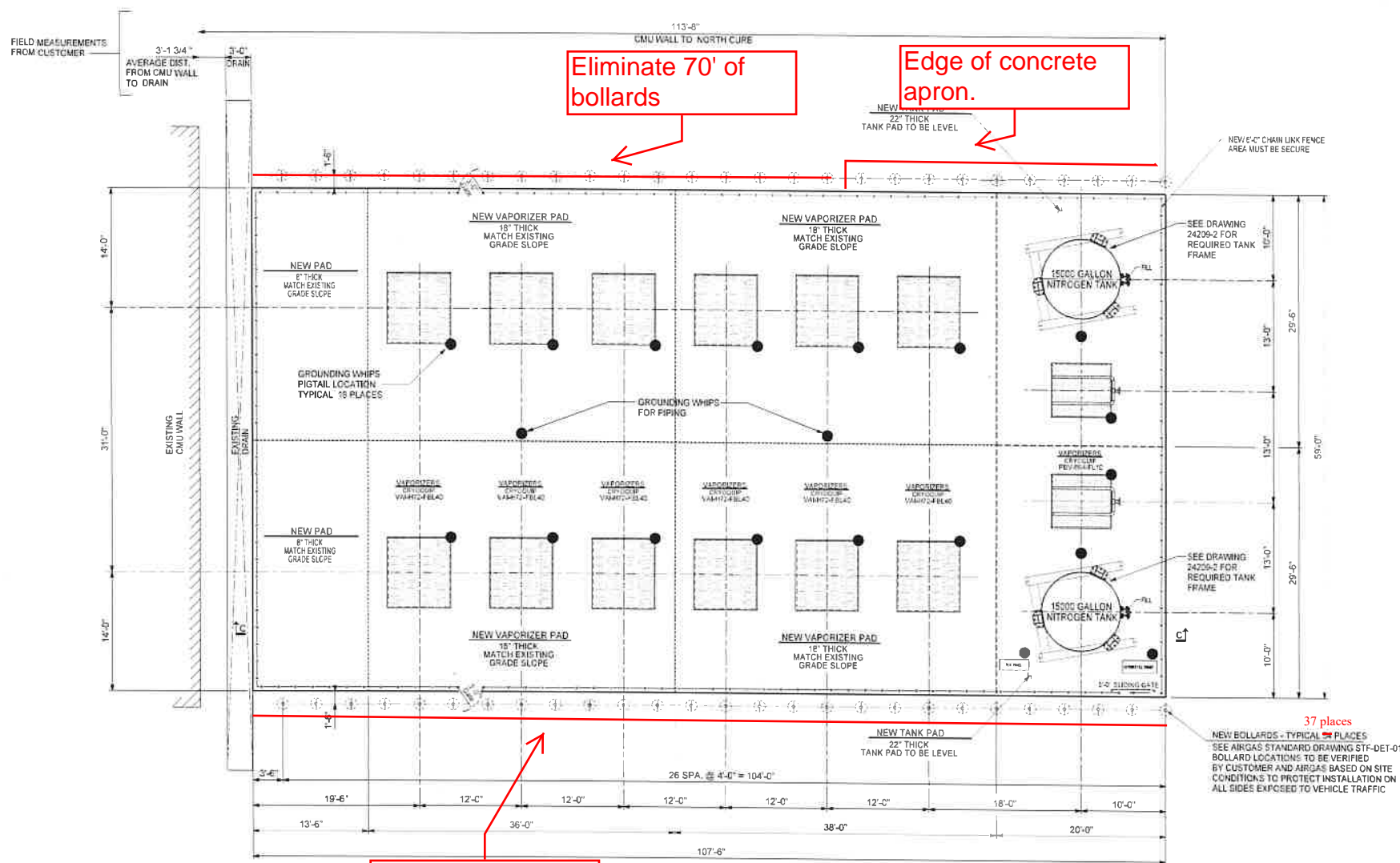


LOCATION AND ORIENTATION OF THE INSTALLATION SHALL BE VERIFIED IN THE FIELD

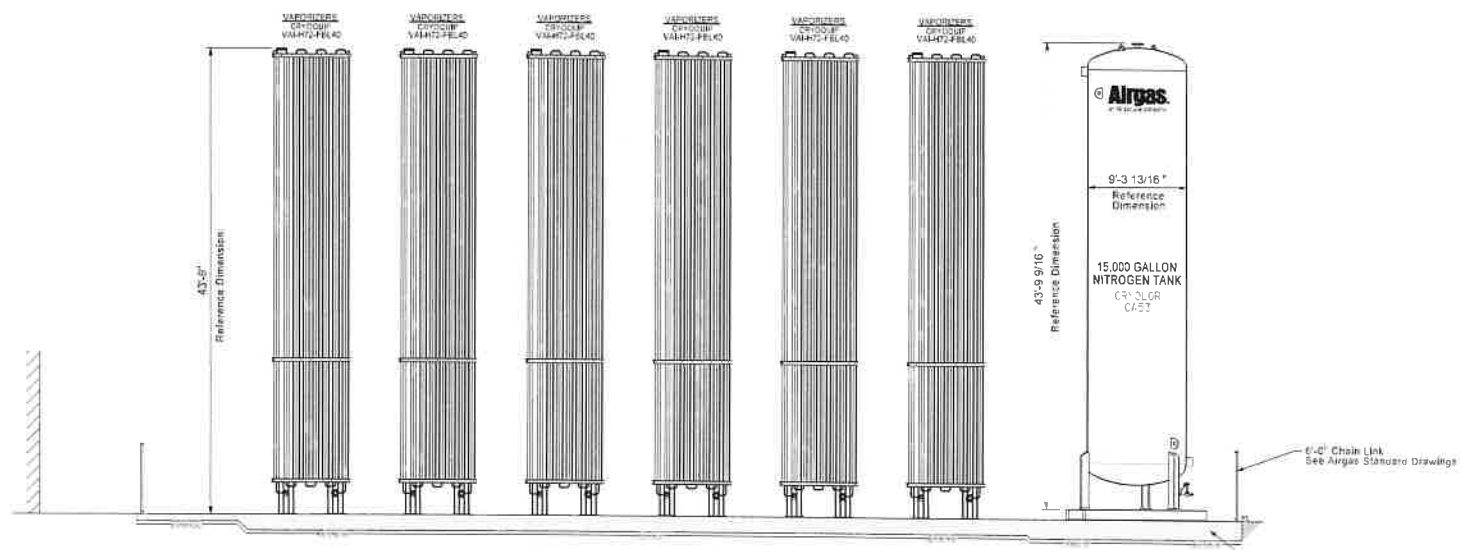
- GENERAL NOTES**
1. VERIFY ALL DIMENSIONS AND CONDITIONS IN FIELD
  2. ALL CONCRETE CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF ACI-301 AND ACI-318
  3. CONCRETE COMPRESSIVE STRENGTH SHALL BE 4000 PSI @ 28 DAYS
  4. ALL REINFORCING BARS SHALL CONFORM TO ASTM A615 GRADE 60
  5. PROVIDE POSITIVE DRAINAGE OF CRUSHED STONE BASE AND SURROUNDING GRADE.
  6. DESIGN SOIL CAPACITY 2000 PSF MINIMUM
  7. THE SOIL BELOW AND AROUND THE NEW FOUNDATION SLAB SHOULD BE PREPARED PER AGECC GEOTECHNICAL REPORT DATED FEBRUARY 26, 2025. AGECC SHOULD BE CONTACTED FOR ADDITIONAL GUIDANCE.
  8. DESIGN FOR OCCUPANCY CATEGORY II.
  9. DESIGN WIND VELOCITY 103 MPH (ASCE 7-16) EXPOSURE C
  10. DESIGN SEISMIC:  
0.2 SEC. SPECTRAL RESPONSE ACCELERATION 132 1/g  
1.0 SEC. SPECTRAL RESPONSE ACCELERATION 46.8/g  
SEISMIC DESIGN CATEGORY D
  11. ALL ELECTRICAL WORK SHALL COMPLY WITH THE LOCAL ADOPTED VERSION OF NFPA 70, NEC

Work This Drawing With 2021 Versions of Airgas Standard Drawings:  
 STF-DET-01 - Standard Bollard, Fence, and Joint Details  
 STF-DET-02 - Tank Pad and Anchoring Installation Notes  
 See Airgas Representative For Drawings Regarding:  
 Grounding (STE-GEN-001), Delivery Guidelines, Exposure Distances, and Courtyard Guidelines.



Edge of concrete apron is 5'-0" from slab, typical.

**15,000 GALLON NITROGEN SUPPLY SYSTEM**  
 X=1'-0"  
 ● = GROUNDING WHIP PIGTAIL LOCATION



**ELEVATION**  
 X=1'-0"

For Pad Installation Procedure See Airgas Standard Details

REV	DESCRIPTION	BY	DATE	CHKD	DATE	BY	DATE	CHKD	DATE
0	FOR CONSTRUCTION	RG	5-10-23						
A	FOR CLIENT REVIEW	RG	3-6-25						

**Airgas** an Air Liquide company  
 Airgas USA, LLC  
 Intermountain  
 1610 S. Wadsworth Blvd.  
 Denver, CO 80227  
 Phone (303) 318-7124  
 HTTP://www.airgas.com

DESIGN	CE	1-25
CHECKED	RG	3-25
PROJECT NO.	24209	

**S.M.HAW**  
 ASSOCIATES, L.L.C.  
 2283 E ENTERPRISE PKWY.  
 TWINSBURG, OH | 330.403.4480

WORK THIS DRAWING WITH DRAWING 24209-2 & 24209-3

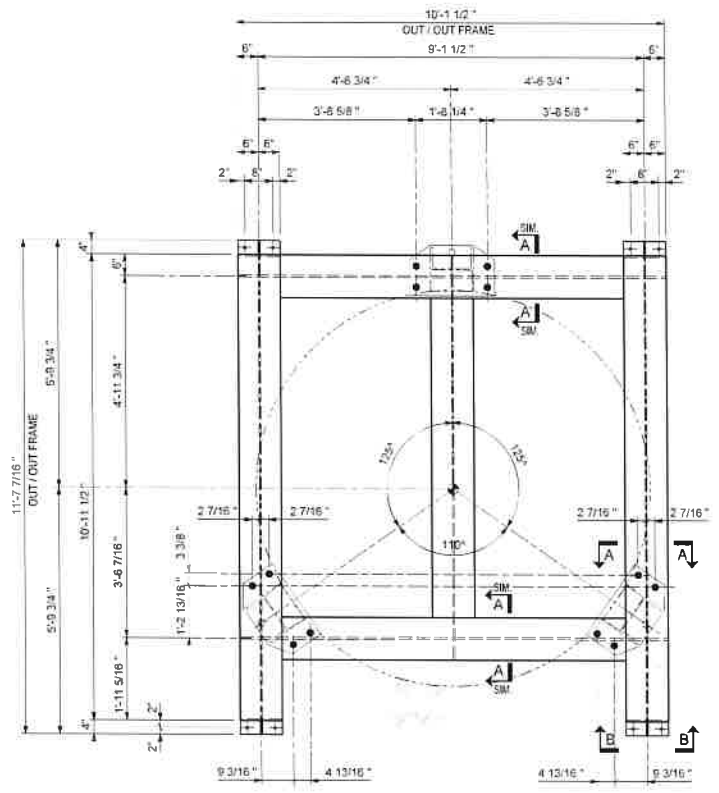
Albany Engineered Composites 6955 W. Amelia Earhart Dr., Salt Lake City, UT 84116	SCALE 1/8" = 1'-0"	ISSUE DATE 3-10-25
15,000 GALLON NITROGEN SUPPLY SYSTEM PLAN & ELEVATION	DRAWING NO. 24209-1	PAGE 0



