design

Envelope AISC 14th(360-10): ASD Steel Code Checks

Hot Rolled Steel | Cold Formed Steel | Wood | Concrete Beams | Concrete Columns | Aluminum

	Member	Shape	Code Check	Lo...	L..	Shea...	Lo...	D..	L..	Pnc/o...	Pnt/om...	Mnyy/o...	Mnzz/o...	C..	Eqn
1	M1	PIPE_6.0	.182	0	1	.018	0		1	54.672	108.982	18.513	18.513	1.0	H1-1b
2	M2	PIPE_6.0	.028	1	1	.032	.5		1	108.353	108.982	18.513	18.513	1.9	H1-1b

Joint Deflections

	L...	Joint Label	X [in]	Y [in]	Z [in]	X Rotat...	Y Rotat...	Z Rotat...
1	1	N4	-.077	.014	-.317	-3.852e-3	-3.807e-4	1.23e-3
2	2	N4	-.409	.062	0	0	0	5.238e-3
3	3	N4	-.609	.091	0	0	0	7.66e-3

Stantec

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CHKD. BY	0	DATE	1/0/00

CALIFORNIA RESOURCES COMPANY

VACUUM PUMPS INSTALLATION

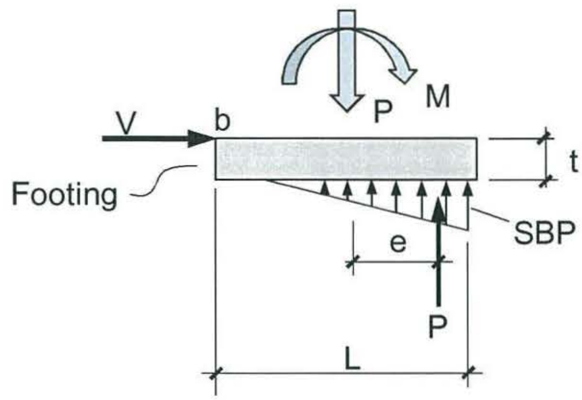
Foundation

See previous pages
Axial Load, P = 1230 lbs
Lateral Load, V = 560 lbs
Moment, M = 6093 lbs - ft

Pedestal Width, b = 0.00 ft
Pedestal Height, h = 0.00 ft
Weight of Ped, Wp = 0 lbs

Try Fdn Length, L = 22.50 ft
Try Fdn Width, D = 18.50 ft
Fdn Thickness, t = 2.00 ft
Weight of Fdn, Wf = 124875 lbs

P = P + Wp + Wf = 126105 lbs



Overturning Force @ Bottom of Footing
Mo = M + V (h + t)
Mo = 7213 lbs - ft

e = Mo / P = 0.06 ft < D / 6
a = D / 2 - e = 0.00 ft
A = L x D = 416.25 sf S = L D^2 / 6 = 1283.44 ft^3

Soil Bearing Pressure, SBP
SBP = (P / A) + (Mo / S)
SBP = 308.58 psf

SBP_{allow} = 2000 psf DL + LL + Seismic (Soils Report)

D/C = (SBP / SBPallow) < or = 1.0
D/C = <u>0.15</u> < 1.0, OK

Safety Factor Against Overturning, SF
SF = Mr / Mo > or = 1.5
Mr = 0.9P D / 2 = 1049824 lbs - ft resisting moment

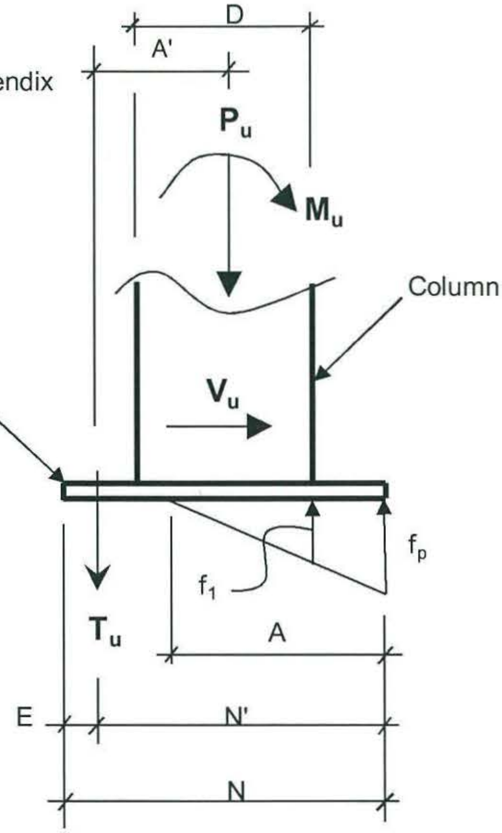
SF = 145.55 > 1.0, OK

Use 22.5 ft x 18.50 ft x 2.00 ft Footing
By inspection, provide #5 @ 12" max., o.c. rebar, top and bottom, both directions

