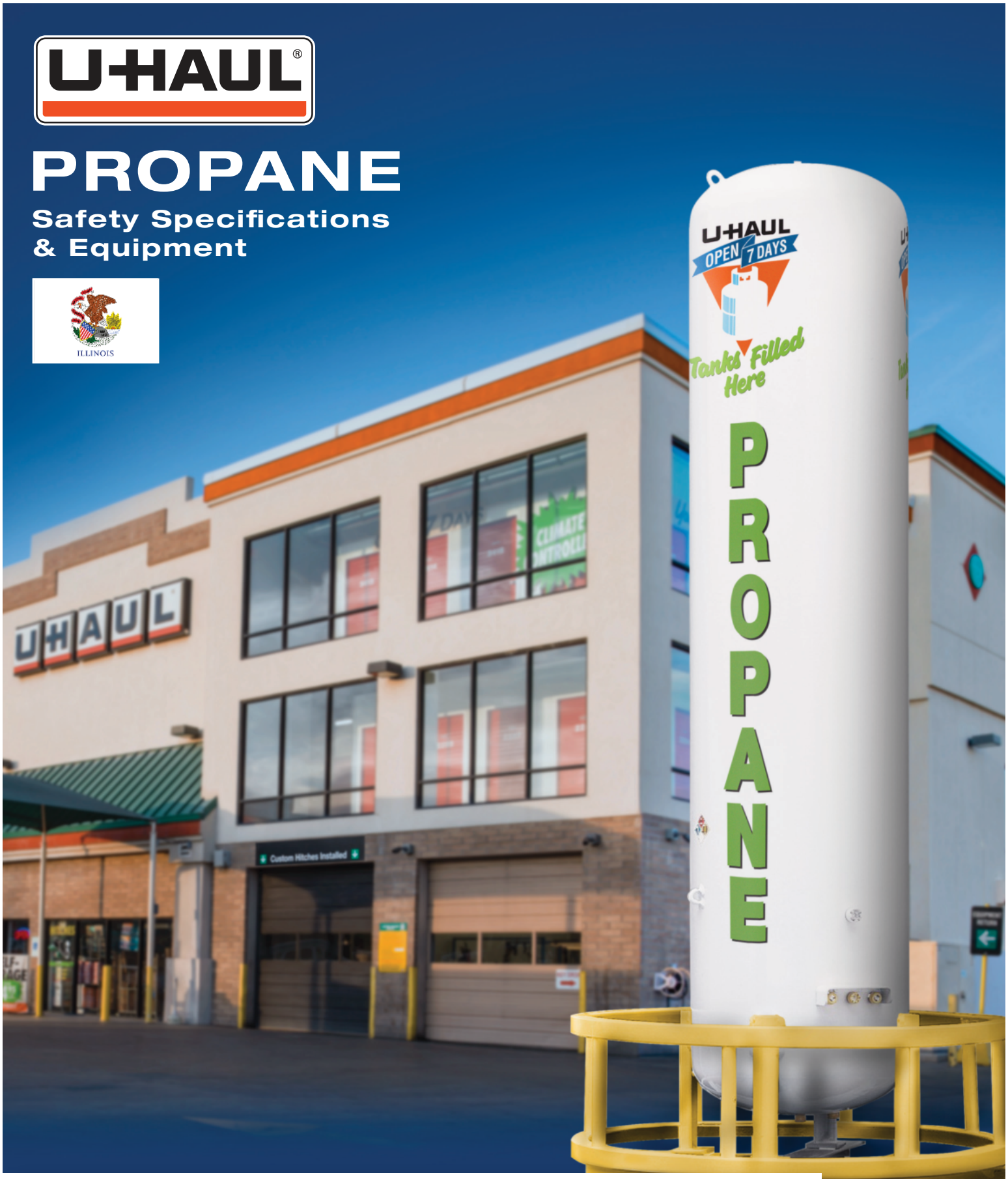
U-HAUL®

PROPANE

Safety Specifications & Equipment

ILLINOIS



U-Haul® Moving and Storage of Moline

5000 Avenue of the Cities • Moline IL, 61265

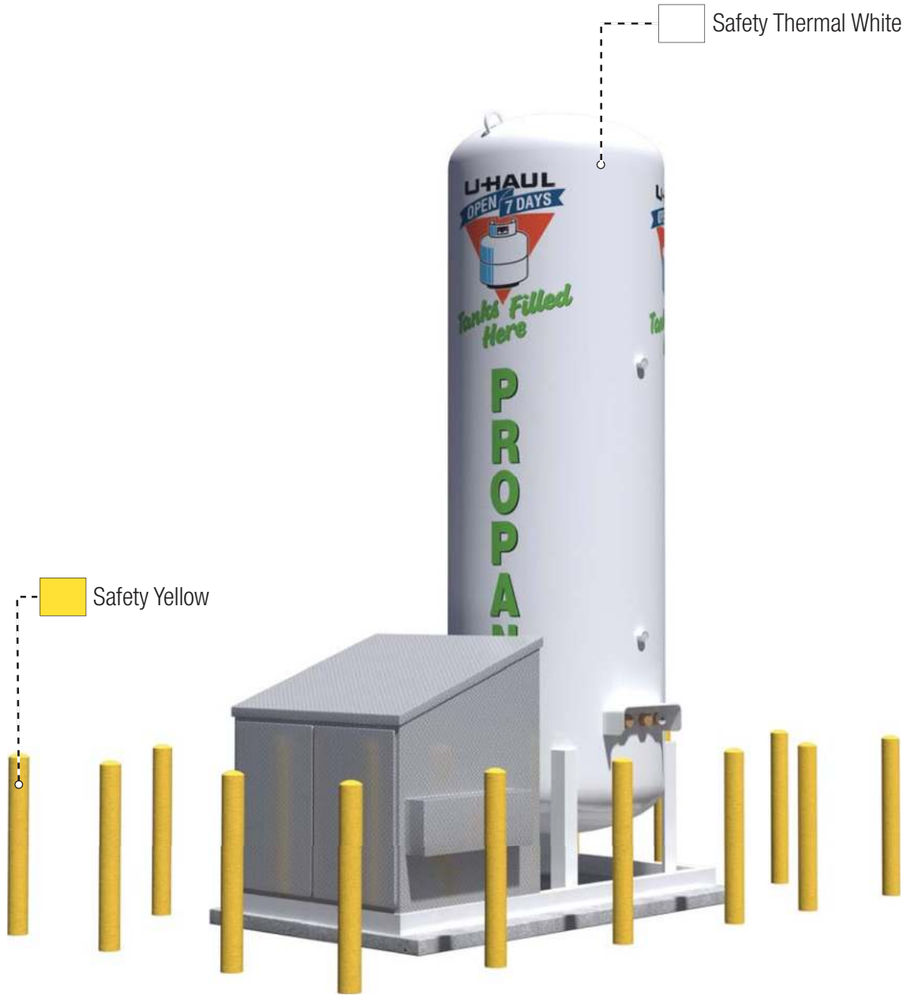
ELEVATION

A&M ASSOCIATES, INC.
2727 N. CENTRAL AVENUE
PHOENIX, ARIZONA 85004
P: 602.263.6841

U-HAUL
Of Moline
Moline, IL (932077)