ORIENTATION OF THE INSTALLATION SHALL BE VERIFIED IN THE FIELD

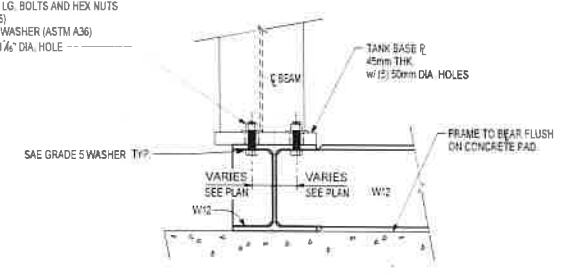
TANK SUPPORT FRAME DESIGNED TO SUPPORT A CRYOLOR CA53 NITROGEN TANK, 9'-3 3/8" DIAMETER x 43'-9 1/2" HIGH

- NOTES:
- 1) ALL STEEL TO BE DETAILED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE LATEST AISC & AWS SPECIFICATIONS.
  - 2) ALL STEEL TO BE ASTM A992.
  - 3) ALL WELDING SHALL BE MADE BY CERTIFIED WELDERS USING E70XX ELECTRODES IN ACCORDANCE WITH THE LATEST AWS SPECIFICATIONS D1.1.
  - 4) PAINT
    - a. CLEAN SURFACE PER SSPC-SP 3 TO REMOVE RUST & SCALE.
    - b. PRIMER: RUST-OLEUM 9300 HIGH SOLID EPOXY PRIMER.
    - c. FINISH: COAT RUST-OLEUM E100 SYSTEM HIGH PERFORMANCE HIGH BUILD EPOXY, COLOR WHITE.
 APPLY PER MANUFACTURERS RECOMMENDATIONS. COMPARABLE PAINT SYSTEMS MAY BE USED IF APPROVED BY AIRGAS.

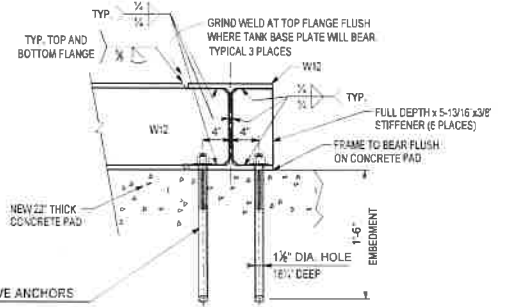


ENLARGED TANK BASE PLATE INSTALLATION DETAIL  
1/8\"/>

- (4) 1\"/>



SECTION A-A  
1/8\"/>



SECTION B-B  
1/8\"/>

- "HILTI" HIT-HY 200 ADHESIVE ANCHORS
- (2) 1 x 24\"/>

David K Cremer  
  
 No. 12584749-2202  
 DAVID K CREMERS  
 STATE OF UTAH

WORK THIS DRAWING WITH DRAWING 24209-1 & 24209-3

0	FOR CONSTRUCTION	RG	3-10-25						
A	FOR REVIEW	RC	3-25						
DATE	DESCRIPTION	BY	DATE	CHKD	DATE	DESCR	BY	DATE	CHKD

**Airgas** Airgas USA, LLC Intermountain  
 an Air Liquide company  
 4510 S HANCOCK BLVD  
 DENVER, COLORADO 80214  
 PHONE (303) 576-1000  
 WWW.AIRGAS.COM

CREAT	CE	DATE	1-25
CHECKED	RG	DATE	3-25
DRAWING NO.	24209		

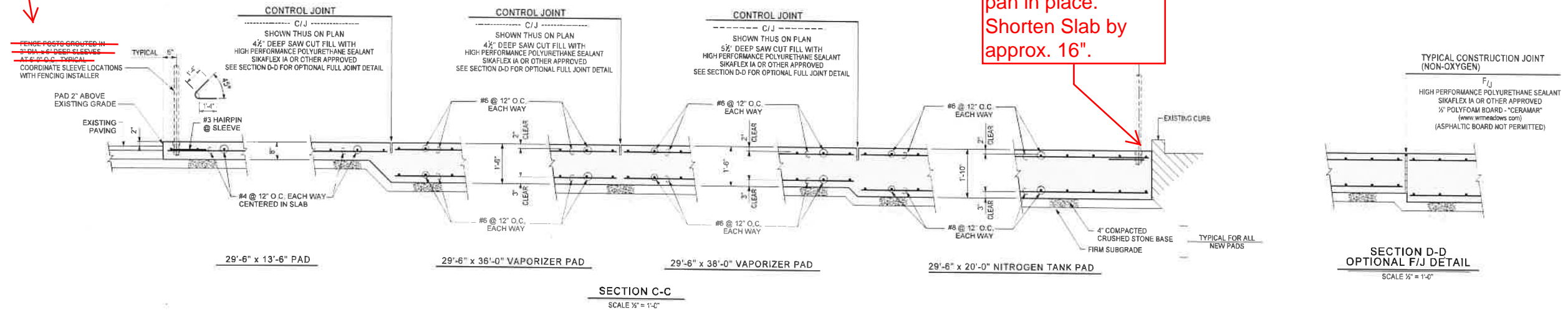
**S.M.HAW** ASSOCIATES, INC.  
 2225 E ENTERPRISE PARKWAY  
 TWINSBURG, OH 43085-4480

Albany Engineered Composites  
 5695 W. Amelia Earhart Dr.,  
 Salt Lake City, UT 84116  
 15,000 GALLON NITROGEN SUPPLY SYSTEM  
 FRAME DETAILS

SCALE	1/8" = 1'-0"	ISSUE DATE	3-10-25
DRAWING NO.	24209-2	ISSUE	0

Core drill all fence posts for 12" embedment into slab.

Leave existing curb pan in place. Shorten Slab by approx. 16".



TANK ANCHORAGE

**15,000 GALLON NITROGEN TANK ANCHORAGE - TANK TO FRAME**  
 ASTM A325 OR SAE GRADE 5 BOLTS  
 4 - ANCHORS AT EACH CORNER - 16 ANCHORS TOTAL  
 1" DIA. x 4" LG. ASTM A325 OR SAE GRADE 5 BOLT W/1-HEX NUT (ASTM A503 STEEL)  
 AND PLATE WASHER 3/4"x3"x3"  
 W/ 1 1/4" DIA. HOLE - ZINC PLATED

TANK FRAME ANCHORAGE

**TANK FRAME ANCHORAGE - FRAME TO CONCRETE - NO GROUT**  
 "HILTI" HIT-HY 200A ADHESIVE ANCHORS  
 2 - ANCHORS PER CORNER - 8 ANCHORS TOTAL  
 1" DIA. x 24" LG. HAS-V-36 THREADED ROD W/1-HEX NUT (ASTM F1554 STEEL)  
 HIT-HY 200A ADHESIVE  
 18" MINIMUM EMBEDMENT (SEE NOTE 'A')  
 3/4" DIA. x 16 1/2" DEEP HOLES IN CONCRETE  
 MAXIMUM TIGHTENING TORQUE = 150 FT. LBS.

NOTE 'A'  
 BECAUSE THE SEISMIC DESIGN CATEGORY (SDC) IS D,  
 THE TANK LEG ANCHORAGE MUST BE EMBEDDED INTO THE CONCRETE  
 ENOUGH TO HANDLE THE TENSILE STRENGTH OF THE ANCHOR ROD.  
 REFERENCE ASCE 7-15 SECTION 15.7.5.

VAPORIZER ANCHORAGE

**CRYOQUIP PBV-864-FL10 - NO GROUT ALLOWANCE**  
 "HILTI" HIT-HY 200 ADHESIVE ANCHORS  
 1 ANCHOR PER BASE PLATE  
 TOTAL OF 4 REQUIRED PER VAPORIZER  
 3/4" DIA. x 12" HAS-V-36 THREADED ROD W/1-HEX NUT (ASTM F1554 STEEL)  
 8" MINIMUM EMBEDMENT INTO  
 3/4" DIA. x 8 1/2" DEEP HOLES IN CONCRETE  
 MAXIMUM TIGHTENING TORQUE = 100 FT. LBS.

**CRYOQUIP VAI-H72-FBL40 - 1" MAXIMUM GROUT ALLOWANCE**  
 "HILTI" HIT-HY 200 ADHESIVE ANCHORS  
 4 ANCHORS PER BASE PLATE  
 TOTAL OF 16 REQUIRED PER VAPORIZER  
 3/4" DIA. x 12" HAS-V-36 THREADED ROD W/1-HEX NUT (ASTM F1554 STEEL)  
 8" MINIMUM EMBEDMENT INTO  
 3/4" DIA. x 8 1/2" DEEP HOLES IN CONCRETE  
 MAXIMUM TIGHTENING TORQUE = 100 FT. LBS.

0	FOR CONSTRUCTION	RG	3-10-25						
A	FOR REVIEW	RG	3-25						
REV	DESCRIPTION	BY	DATE	MAPP	DESCRIPTION	BY	DATE	MAPP	DESCRIPTION

**Airgas** an Air Liquide company  
 Airgas USA, LLC  
 Intermountain  
 4810 Van Ness Blvd.  
 Denver, Colorado 80216  
 Phone: (303) 370-9829  
 HTTP://www.airgas.com

PROJECT NO: 24209

**S.M.HAW**  
 ASSOCIATES INC.  
 2235 E ENTERPRISE PKWY.  
 TWINBURGH, OH | 330 403 4490

WORK THIS DRAWING WITH DRAWING 24209-1 & 24209-2

Albany Engineered Composites 5995 W. Amelia Earhart Dr., Salt Lake City, UT 84116		SCALE 1/2" = 1'-0"	ISSUE DATE 3-10-25
15,000 GALLON NITROGEN SUPPLY SYSTEM PAD DETAILS		PROJECT NO. 24209-3	ISSUE NO. 0