Base Plate

Design Load
See Support Reactions from RISA Analysis & Design in Appendix

P_u = 1.11 k Compression
V_u = 1.56 k
M_u = 15.55 k - ft



Try Base Plate Dimension
Width, B = 14.00 in
Length, N = 14.00 in
Edge Dist., E = 1.50 in
Thickness, t_p = 1.00 in

Depth or Diameter of Column, D = 6 in
Concrete Strength, fc' = 4.00 ksi
Plate Yield Strength, Fy = 36 ksi

Area of base plate, $A_1 = B * N$ = 196 si
Area of conc. support, A_2 = 342 si
A_2 / A_1 = 1.74 OK

eccentricity, $e = M_u / P_u$ = 168.60 in

Design bearing stress
$F_p = 0.85\ \varphi_c\ fc'\ (A_2 / A_1)^{0.5}$ < or = $1.7\ \varphi_c\ fc'$ φ_c = 0.60
F_p = 2.69 ksi OK **$1.7\ \varphi_c\ fc'$ = 4.08 ksi**

$A' = (N / 2) - E$ = 5.50 in $N' = N - E$ = 12.50 in

Let $f_p = F_p$ = 2.69 ksi $f' = f_p\ B\ N' / 2$ = 235.79 k

$A = \{ f' + \text{or} - [f'^2 - 4 (f_p B / 6)(P_u A' + M_u)]^{0.5} \} / (f_p B / 3)$ in
let $k_1 = [f'^2 - 4 (f_p B / 6)(P_u A' + M_u)]^{0.5}$ = 225.28 k

$A = \{ f' + \text{or} - k_1 \} / (f_p B / 3)$ f_1 = 0.00 ksi
A = 0.84 in OK

Tension per Anchor Bolt, N_{ua}
$T_u = (f_p\ A\ B / 2) - P_u$
T_u = 14.66 k

$N_{ua} = T_u$ / Number of anchors per side Number of anchors per side = 2
N_{ua} = 7.33 k

Base Plate (cont)

Shear per anchor bolt, $V_{ua} = V_u$ / Number of Anchor Bolts Resisting Shear

V_{ua} = 0.39 k

Bending of Base Plate

Compression side

$N - \delta D$ = 9.20 in

M_{pl} = 68.15 k - in

Column-Type Number

1 δ = 0.95 for HSS & WF strong axis bending

2 δ = 0.80 for Pipe & WF weak axis bending

Choose Column-Type Number ? 2

Assume effective width, b = 14 in

Thickness of Base Plate

$t_p = (4 M_{pl} / b\ 0.9F_y)^{0.5}$ = 0.78 in < tp provided, OK

Tension side

Distance of anchor to edge of column, d = 2.65 in

Assume effective width, b = 5 in conservative

$M_{pl} = N_{ua} \times d$

M_{pl} = 19.43 k - in

Thickness of Base Plate

$t_p = (4 M_{pl} / b\ 0.9F_y)^{0.5}$ = 0.69 in < tp provided, OK

Use	**14.00 in x**	**14.00 in x**	**1.00 in**	**thick base plate**
Weld column to base plate using full penetration groove weld				

Anchor Bolt — **Reference: ACI 318-11 Appendix D**

Material Properties and Dimensions

Anchor Bolt Yield Strength, f_{ya} = 36 ksi — ASTM F1554 GR 36 Threaded Rod

Anchor Bolt Tensile Strength, f_{uta} = 60 ksi — < or = 1.9 fya, OK; < or = 125 ksi, OK

Spacing of Anchor Bolts, s = 11.50 in — > or = s min, 6 da, OK — < 3 hef

Edge Distance of Anchor Bolts, c_a = 24.00 in — > or = c min, 6 da, OK — > or = hef