Propane Tank
Composite Rendering

 2023-01-04



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Propane Tank
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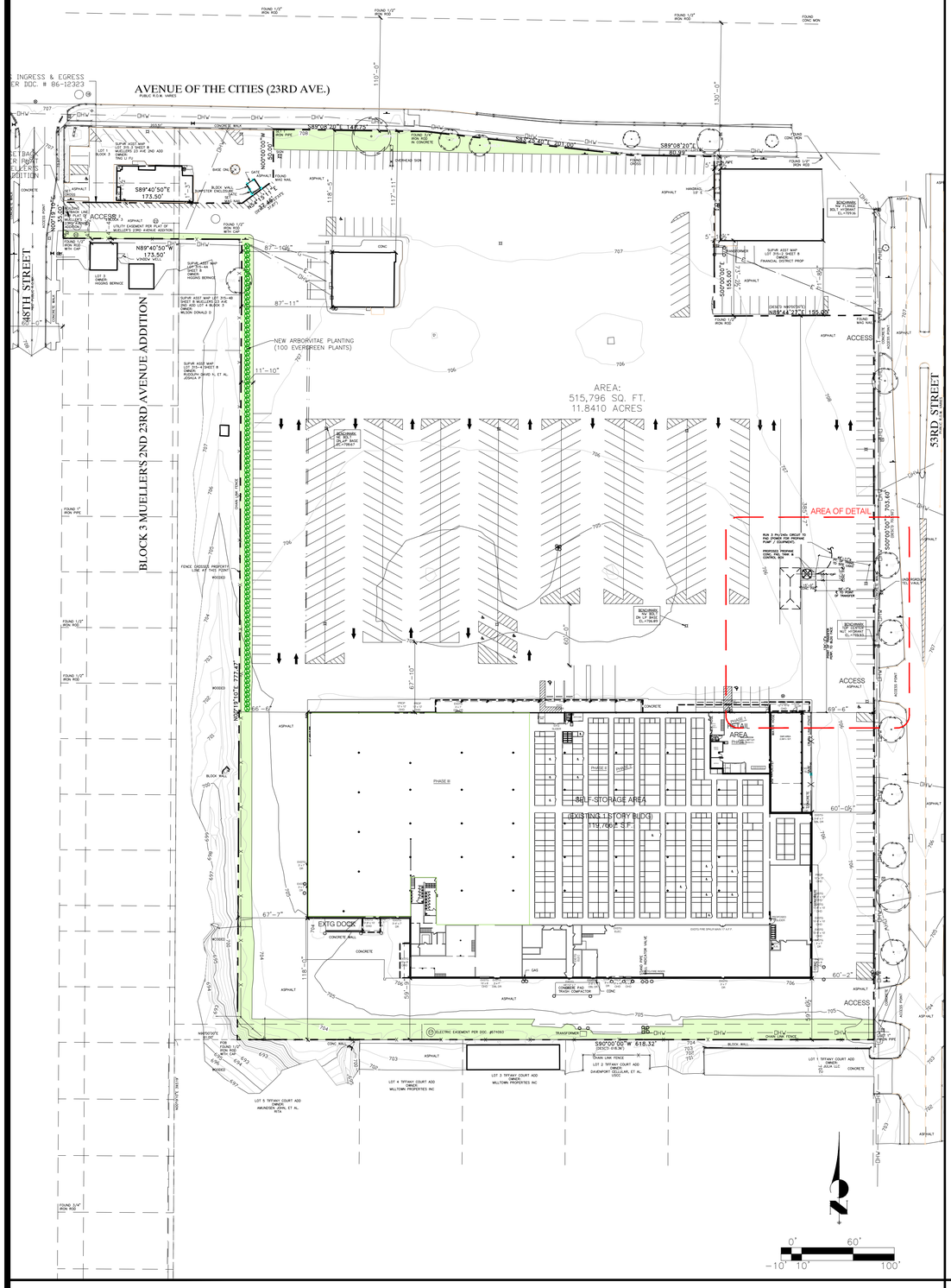
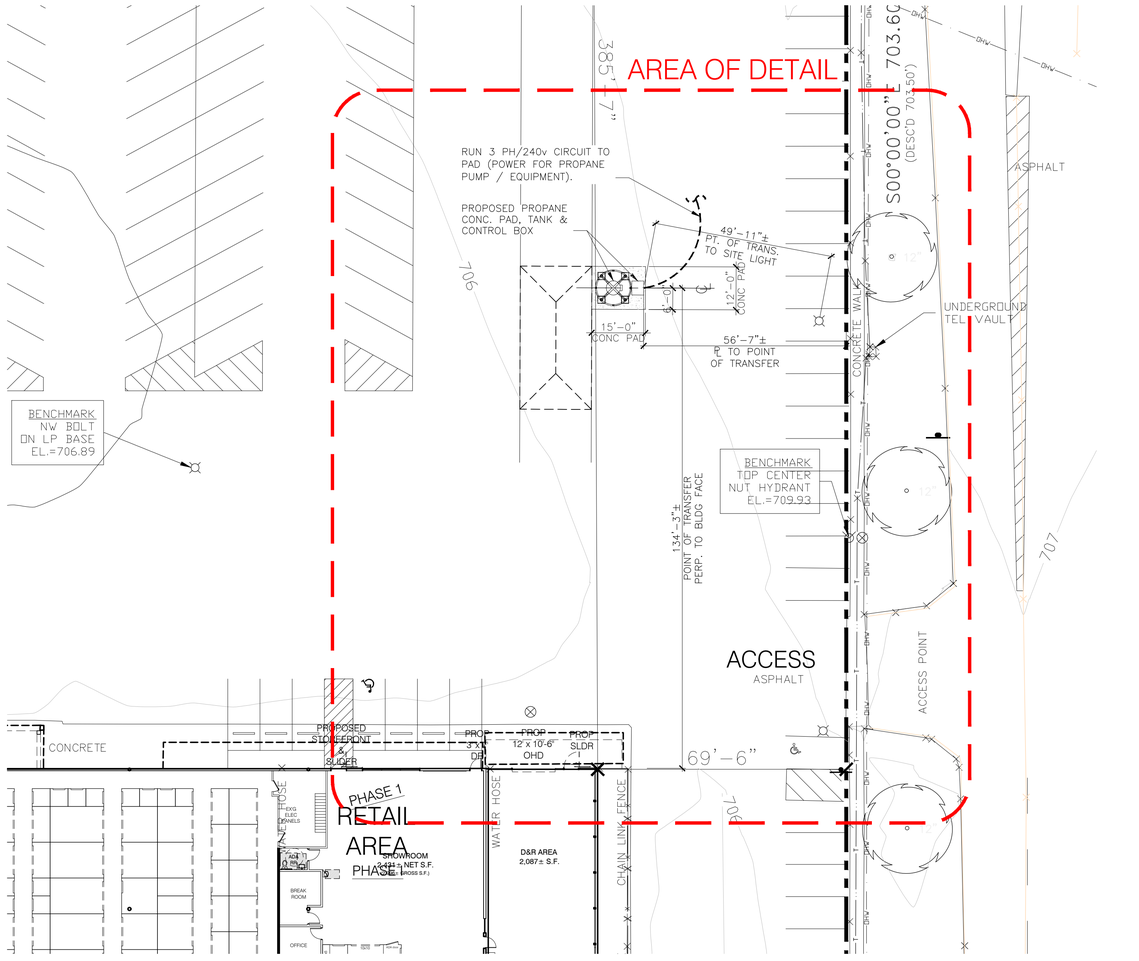
 2023-01-04