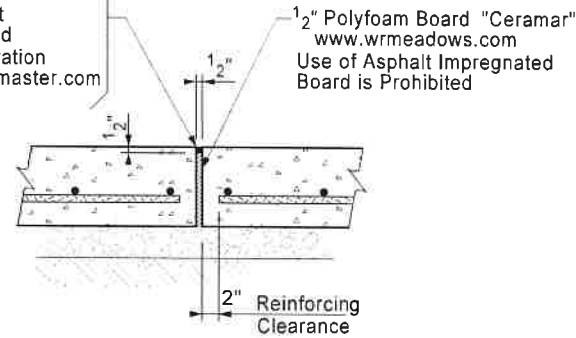


**For Nitrogen or Argon Service**

High Performance Polyurethane Sealant Sikaflex 1a or Other Approved

**For Oxygen Service**

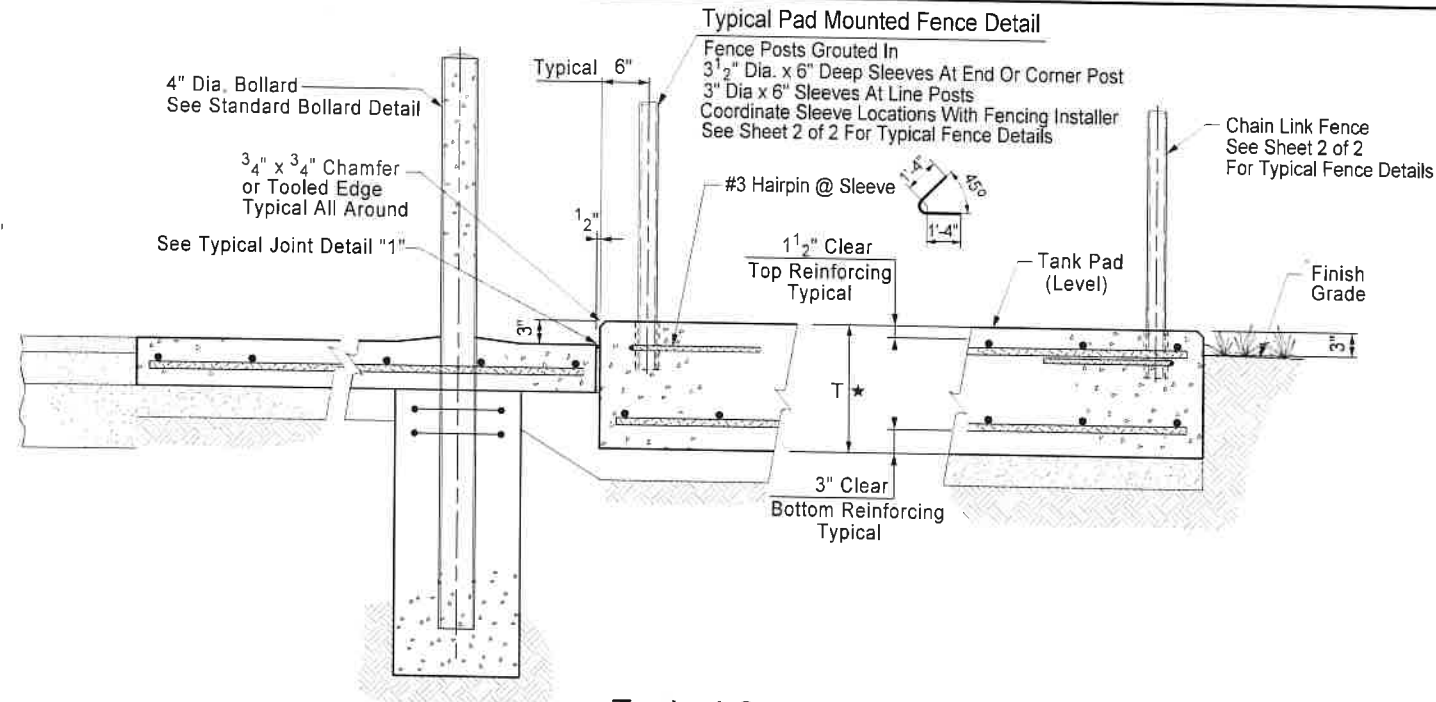
Chem Seal CS 2727 Sealant Other Sealants Not Permitted By The Flamemaster Corporation (818) 890-1401 www.flamemaster.com



**Detail "1"**

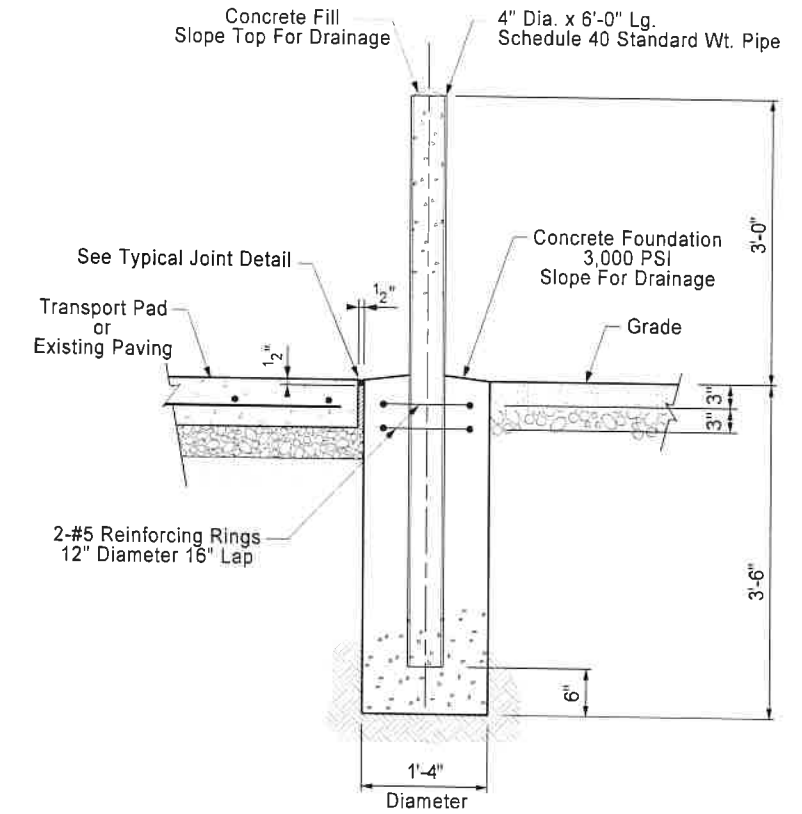
**Pad Isolation Construction Joint**

For Equipment Isolation



**Typical Section Through Pads With Pad Mounted Fence**

★ See Tank And Vaporizer Drawings For Pad Thickness And Reinforcing



**Standard Bollard Detail**

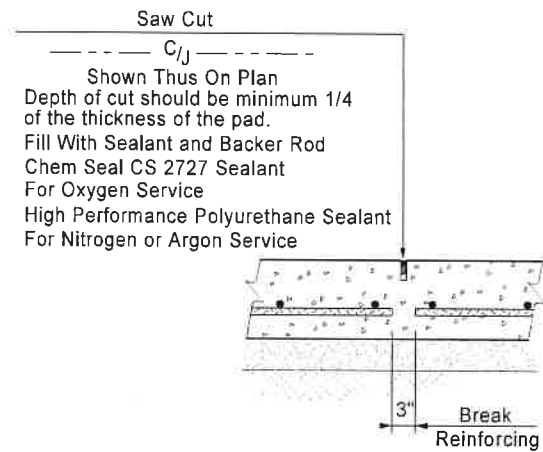
Bollard Design Per International Fire Code Section 312 And NFPA 55 2023

- Bollard Pipe Paint Specification
1. Clean Surface Per SSPC- SP3 to Remove Rust and Scale
  2. Primer: RUST-OLEUM Industrial Choice 340 VOC Alkyd Enamel Primer.
  3. Finish Coat: RUST-OLEUM Industrial Choice 340 VOC Alkyd Enamel Color to be Safety Yellow (206327). Apply Per Manufacturers Recommendations.

**Bollard Locations**

1. Bollard Locations To Be Verified By Customer And Airgas Based Upon Site Conditions To Protect Installation On All Sides Exposed To Vehicle Traffic
2. Maximum Distance Between Bollards is 4'-0" C/C.
3. Location of Bollards Should Not Interfere with Any Access Gates (Prevent Gates From Opening Fully).

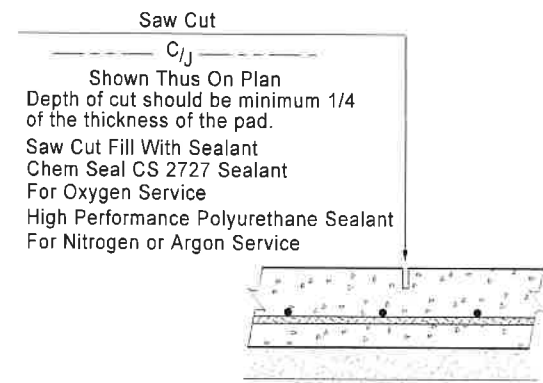
Airgas Standard Reference Drawings: STE-GEN-001 "Standard Grounding Guidelines for Bulk Systems"



**Detail "2"**

**Continuous Pad Or Equipment Isolation Control Joint**

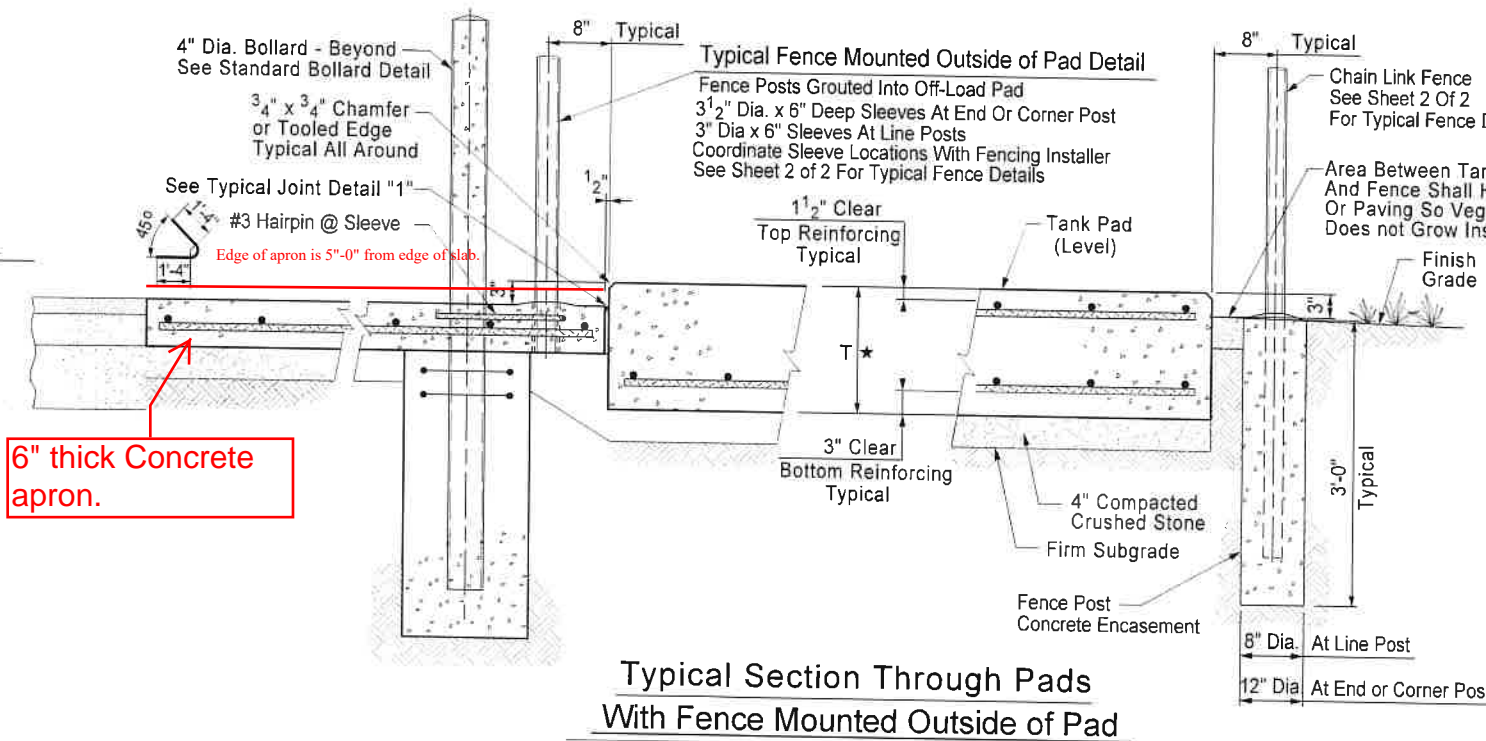
For Equipment Isolation



**Detail "3"**

**Typical Continuous Pad Control Joint**

For Crack Control For Pads Up To 8" Thick



**Typical Section Through Pads With Fence Mounted Outside of Pad**

★ See Tank And Vaporizer Drawings For Pad Thickness And Reinforcing

6" thick Concrete apron.