Concrete Strength, fc' = 4.00 ksi — Concrete cover at the top = 2.00 in

Length of anchor bolt, L = 18.00 in — Thickness of Nut, t_n = 0.75 in

Anchor Bolt Projection, p = 5.00 in — Number of Anchor Bolts, n_T = 4

Anchors in group action ? no — Number of Anchors in Tension, n = 1

Number of Anchors in Shear, n_v = 1

Embedment of anchor bolt, $h_{ef} = L - p - t_n - 0.5$ = 11.75 in

Steel Strength in Tension, N_{sa}

Try 0.75 in diameter ASTM F1554 GR 36 Threaded Rod

$A_{se,N}$ = 0.334 si — AISC Table 7-17

$N_{sa} = A_{se,N} f_{uta}$ = 20.04 k

ϕN_{sa} = 15.03 k — ϕ = 0.75 for ductile steel element

$n \phi N_{sa}$ = 15.03 k

Concrete Breakout Strength in Tension, N_{cb}

$N_b = 16 \lambda_a fc'^{0.5} h_{ef}^{5/3}$ — for 11 in < h_{ef} < 25 in — λ_a = 1.0 NWC

$N_b = k_c \lambda_a fc'^{0.5} h_{ef}^{1.5}$ — for all other values of h_{ef} — k_c = 24 Cast-in Anchor

N_b = 61.45 k

$A_{Nco} = 9 h_{ef}^2$ = 1243 si

$n A_{Nco}$ = 1243 si

$A_{Nc} = (3 h_{ef})(3 h_{ef})$ = 1243 si — < n Anco, OK

$\psi_{ec,N}$ = 1.00 concentrically loaded anchor

$\psi_{ed,N} = 0.7 + 0.3 c_a / 1.5 h_{ef}$ — modification factor for edge effects

$\psi_{ed,N}$ = 1.00

$\psi_{c,N}$ = 1.00 cracked concrete

$\psi_{cp,N}$ = 1.00 cast-in place anchor

Anchor Bolt (cont)

Concrete Breakout Strength in Tension, N_{cb} (cont)

$N_{cb} = A_{Nc}\,\psi_{ed,N}\,\psi_{c,N}\,\psi_{cp,N}\,N_b / A_{Nco}$ for single anchor or group of anchors where s > or = 3 h_{ef}

$N_{cbg} = A_{Nc}\,\psi_{ec,N}\,\psi_{ed,N}\,\psi_{c,N}\,\psi_{cp,N}\,N_b / A_{Nco}$ for group of anchors where s < 3 h_{ef}

N_{cb} = 61.45 k

ϕN_{cb} = 43.02 k ϕ = 0.70 Condition B cracked concrete

Pullout Strength in Tension, N_{pn}

try Heavy HEX Nut for 0.75 in Threaded Rod or Bolt

Area of Heavy HEX Nut, $A_n = (3^{0.5} / 2)\,W^2$ = 1.353 si W = 1.250 in

Area of Rod or Bolt, $A_b = \pi\, d_o^2 / 4$ = 0.442 si d_o = 0.75 in

$A_{brg} = A_n - A_b$ = 0.911 si

$N_p = 8\,A_{brg}\,fc'$ = 29.16 k

$N_{pn} = \psi_{c,p}\,N_p$ = 29.16 k $\psi_{c,p}$ = 1.0 cracked concrete

ϕN_{pn} = 20.41 k ϕ = 0.70 Condition B

Concrete Side-Face Blowout Strength in Tension, N_{sb}

By inspection, concrete side-face blowout strength will not govern the design since the anchors are not in close proximity to the edge of the concrete (c_a > 0.4 h_{ef}) and / or due also to the presence of confining reinforcements.

Governing Concrete Tensile Strength, 0.75 ϕ N_{nc} Min of 0.75 ϕ N_{cb}, 0.75 ϕ N_{pn} & 0.75 ϕ N_{sb}

0.75 ϕ N_{nc} = 15.31 k > Nua, OK

Governing Steel Tensile Strength, ϕ N_{sa}

ϕ N_{sa} = 15.03 k > Nua, OK

Steel Strength in Shear, V_{sa}

Base Plate Over Grout Pad ? yes Ase,v = 0.334 si

Vsa = 0.8 x 0.60 Ase,v futa = 9.62 k

ϕ V_{sa} = 6.25 k ϕ = 0.65 for ductile steel element

$n_T\,\phi\,V_{sa}$ = 25.01 k

Concrete Breakout Strength in Shear, V_{cb}

Note: The following strength calculations are for anchors loaded towards the edge of the concrete member. For anchors that are not loaded towards the edge of the concrete or for anchors that are very far from the edge of the concrete or where anchor reinforcements are provided, the concrete breakout strength in shear will not govern or not applicable.