SITE MAP



2 - SITE PLAN - PROPOSED PROPANE PAD LOCATION SCALE: 1" = 60' - 0"



3 - SITE PLAN DETAIL - PROPOSED PROPANE PAD LOCATION SCALE: 1" = 20' - 0"

1 - SITE AERIAL SCALE: N.T.S.

SHEET NOTES:

NO.	DATE	INITIALS	NOTES
9			
10			
11			
12			
13			
14			
15			
16			

REVISIONS:

NO.	DATE	INITIALS	NOTES
1			
2			
3			
4			
5			
6			
7			
8			

PROFESSIONAL SEAL:

PRELIMINARY DOCUMENTS, NOT FOR CONSTRUCTION, FOR INFORMATION ONLY

ARCHITECT LOGO:

AMERCO REAL ESTATE COMPANY
CONSTRUCTION DEPARTMENT
2727 NORTH CENTRAL AVENUE
PHOENIX, ARIZONA 85004
P: (602) 263-6502

SITE ADDRESS:

U-HAUL OF MOLINE
4902 Avenue of the Cities
MOLINE, IL 61265

SHEET CONTENTS:

SITE PLAN - PROPOSED PROPANE PAD LOCATIOIN

932077

DRAWN:	KMB	SP2
CHECKED:	NH	
DATE:	04/05/22	

932077A1L

EMERGENCY RELIEF

IN THE WAKE OF A HURRICANE

Storm Prep Reminder: Check Propane before Nate Arrives

PHOENIX, Ariz. (Oct. 6, 2017) — U-Haul International and its many propane suppliers are reminding people to fill their propane generators and additional propane cylinders prior to the onset of major storms during the ongoing hurricane season.

Tropical Storm Nate has already been blamed for multiple fatalities in Central America, and the storm is expected to gain strength and become a hurricane as it heads north through the Gulf of Mexico toward the U.S. Officials in Louisiana have declared a state of emergency and ordered some evacuations in coastal areas.

U-Haul, the largest retailer of propane in U.S., has kept a constantly stocked supply of propane at its full-service facilities before and after Hurricanes Harvey and Irma brought massive flooding to Texas, Florida and other regions in and around the Gulf Coast. Propane is again well stocked in anticipation of Nate's arrival.

Find U-Haul propane locations at https://www.uhaul.com/Propane/.

"It's important for people to consider their propane supply in preparing for Nate and other major storms that approach the U.S.," said John Barnett, U-Haul propane program manager. "You don't want to run out of a primary power source. If the flooding and damage from a storm is severe, getting to a propane location after a storm may be difficult."

Propane is important to have in the aftermath of storms in order to power generators, heaters, stoves and grills for cooking, propane-fueled refrigerators, and machinery used for recovery efforts. As a clean-burning fuel, propane is among the most dependable energy sources during weather-related crises. Power outages nullify electric generators, while generators requiring gas and oil can create gunk and stall. Propane is also optimal for performing under temperature swings that high winds can cause.

U-Haul is offering 30 days of free self-storage at 36 facilities across Louisiana, Mississippi and Alabama to anyone who stands to be impacted by Nate. Find a list of participating facilities here.

In addition to its 30 days free self-storage disaster relief program, U-Haul is proud to be at the forefront of aiding communities in times of need as an official American Red Cross Disaster Responder.