REV	DATE	DWN	CHK	APVD	REV	DATE	DWN	CHK	APVD
						12-04-2020			
1	3-11-24					REVISED PAD DETAILS AND FENCING DETAILS	DC	TM	CL
0	12-04-20					FOR CONSTRUCTION	DC	TM	CL

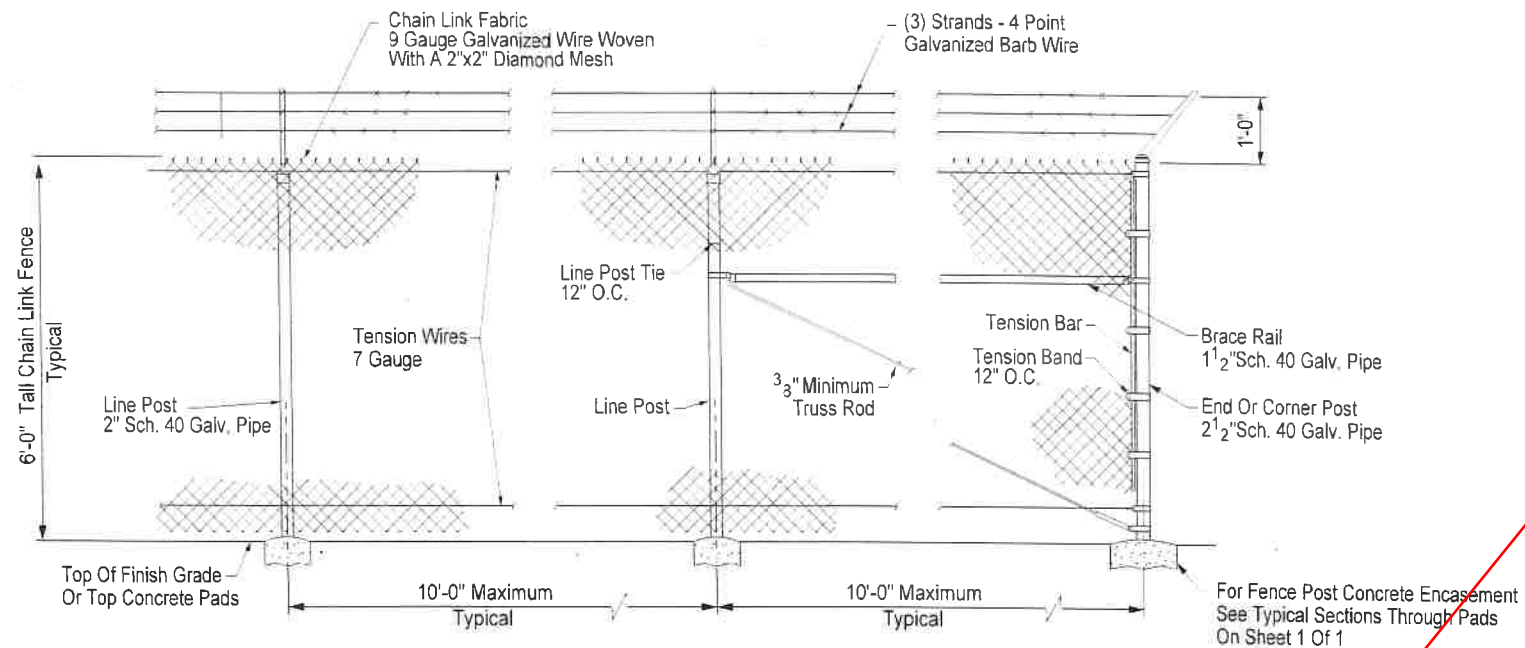
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**Standard Bollard, Fence, and Joint Details**

DATE 3-11-24 REV NO. 1

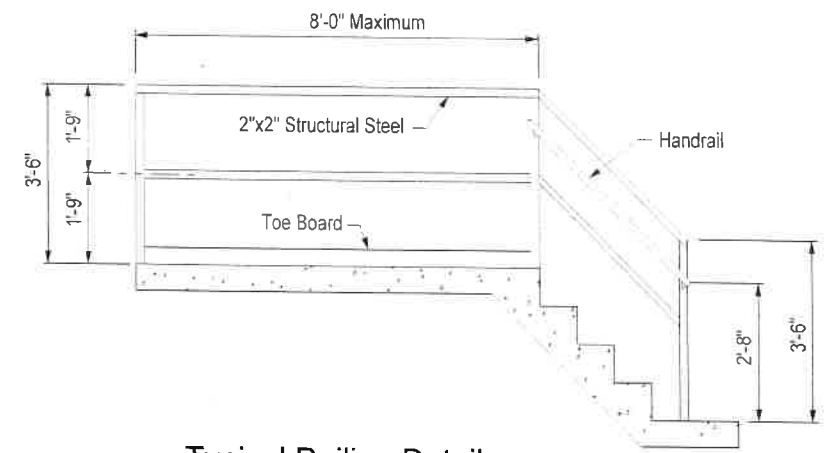
STF-DET-01 Sheet 1 of 2



**Typical Fence Detail**

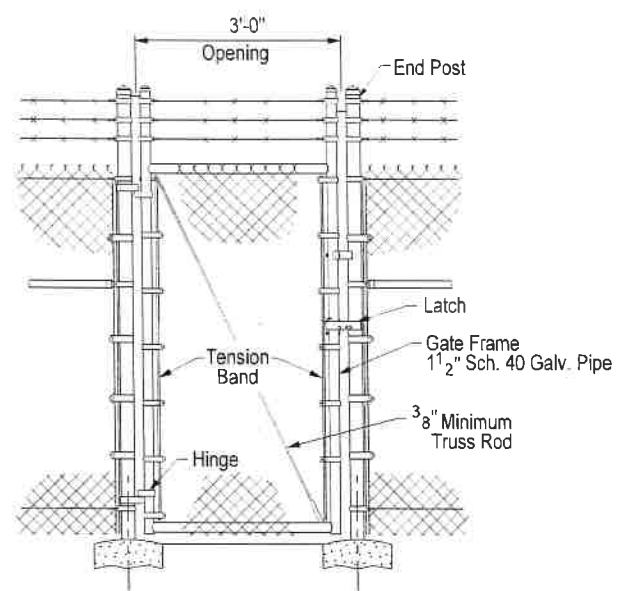
Shown With Fence Mounted Outside of Pad

Delete all barbed wire from fence.



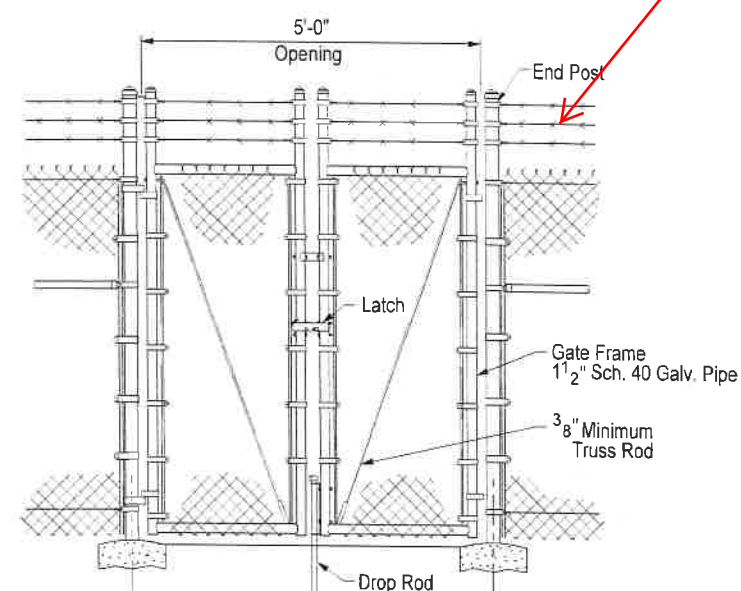
**Typical Railing Detail**

See OSHA Standard 1910.23  
Guardrail, Handrail And Toe Board  
To Be Painted Safety Yellow