$V_{cb} = A_{Vc}\,\psi_{ed,V}\,\psi_{c,V}\,\psi_{h,V}\,V_b / A_{Vco}$ for single anchor

$V_{cbg} = A_{Vc}\,\psi_{ec,V}\,\psi_{ed,V}\,\psi_{c,V}\,\psi_{h,V}\,V_b / A_{Vco}$ for group of anchors

Anchor Bolt (cont)

$A_{Vco} = 4.5\ c_{a1}^2 =$ 2592 si

$n_v\ A_{Vco} =$ 2592 si

$Avc = 2\ (1.5\ ca1)\ (ha)$

$A_{Vc} =$ 1728 si < n Avco, OK

$c_{a1} =$ 24.00 in distance from edge of concrete

$h_a =$ 24.00 in thickness of concrete member

$h_a < 1.5\ c_{a1}$? yes

$s_1 = s =$ 11.50 in

V_b shall be the smaller of

$V_b = [\ 7\ (l_e / d_a)^{0.2}\ (\ d_a\ )^{0.5}\ ]\ \lambda_a\ (\ fc'\ )^{0.5}\ c_{a1}^{1.5}$

$V_b = 9\ \lambda_a\ (\ fc'\ )^{0.5}\ c_{a1}^{1.5}$

$V_b =$ 66.93 k

$l_e =$ 6.00 in

$\psi_{ec,\,V} =$ 1.00 concentric shear

$\psi_{ed,\,V} =$ 1.00

$\psi_{c,\,V} =$ 1.00

$\psi_{h,\,V} =$ 1.22

$n_v =$ 1

$V_{cb} = A_{Vc}\ \psi_{ed,\,V}\ \psi_{c,\,V}\ \psi_{h,\,V}\ V_b / A_{Vco}$ or

$V_{cbg} = A_{Vc}\ \psi_{ec,\,V}\ \psi_{ed,\,V}\ \psi_{c,\,V}\ \psi_{h,\,V}\ V_b / A_{Vco}$

$V_{cb} =$ 54.64 k

$\phi\ V_{cb} =$ 38.25 k

$\phi =$ 0.70 Condition B

Concrete Pryout Strength in Shear, V_{cp}

$V_{cp} = k_{cp}\ N_{cp}$ for single anchor

$V_{cpg} = k_{cp}\ N_{cpg}$ for group of anchors

$N_{cp} = N_{cb} =$ 61.45 k

$N_{cpg} = N_{cbg} =$ 61.45 k

$V_{cp} =$ 122.91 k

$\phi\ V_{cp} =$ 86.03 k

$k_{cp} =$ 2.0

$\phi =$ 0.70 Condition B

Governing Concrete Shear Strength, $0.75\ \phi\ V_{nc}$

Min of $0.75\ \phi\ V_{cb}$ & $0.75\ \phi\ V_{cp}$

$0.75\ \phi\ V_{nc} =$ 28.69 k > Vua, OK

Governing Steel Shear Strength, $\phi\ V_{sa}$

$\phi\ V_{sa} =$ 6.25 k > Vua, OK

Check Interaction Equation (anchor is loaded in tension and shear)

Steel Strength Interaction

$0.2 \times \phi\ V_{sa} =$	1.25 k	> Vua	SDC C and Higher
$\phi\ N_{sa} =$	**15.03 k**	**> Nua, OK**	
$0.2 \times \phi\ N_{sa} =$	3.01 k	< Nua, See Below Interaction	SDC C and Higher
$\phi\ V_{sa} =$	**6.25 k**	*	

$(N_{ua} / \phi\ N_{sa}) + (V_{ua} / \phi\ V_{sa}) \le 1.20$

$(N_{ua} / \phi\ N_{sa}) + (V_{ua} / \phi\ V_{sa}) =$ 0.55 < 1.2, OK

Anchor Bolt (cont)

Concrete Strength Interaction

$0.2 \times 0.75\ \phi\ V_{nc}$ =	5.74 k	> Vua	SDC C and Higher
$0.75\ \phi\ N_{nc}$ =	**15.31 k**	**> Nua, OK**	
$0.2 \times 0.75\ \phi\ N_{nc}$ =	3.06 k	< Nua, See Below Interaction	SDC C and Higher
$0.75\ \phi\ V_{nc}$ =	**28.69 k**	*	

$(N_{ua} / 0.75\ \phi\ N_{nc}) + (V_{ua} / 0.75\ \phi\ V_{nc}) \leq 1.20$

$(N_{ua} / 0.75\ \phi\ N_{nc}) + (V_{ua} / 0.75\ \phi\ V_{nc})$ = 0.49 < 1.2, OK

Use 0.75 in diameter ASTM F1554 GR 36 Threaded Rod x 18 in long with 12 in Embedment (4 total per base plate)