About U-Haul

Since 1945, U-Haul has been the No. 1 choice of do-it-yourself movers, with a network of more than 21,000 locations across all 50 states and 10 Canadian provinces. U-Haul Truck Share 24/7 now offers customers access to U-Haul trucks every hour of every day through the self-service options on their internet-connected mobile devices. U-Haul customers' patronage has enabled the U-Haul fleet to grow to more than 150,000 trucks, 112,000 trailers and 40,000 towing devices. U-Haul offers more than 581,000 rooms and more than 51 million square feet of self-storage space at owned and managed facilities throughout North America. U-Haul is the largest

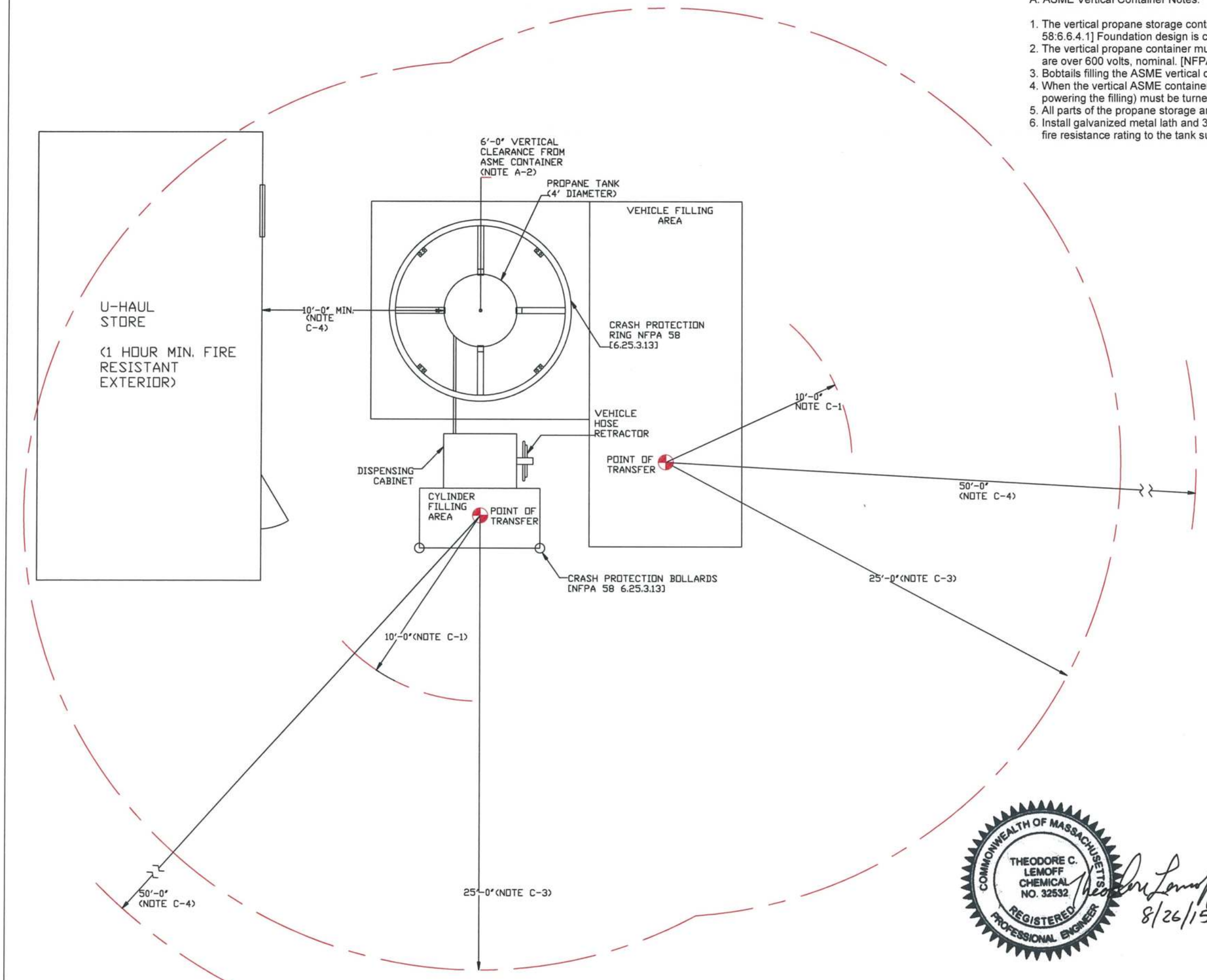
installer of permanent trailer hitches in the automotive aftermarket industry and is the largest retailer of propane in the U.S.