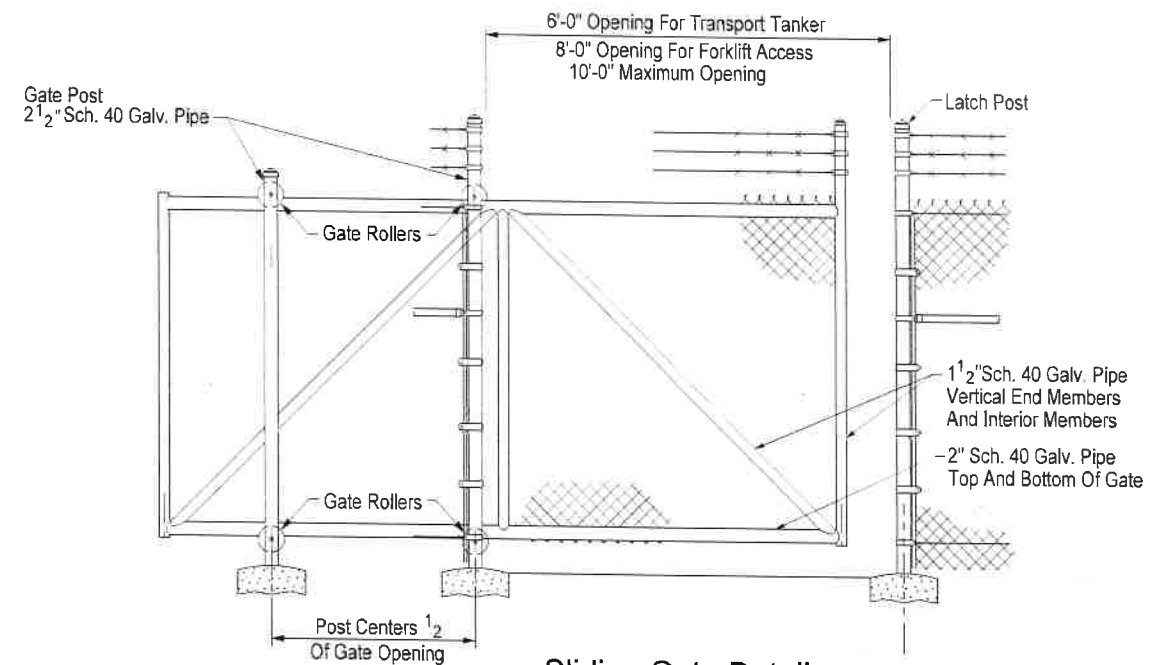
**Single Gate Detail**

Shown With Fence Mounted Outside of Pad



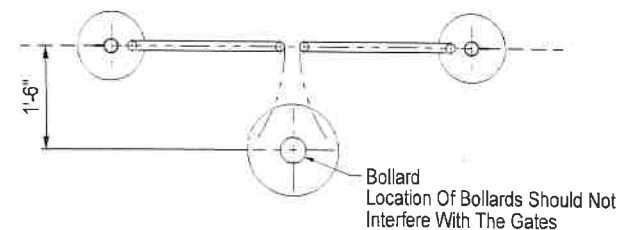
**Double Gate Detail**

Shown With Fence Mounted Outside of Pad

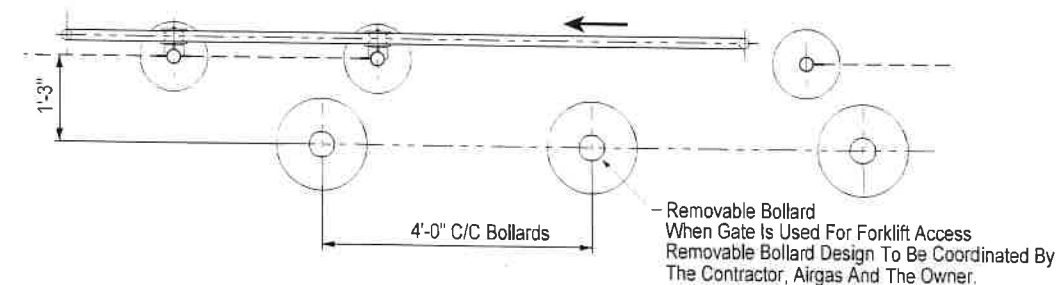


**Sliding Gate Detail**

Shown With Fence Mounted Outside of Pad



**Double Gate Plan**



**Sliding Gate Plan**

REV	DATE	BY	CHK	APP'D	DATE	DESCRIPTION	DC	TM	CL
					12-04-2020				
1	3-11-24					REVISED PAD DETAILS AND FENCING DETAILS FOR CONSTRUCTION	DC	TM	CL
D	12-04-20						DC	TM	CL

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**Standard Bollard, Fence, and Joint Details**

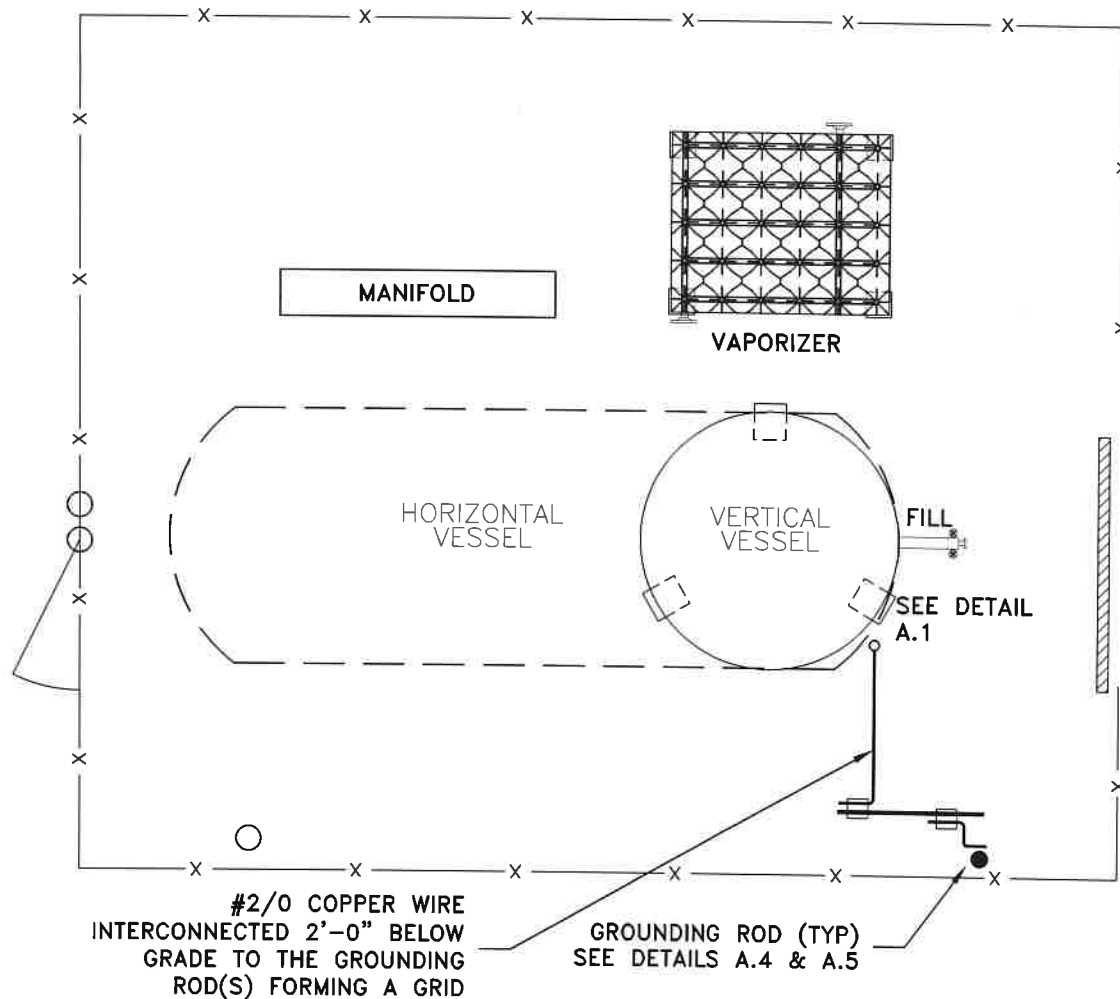
DATE: 3-11-24 REV. NO.: 1

STF-DET-01  
Sheet 2 of 2



# BULK LIN/LOX/LAR SYSTEMS

Notes reflect the requirements of NFPA70, National Electric Code and Airgas requirements. Additional requirements may be imposed by the AHJ (Authority Having Jurisdiction).



## NOTES FOR GROUNDING REQUIREMENTS

\*\*NOTE: TELEMETRY BASED SYSTEMS ARE NOT CONSIDERED TO BE A PLC OR DCS SYSTEM.

- GROUND GRID SHALL BE DESIGNED PER NEC. GROUND GRIDS OR MATS SHALL BE ACHIEVED BY MEANS OF ZINC OR COPPER-CLAD STEEL RODS OF SUFFICIENT LENGTH TO REACH PERMANENT GROUND MOISTURE. THE EQUIPMENT TO BE GROUNDED SHALL BE CONNECTED TO THE GROUND SYSTEM BY MEANS OF ADEQUATELY SIZED, BARE, STRANDED, COPPER CABLES.
- CONNECTIONS TO MOTOR FRAMES AND GROUND BUSES SHALL BE MADE WITH LUGS BOLTED OR WELDED TO THE EQUIPMENT. ANCHOR BOLTS WILL NOT BE USED FOR FASTENING LUGS OF GROUNDING CABLES. CONNECTIONS OF CABLE TO CABLE OR CABLE TO STRUCTURE ARE TO BE MADE BY MEANS OF COPPER OXIDE AND ALUMINUM POWDER WELDING PROCESS OR "UL" RATED COMPRESSION GROUNDING CONNECTIONS. EQUIPMENT THAT IS FURNISHED WITH GROUNDING PADS SHALL BE CONNECTED TO THE GROUND GRID USING "UL" RATED MECHANICAL GROUND CONNECTER AT THE PAD AND COMPRESSOR OR COPPER OXIDE AND ALUMINUM POWDER WELDING PROCESS.
- GROUND GRID OR MAT SHALL BE TESTED TO VERIFY DESIGN AND ALL EQUIPMENT TESTED VALUES SHALL BE BELOW (10 OHMS FOR PLC/DCS AND 25 OHMS WITHOUT) FOR ENTIRE GROUND GRID VALUE WITH RESPECT TO THE REFERENCE ROD.
- INDIVIDUAL GROUND RODS MUST MEASURE (10 OHMS FOR PLC/DCS AND 25 OHMS WITHOUT) OR LESS. FOR EACH GROUND ROD MEASURING GREATER THAN (10 OHMS FOR PLC/DCS AND 25 OHMS WITHOUT) ONE ADDITIONAL GROUND ROD MUST BE INSTALLED. THE ADDITIONAL GROUND ROD SHALL BE INSTALLED A DISTANCE OF 1.2 TIMES THE GROUND ROD LENGTH FROM THE INSTALLED GROUND ROD. A REFERENCE GROUND ROD FOR CURRENT AND FUTURE TESTING SHALL ALSO BE INSTALLED.
- THE NON-ELECTRICAL EQUIPMENT SHALL BE CONSIDERED TO BE ADEQUATELY GROUNDED WHEN THE CONDUCTIVE STRUCTURAL ELEMENT ON WHICH IT IS SUPPORTED IS CONNECTED TO THE GROUNDING SYSTEM WITH A 0.5 OHMS POINT-TO-POINT TEST (FROM ANY POINT ON THE STRUCTURAL ELEMENT TO THE GROUNDING SYSTEM). THE NON-ELECTRICAL EQUIPMENT TO BE GROUNDED IN A TYPICAL FLAMMABLE BULK INSTALLATION INCLUDES: VESSELS, TUBES, VAPORIZERS, CONTROL MANIFOLDS, VENT STACKS, FENCING & DISTRIBUTION TRAILERS.
- THE CONDUIT AND/OR RACEWAY SYSTEM FOR EACH CIRCUIT SHALL BE BONDED TOGETHER TO BE ELECTRICALLY CONTINUOUS. CONDUIT MAY BE USED TO PROTECT THE BARE COPPER GROUND WIRE WHEN ROUTED THROUGH THE FOUNDATION OR WHEN RUN ABOVE THE FOUNDATION WHERE EXPOSED TO POTENTIAL DAMAGE. IF METAL CONDUIT IS USED, THE CONDUIT SHALL BE BONDED TO THE CABLE AT BOTH ENDS. SLEEVES OR CLOSE NIPPLES USED BY CABLES EXITING ENCLOSURES RUNNING TO CABLE TRAY SHALL BE GROUNDED TO THE TRAY. CONDUIT DROPS FROM TRAYS SHALL BE GROUNDED TO THE TRAY. NON-METALLIC LIQUID TIGHT FLEXIBLE CONDUIT ABOVE 1" SHALL HAVE BONDING JUMPERS BETWEEN THE CONNECTORS OR CONDUIT. FLEXIBLE CONDUIT SIZES 1" AND SMALLER SHALL HAVE AN INTERNAL GROUND WIRE "UL" LISTED FOR GROUNDING.
- SLEEVES OR CLOSE NIPPLES USED BY CABLES EXITING ENCLOSURES RUNNING TO CABLE TRAY SHALL BE GROUNDED TO THE TRAY. CONDUIT DROPS FROM TRAYS SHALL BE GROUNDED TO THE TRAY. NON-METALLIC LIQUID TIGHT FLEXIBLE CONDUIT ABOVE 1" SHALL HAVE BONDING JUMPERS BETWEEN THE CONNECTORS OR CONDUIT. FLEXIBLE CONDUIT SIZES 1" AND SMALLER SHALL HAVE AN INTERNAL GROUND WIRE "UL" LISTED FOR GROUNDING.
- ALL LOW VOLTAGE MOTORS 600 VAC OR LESS AND 50 HP OR LESS SHALL HAVE AN INSULATED GROUND WIRE TERMINATED TO THE MOTOR FRAME IN THE PECKER HEAD GROUND LUG AND LANDED IN THE MOTOR CONTROL CENTER.
- ALL MOTORS GREATER THAN 50 HP SHALL HAVE ONE GROUND WIRE CONNECTED TO ITS FRAME RUNNING DIRECTLY TO THE GROUND GRID (MINIMUM SIZE GROUND WIRE SHALL BE THAT OF THE REQUIRED BOND WIRE) AND SHALL ALSO HAVE THE INSULATED GROUND WIRE TERMINATED TO THE MOTOR FRAME IN THE PECKER HEAD GROUND LUG AND LANDED IN THE MOTOR CONTROL CENTER.
- ALL RESISTIVE ELECTRICAL EQUIPMENT (HEATERS) WITH A RATING OF 1 KW OR ABOVE SHALL HAVE AN ADDITIONAL GROUND WIRE (MINIMUM SIZE GROUND WIRE SHALL BE THAT OF THE REQUIRED BOND WIRE) FROM THE FRAME RUNNING DIRECTLY TO THE GROUND GRID IN ADDITION TO THE GROUND WIRE RUNNING FROM THE ELECTRICAL GROUND IN THE EQUIPMENT CONTROL PANEL TO THE DISTRIBUTION OR MOTOR CONTROL CENTER.
- CABLE TRAYS AND RACEWAY SYSTEMS SHALL BE BONDED TOGETHER AND TO THE GROUND GRID AS SHOWN ON THE GROUNDING DRAWINGS AND DETAILS AND, AS A MINIMUM, GROUNDED AT BOTH ENDS AND AT 60-FOOT INTERVALS.
- FOR INSTALLATIONS WITH NEW FOUNDATIONS, ROUTE GROUNDING ELECTRODES THROUGH CONCRETE PER FOUNDATION AND LAYOUT DRAWINGS. FOR EXISTING FOUNDATIONS, RUN GROUNDING LEADS ABOVE FOUNDATION, LOCATED TO MINIMIZE TRIPPING HAZARDS. GROUNDING SYSTEMS INCORPORATED INTO THE STEEL REINFORCED CONCRETE FOUNDATION ARE PERMITTED ON NEW INSTALLATIONS ONLY.
- EQUIPMENT TO BE GROUNDED FOR LIGHTING PROTECTION SHALL BE VESSELS, VAPORIZERS, AND VENT STACKS. HORIZONTAL EQUIPMENT OVER 15 FEET IN LENGTH AND VESSELS OVER 10 FEET IN DIAMETER SHALL HAVE TWO DIAGONALLY OPPOSED GROUND CONNECTIONS AT A MINIMUM.
- SEE PAGE 5 FOR EQUIPMENT GROUNDING DETAILS