Contact:

Jeff Lockridge
Sebastien Reyes
E-mail: publicrelations@uhaul.com
Phone: 602-263-6981
Website: uhaul.com

NFPA 58

NFPA-(NATIONAL FIRE PROTECTION ASSOCIATION) 58-(LIQUID PETROLEUM-GAS)



A. ASME Vertical Container Notes:

1. The vertical propane storage container foundation to be designed to resist wind and seismic forces at the location. [NFPA 58:6.6.4.1] Foundation design is covered in other documents to be provided by Uhaul.
2. The vertical propane container must be at least 6 ft. from the vertical plane beneath overhead electric power lines that are over 600 volts, nominal. [NFPA58: 6.4.4.13]
3. Bobtails filling the ASME vertical container must be at least 10 ft. from the vertical ASME container. [NFPA 58:7.2.3.3]
4. When the vertical ASME container is being filled, all internal combustion engines on vehicles (other than the engine powering the filling) must be turned off within 15 ft. of the vertical container. [NFPA 58:7.2.3.2 (A)]
5. All parts of the propane storage and dispensing system must be at least 25 ft. from pits. [NFPA 58: 6.25.2.2]
6. Install galvanized metal lath and 3/8" Pyrocrete to vertical tank legs per tank installation instructions to provide a 2 hour fire resistance rating to the tank supports. [NFPA 58: 5.2.7.1 (B)]

B. Dispensing Notes:

1. Filling propane cylinders and propane vehicle fuel containers to be conducted only by trained employees. [NFPA 58: 7.2.1.1]
2. Trained employees to remain in attendance during all propane transfer operations. [NFPA 58: 7.2.1.2]
3. Cylinders, other than engine fuel cylinders, older than 12 years from the date of manufacture or 5 or 12 years from recertification (marked on the cylinder) via the visual or hydrostatic recertification method cannot be filled until recertified. (Not applicable to ASME containers installed on vehicles.) [NFPA 58: 5.2.2.2]
4. Only cylinders fabricated to U. S. Department of Transportation and the ASME Boiler and Pressure Vessel Code Section VIII can be filled with propane. [NFPA 58: 5.2.1.1]
5. Minimum 15 ft. from the point of transfer to areas where cell phones, electrical equipment, and other sources of ignition are used during propane transfer. [NFPA 58: 6.23.2.2]
6. Minimum 35 ft. from the points of transfer to metal cutting, grinding, oxygen-fuel cutting, brazing, soldering, or welding during propane transfer operations. [NFPA 58: 7.2.3.2 (C)]
7. Dispensing systems must be secured when dispensing service is not offered. [NFPA 58: 6.25.3.7]
8. A station to stop the LP-Gas pump must be located at the pump. [NFPA 58: 6.25.3.4]
9. Locate the actuator for the emergency shutoff valve within 3 ft. of each point of transfer. [NFPA 58: 6.25.3.9]
10. An emergency stop switch must be located between 20 ft. and 100 ft. from the points of transfer and dispensing cabinet and identified with signs visible from the points of transfer. [NFPA 58: 6.25.3.17]

C. Drawing Notes:

1. Minimum 10 ft. from the points of transfer to:
   a. Buildings with a 1 hour or greater fire rated walls (i.e. wood buildings and building walls with windows). [NFPA 58: Table 6.5.2.1 (A)]
   b. Public ways, including public streets, highways, thoroughfares and sidewalks. [NFPA 58: Table 6.5.2.1 (F) (1)]
   c. LP-Gas containers other than those being filled or waiting to be filled. [NFPA 58: Table 6.5.2.1 (I)]. (Does not apply to the vertical propane storage container at the Uhaul site.)
2. Minimum of 15 ft. from the points of transfer to:
   a. Internal combustion engines during transfer of propane, other than the engine on a cargo tank vehicle powering filling of the vertical storage tank. [NFPA 58: 7.2.3.2]
   b. Electrical equipment and lights unless designed and installed for electrically classified areas. [NFPA 58: 6.23.2.2]
3. Minimum 25 ft. from the point of transfer to:
   a. Building with wall of less than 1 hour fire resistant rating (i.e. wood buildings) [NFPA 58: Table 6.5.2.1 (B)]
   b. Buildings with openings below the level of the point of transfer. [NFPA 58: Table 6.5.2.1 (C)]
   c. Line of adjoining property that can be built upon. [NFPA 58: Table 6.5.2.1(D)]
   d. Mainline railroad track centerlines. [NFPA 58: Table 6.5.2.1 (H)] buildings and the line of adjoining property that can be built upon. [NFPA 58: 6.3.1.1]
   e. Buildings and the line of adjoining property that can be built upon. [NFPA 58: 6.3.1.1]
   f. Smoking, open flame, portable electrical tools, and extension cords during propane transfer operations. [NFPA 58: 7.2.3.2 (B)]
4. Minimum 50 ft. from all points of transfer to outdoor places of public assembly (i.e. schoolyards, athletic fields, playgrounds). [NFPA 58: Table 6.5.2.1 (E)]