SEE SITE SPECIFIC EQUIPMENT ARRANGEMENT DRAWING FOR ACTUAL CONDUCTOR LOCATION

REV	DATE	BY	CHK	APP	REV	DATE	BY	CHK	APP	DATE	BY	CHK	APP	DATE	BY	CHK	APP
7					3					4-16-20							
6					2												
5					1	3-31-21											
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PG	TM	CL	COMPUTER FILE	APPROV. / DATE	C.LAFLIN
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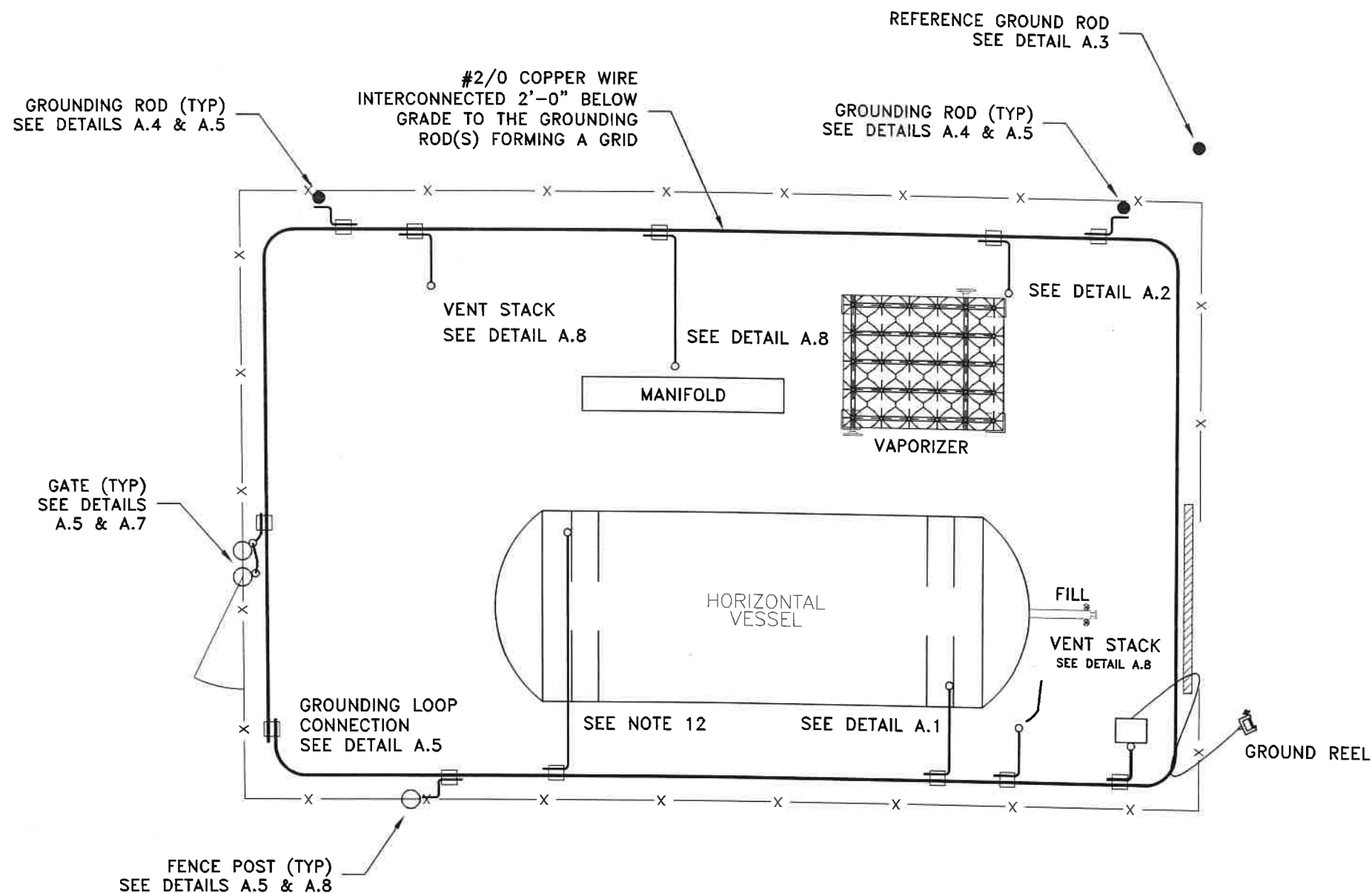
  

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PG	1 OF 5			REV NO.

# BULK HORIZONTAL LH2 SYSTEMS

Notes reflect the requirements of NFPA70, National Electric Code; CGA H-5, Installation Standards for Bulk Hydrogen Supply Systems; CGA H-3, Cryogenic Hydrogen Storage; CGA G-5.5, Hydrogen Vent Systems; 29 CFR Section 1910.103 and Airgas requirements.

Additional requirements may be imposed by the AHJ (Authority Having Jurisdiction).



## NOTES FOR GROUNDING REQUIREMENTS

- GROUND GRID SHALL BE DESIGNED PER NEC. GROUND GRIDS OR MATS SHALL BE ACHIEVED BY MEANS OF ZINC OR COPPER-CLAD STEEL RODS OF SUFFICIENT LENGTH TO REACH PERMANENT GROUND MOISTURE. THE EQUIPMENT TO BE GROUNDED SHALL BE CONNECTED TO THE GROUND SYSTEM BY MEANS OF ADEQUATELY SIZED, BARE, STRANDED, COPPER CABLES.
- CONNECTIONS TO MOTOR FRAMES AND GROUND BUSES SHALL BE MADE WITH LUGS BOLTED OR WELDED TO THE EQUIPMENT. ANCHOR BOLTS WILL NOT BE USED FOR FASTENING LUGS OF GROUNDING CABLES. CONNECTIONS OF CABLE TO CABLE OR CABLE TO STRUCTURE ARE TO BE MADE BY MEANS OF COPPER OXIDE AND ALUMINUM POWDER WELDING PROCESS OR "UL" RATED COMPRESSION GROUNDING CONNECTIONS. EQUIPMENT THAT IS FURNISHED WITH GROUNDING PADS SHALL BE CONNECTED TO THE GROUND GRID USING "UL" RATED MECHANICAL GROUND CONNECTER AT THE PAD AND COMPRESSOR OR COPPER OXIDE AND ALUMINUM POWDER WELDING PROCESS.
- GROUND GRID OR MAT SHALL BE TESTED TO VERIFY DESIGN AND ALL EQUIPMENT TESTED VALUES SHALL BE BELOW 10 OHMS FOR ENTIRE GROUND GRID VALUE WITH RESPECT TO THE REFERENCE ROD.
- INDIVIDUAL GROUND RODS MUST MEASURE 10 OHMS OR LESS. FOR EACH GROUND ROD MEASURING GREATER THAN 10 OHMS ONE ADDITIONAL GROUND ROD MUST BE INSTALLED. THE ADDITIONAL GROUND ROD SHALL BE INSTALLED A DISTANCE OF NOT LESS THAN 5 FEET FROM THE INSTALLED GROUND ROD. A REFERENCE GROUND ROD FOR CURRENT AND FUTURE TESTING SHALL ALSO BE INSTALLED.
- THE NON-ELECTRICAL EQUIPMENT SHALL BE CONSIDERED TO BE ADEQUATELY GROUNDED WHEN THE CONDUCTIVE STRUCTURAL ELEMENT ON WHICH IT IS SUPPORTED IS CONNECTED TO THE GROUNDING SYSTEM WITH A 0.5 OHMS POINT-TO-POINT TEST (FROM ANY POINT ON THE STRUCTURAL ELEMENT TO THE GROUNDING SYSTEM). THE NON-ELECTRICAL EQUIPMENT TO BE GROUNDED IN A TYPICAL FLAMMABLE BULK INSTALLATION INCLUDES: VESSELS, TUBES, VAPORIZERS, CONTROL MANIFOLDS, VENT STACKS, FENCING & DISTRIBUTION TRAILERS.
- THE CONDUIT AND/OR RACEWAY SYSTEM FOR EACH CIRCUIT SHALL BE BONDED TOGETHER TO BE ELECTRICALLY CONTINUOUS. CONDUIT MAY BE USED TO PROTECT THE BARE COPPER GROUND WIRE WHEN ROUTED THROUGH THE FOUNDATION OR WHEN RUN ABOVE THE FOUNDATION WHERE EXPOSED TO TRAFFIC. IF METAL CONDUIT IS USED, THE CONDUIT SHALL BE BONDED TO THE CABLE AT BOTH ENDS. SLEEVES OR CLOSE NIPPLES USED BY CABLES EXITING ENCLOSURES RUNNING TO CABLE TRAY SHALL BE GROUNDED TO THE TRAY. CONDUIT DROPS FROM TRAYS SHALL BE GROUNDED TO THE TRAY. NON-METALLIC LIQUID TIGHT FLEXIBLE CONDUIT ABOVE 1" SHALL HAVE BONDING JUMPERS BETWEEN THE CONNECTORS OR CONDUIT. FLEXIBLE CONDUIT SIZES 1" AND SMALLER SHALL HAVE AN INTERNAL GROUND WIRE "UL" LISTED FOR GROUNDING.
- ALL LOW VOLTAGE MOTORS 500 VAC OR LESS AND 50 HP OR LESS SHALL HAVE AN INSULATED GROUND WIRE TERMINATED TO THE MOTOR FRAME IN THE PECKER HEAD GROUND LUG AND LANDED IN THE MOTOR CONTROL CENTER.
- ALL MOTORS GREATER THAN 50 HP SHALL HAVE ONE GROUND WIRE CONNECTED TO ITS FRAME RUNNING DIRECTLY TO THE GROUND GRID (MINIMUM SIZE GROUND WIRE SHALL BE THAT OF THE REQUIRED BOND WIRE) AND SHALL ALSO HAVE THE INSULATED GROUND WIRE TERMINATED TO THE MOTOR FRAME IN THE PECKER HEAD GROUND LUG AND LANDED IN THE MOTOR CONTROL CENTER.
- ALL RESISTIVE ELECTRICAL EQUIPMENT (HEATERS) WITH A RATING OF 1 KW OR ABOVE SHALL HAVE AN ADDITIONAL GROUND WIRE (MINIMUM SIZE GROUND WIRE SHALL BE THAT OF THE REQUIRED BOND WIRE) FROM THE FRAME RUNNING DIRECTLY TO THE GROUND GRID IN ADDITION TO THE GROUND WIRE RUNNING FROM THE ELECTRICAL GROUND IN THE EQUIPMENT CONTROL PANEL TO THE DISTRIBUTION OR MOTOR CONTROL CENTER.
- CABLE TRAYS AND RACEWAY SYSTEMS SHALL BE BONDED TOGETHER AND TO THE GROUND GRID AS SHOWN ON THE GROUNDING DRAWINGS AND DETAILS AND, AS A MINIMUM, GROUNDED AT BOTH ENDS AND AT 60-FOOT INTERVALS.
- FOR INSTALLATIONS WITH NEW FOUNDATIONS, ROUTE GROUNDING ELECTRODES THROUGH CONCRETE PER FOUNDATION AND LAYOUT DRAWINGS. FOR EXISTING FOUNDATIONS, RUN GROUNDING LEADS ABOVE FOUNDATION, LOCATED TO MINIMIZE TRIPPING HAZARDS. GROUNDING SYSTEMS INCORPORATED INTO THE STEEL REINFORCED CONCRETE FOUNDATION ARE PERMITTED ON NEW INSTALLATIONS ONLY.
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- PAGE 5 FOR EQUIPMENT GROUNDING DETAILS

SEE SITE SPECIFIC EQUIPMENT ARRANGEMENT DRAWING FOR ACTUAL CONDUCTOR LOCATION

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7					3						4-16-20	P. GLEZMAN				
6					2							T. MIRABELLA				
5					1	3-31-21	CHANGED TITLE BLOCK TITLE, ADDED PAGE TITLE	PG	TM	CL						
4					0	4-16-20	DRAWING UPDATE	PG	TM	CL						

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STANDARD GROUNDING GUIDELINES  
FOR BULK SYSTEMS

PAGE 2 OF 5

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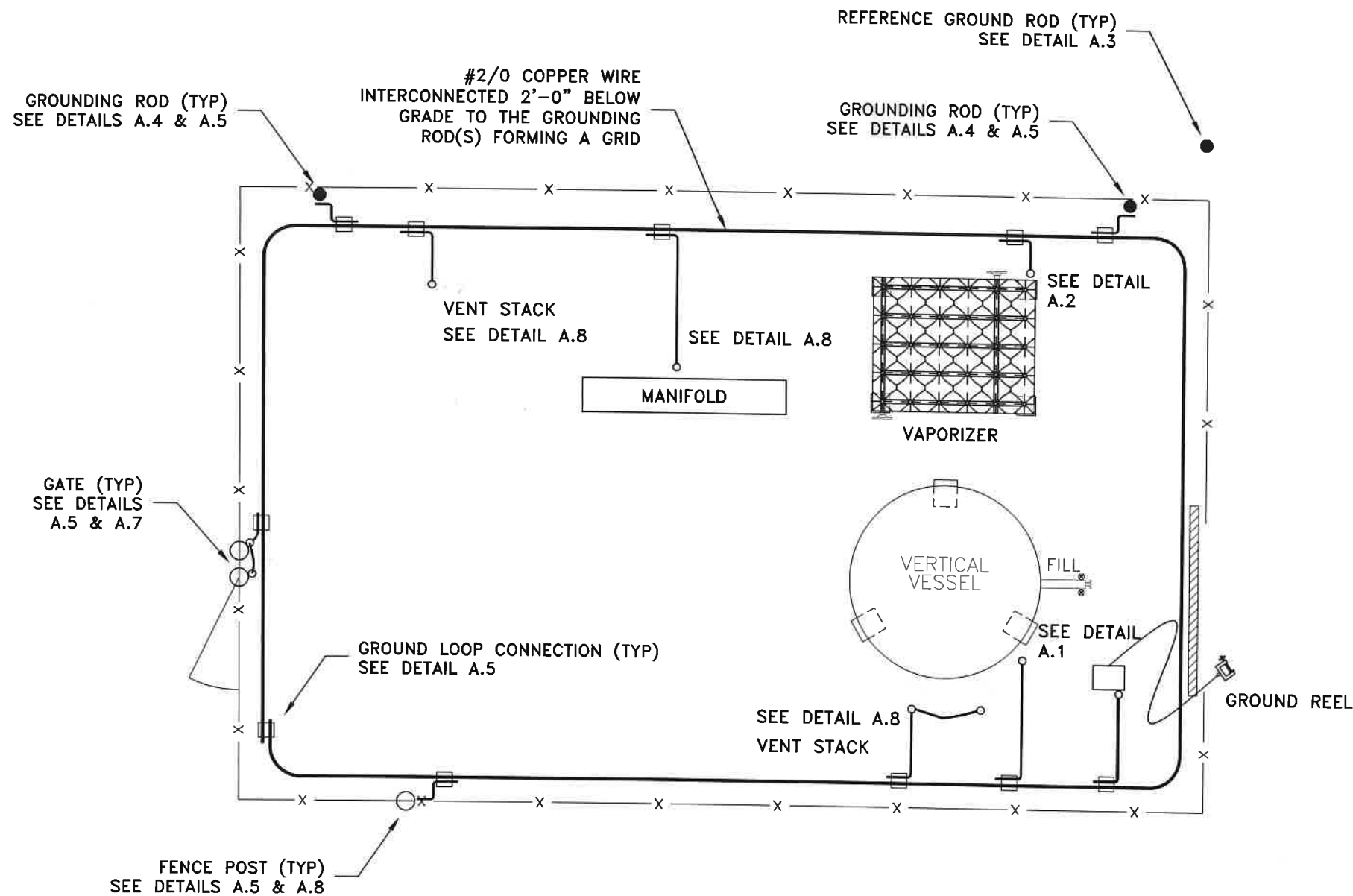
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# BULK VERTICAL LH2 SYSTEMS

Notes reflect the requirements of NFPA70, *National Electric Code*; CGA H-5, *Installation Standards for Bulk Hydrogen Supply Systems*; CGA H-3, *Cryogenic Hydrogen Storage*; CGA G-5.5, *Hydrogen Vent Systems*; 29 CFR Section 1910.103 and Airgas requirements.

Additional requirements may be imposed by the AHJ (Authority Having Jurisdiction).



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- INDIVIDUAL GROUND RODS MUST MEASURE 10 OHMS OR LESS. FOR EACH GROUND ROD MEASURING GREATER THAN 10 OHMS ONE ADDITIONAL GROUND ROD MUST BE INSTALLED. THE ADDITIONAL GROUND ROD SHALL BE INSTALLED A DISTANCE OF NOT LESS THAN 6 FEET FROM THE INSTALLED GROUND ROD. A REFERENCE GROUND ROD FOR CURRENT AND FUTURE TESTING SHALL ALSO BE INSTALLED.
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- SEE PAGE 5 FOR EQUIPMENT GROUNDING DETAILS