COMMONWEALTH OF MASSACHUSETTS
THEODORE C. LEMOFF
CHEMICAL
NO. 32532
REGISTERED
PROFESSIONAL ENGINEER

8/26/15

ALL WORK TO BE PERFORMED IN ACCORDANCE WITH NFPA 58 2014 EDITION

DO NOT SCALE DRAWING

REVISIONS

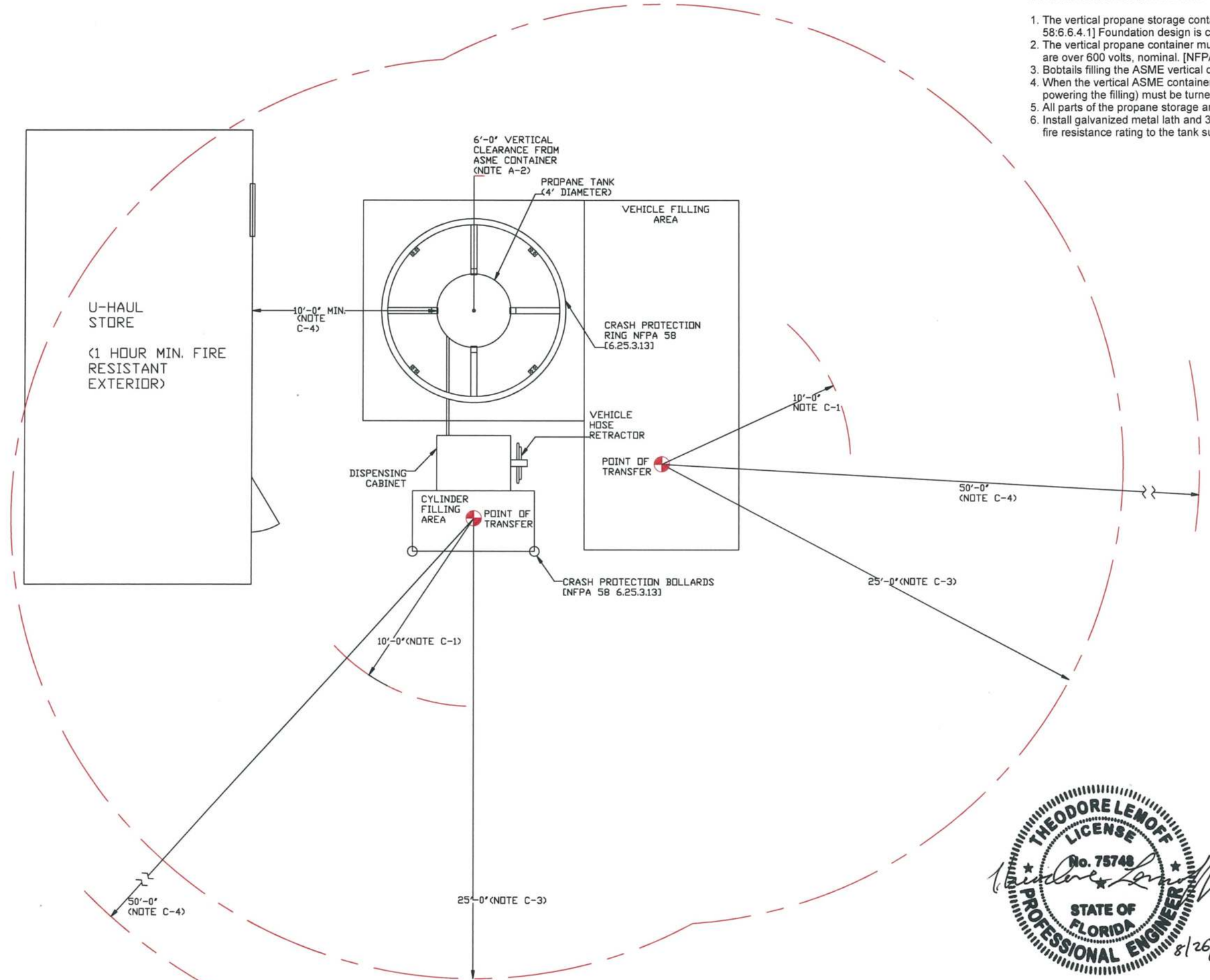
REV.	DESCRIPTION	DATE	DRV	ENG
0	ISSUED FOR REVIEW	07/24/15	CR	TL
1	ISSUED FOR REVIEW	07/29/15	CR	TL
2	CHANGED NOTES	08/17/15	CR	TL
3	ISSUED FOR CLIENT APPROVAL	08/19/15	CR	TL