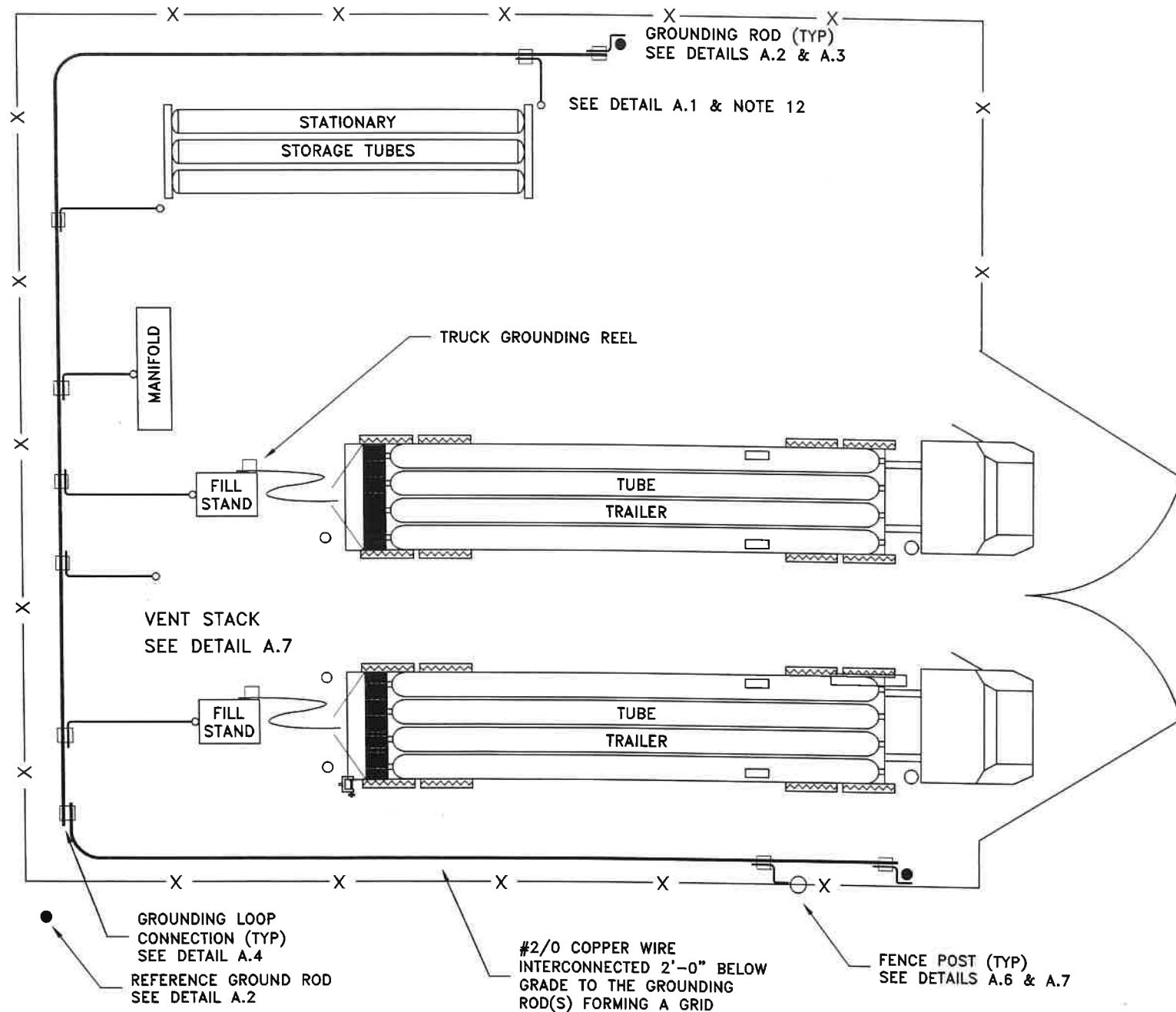
SEE SITE SPECIFIC EQUIPMENT ARRANGEMENT DRAWING FOR ACTUAL CONDUCTOR LOCATION

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7					3							P. GUZMAN	4-16-20		THIS DOCUMENT AND THE DESIGN, SPECIFICATIONS AND ENGINEERING INFORMATION ENCLOSED HEREIN ARE THE PROPERTY OF AIRGAS, AN AIR LIQUIDE COMPANY, AND ARE NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE EXPRESS WRITTEN CONSENT OF AIRGAS, AN AIR LIQUIDE COMPANY. THIS PROPRIETARY DOCUMENT IS BEING SENT IN CONFIDENCE AND ONLY FOR CONSIDERATION OF THE PARTIES HERETO IN ACCEPTING THE LOAN OF THIS DOCUMENT. RECIPIENT AGREES TO KEEP IT AND THE CONTENTS THEREOF STRICTLY CONFIDENTIAL AND SHALL NOT USE THEM FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT WAS ORIGINALLY INTENDED.		STANDARD GROUNDING DETAIL FOR BULK SYSTEMS	3 OF 5	1
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# BULK GH2 SYSTEMS

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- INDIVIDUAL GROUND RODS MUST MEASURE 13 OHMS OR LESS. FOR EACH GROUND ROD MEASURING GREATER THAN 10 OHMS ONE ADDITIONAL GROUND ROD MUST BE INSTALLED. THE ADDITIONAL GROUND ROD SHALL BE INSTALLED A DISTANCE OF NOT LESS THAN 8 FEET FROM THE INSTALLED GROUND ROD. A REFERENCE GROUND ROD FOR CURRENT AND FUTURE TESTING SHALL ALSO BE INSTALLED.
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- PAGE 5 FOR EQUIPMENT GROUNDING DETAILS

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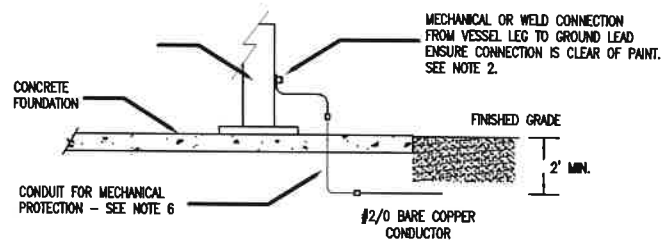
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STANDARD GROUNDING DETAIL  
 FOR BULK SYSTEMS

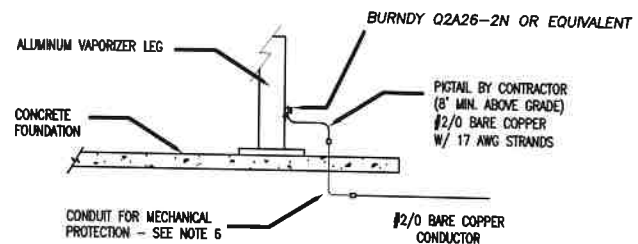
# EQUIPMENT GROUNDING DETAILS

**DETAIL A.1**  
CONNECTION TO VESSEL  
SEE NOTE 5



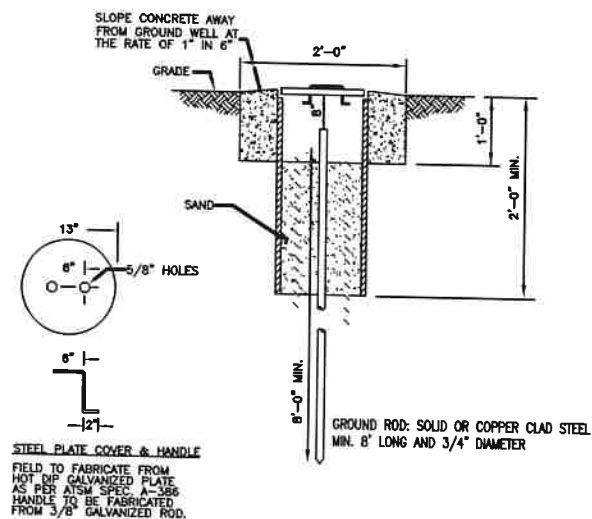
ALL PIGTAILS BY CONTRACTOR SHALL BE MINIMUM 6' LENGTH ABOVE GRADE FROM POINT IDENTIFIED ON SITE SPECIFIC ARRANGEMENT DRAWING  
#2/0 BARE COPPER W/ 17 AWG STRANDS

**DETAIL A.2**  
CONNECTION TO VAPORIZER  
SEE NOTE 5



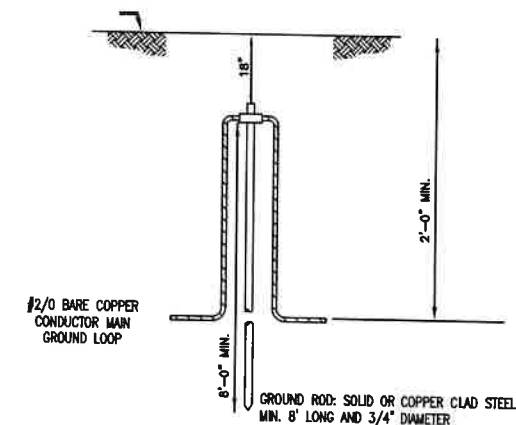
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#2/0 BARE COPPER W/ 17 AWG STRANDS

**DETAIL A.3**  
REFERENCE GROUND ROD



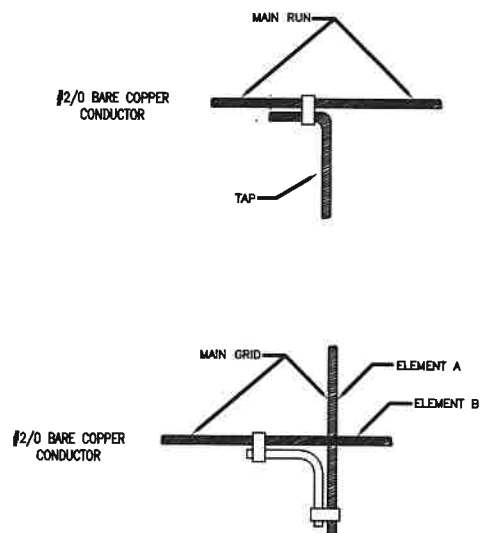
WHERE ROCK BOTTOM IS ENCOUNTERED, THE GROUND ROD SHALL BE DRIVEN AT AN OBLIQUE ANGLE NOT TO EXCEED 45 DEGREES FROM THE VERTICAL. WHERE THE ROCK BOTTOM IS ENCOUNTERED AT AN ANGLE UP TO 45 DEGREES, THE GROUND ROD CAN BE PERMITTED TO BE BURIED IN A TRENCH THAT IS AT LEAST 30 INCHES DEEP

**DETAIL A.4**  
GRADE GROUND ROD

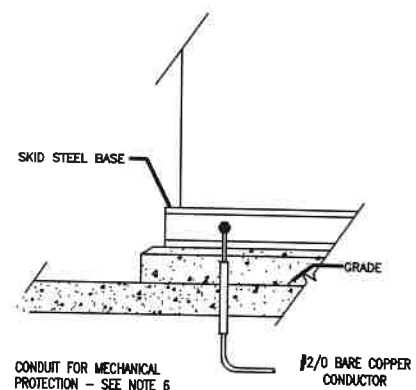


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**DETAIL A.5**  
GROUND LOOP CABLE CONNECTIONS  
SEE NOTE 2

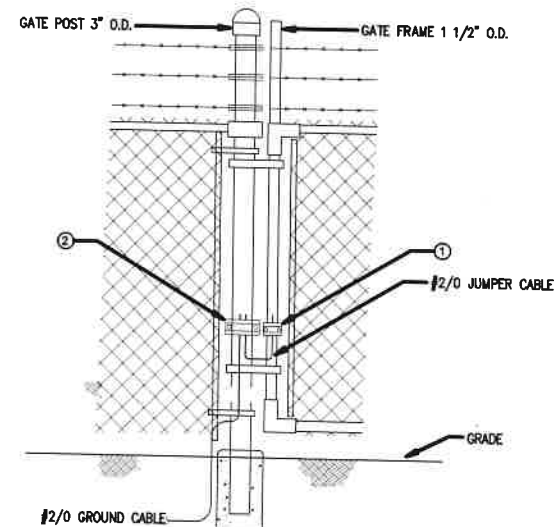


**DETAIL A.6**  
CONNECTION TO SKID  
SEE NOTE 5



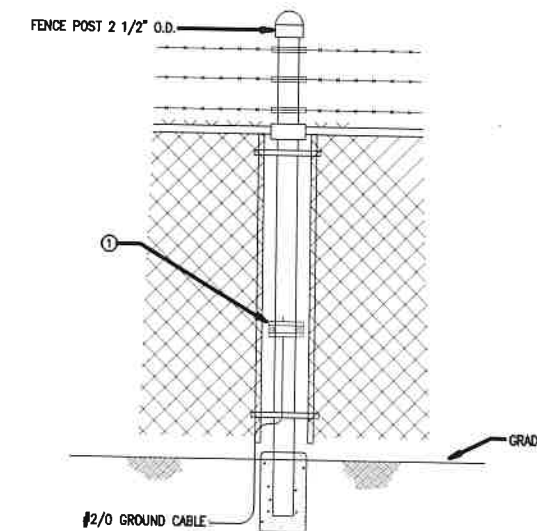
ALL PIGTAILS BY CONTRACTOR SHALL BE MINIMUM 6' LENGTH ABOVE GRADE FROM POINT IDENTIFIED ON SITE SPECIFIC ARRANGEMENT DRAWING  
#2/0 BARE COPPER W/ 17 AWG STRANDS

**DETAIL A.7**  
FENCING WITH GATE  
SEE NOTE 5



ALL PIGTAILS BY CONTRACTOR SHALL BE MINIMUM 6' LENGTH ABOVE GRADE FROM POINT IDENTIFIED ON SITE SPECIFIC ARRANGEMENT DRAWING  
#2/0 BARE COPPER W/ 17 AWG STRANDS

**DETAIL A.8**  
FENCE OR PIPE CONNECTIONS



GROUND CLAMP SPECIFICATION		BURNDY PART NUMBER	
NOMINAL PIPE OR FENCE POST SIZE	SINGLE CONDUCTOR	DUAL CONDUCTOR	
1" NPS	GAR1526	GD1526	
1-1/2" NPS	GAR1726	GD1726	
2" NPS	GAR1826	GD1826	
2-1/2" NPS	GAR1926	GD1926	
3" NPS	GAR2026	GD2026	

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STANDARD GROUNDING DETAIL  
FOR BULK SYSTEMS

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