TLemoff Engineering
Naples, Florida
Tlemoffengineering@gmail.com
617 308-0159

STANDARD LAYOUT FOR UHAUL VERTICAL PROPANE SITE INSTALLATION

DWG #: TLE 151

SHEET 1 OF 1 REV: 3



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3. Bobtails filling the ASME vertical container must be at least 10 ft. from the vertical ASME container. [NFPA 58:7.2.3.3]
4. When the vertical ASME container is being filled, all internal combustion engines on vehicles (other than the engine powering the filling) must be turned off within 15 ft. of the vertical container. [NFPA 58:7.2.3.2 (A)]
5. All parts of the propane storage and dispensing system must be at least 25 ft. from pits. [NFPA 58: 6.25.2.2]
6. Install galvanized metal lath and 3/8" Pyrocrete to vertical tank legs per tank installation instructions to provide a 2 hour fire resistance rating to the tank supports. [NFPA 58: 5.2.7.1 (B)]

B. Dispensing Notes:

1. Filling propane cylinders and propane vehicle fuel containers to be conducted only by trained employees. [NFPA 58: 7.2.1.1]
2. Trained employees to remain in attendance during all propane transfer operations. [NFPA 58: 7.2.1.2]
3. Cylinders, other than engine fuel cylinders, older than 12 years from the date of manufacture or 5 or 12 years from recertification (marked on the cylinder) via the visual or hydrostatic recertification method cannot be filled until recertified. (Not applicable to ASME containers installed on vehicles.) [NFPA 58: 5.2.2.2]
4. Only cylinders fabricated to U. S. Department of Transportation and the ASME Boiler and Pressure Vessel Code Section VIII can be filled with propane. [NFPA 58: 5.2.1.1]
5. Minimum 15 ft. from the point of transfer to areas where cell phones, electrical equipment, and other sources of ignition are used during propane transfer. [NFPA 58: 6.23.2.2]
6. Minimum 35 ft. from the points of transfer to metal cutting, grinding, oxygen-fuel cutting, brazing, soldering, or welding during propane transfer operations. [NFPA 58: 7.2.3.2 (C)]
7. Dispensing systems must be secured when dispensing service is not offered. [NFPA 58: 6.25.3.7]
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C. Drawing Notes:

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2. Minimum of 15 ft. from the points of transfer to:
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3. Minimum 25 ft. from the point of transfer to:
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   d. Mainline railroad track centerlines. [NFPA 58: Table 6.5.2.1 (H)] buildings and the line of adjoining property that can be built upon. [NFPA 58: 6.3.1.1]
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4. Minimum 50 ft. from all points of transfer to outdoor places of public assembly (i.e. schoolyards, athletic fields, playgrounds). [NFPA 58: Table 6.5.2.1 (E)]

THEODORE LEMOFF LICENSE No. 75748 STATE OF FLORIDA PROFESSIONAL ENGINEER

8/26/15

ALL WORK TO BE PERFORMED IN ACCORDANCE WITH NFPA 58 2014 EDITION

DO NOT SCALE DRAWING

REVISIONS

REV.	DESCRIPTION	DATE	DRV	ENG
0	INSERT FOR REVIEW	07/24/15	DS	TL
1	INSERT FOR REVIEW	07/29/15	DS	TL
2	CHANGE NOTES	08/17/15	DS	TL
3	INSERT FOR CLIENT APPROVAL	08/19/15	DS	TL

TLemoff Engineering
Naples, Florida
Tlemoffengineering@gmail.com
617 308-0159

STANDARD LAYOUT FOR UHAUL VERTICAL PROPANE SITE INSTALLATION

DWG #: TLE 151

SHEET 1 OF 1 REV: 3

DOT Cylinder Refilling

DOT Cylinders can be refilled

Do not fill:

- Canadian cylinders (marked TC - Transport Canada). (They can be used.)
- Cylinders that are out of date:
  New cylinders can be filled for 12 years from the date of manufacture (usually stamped into the collar)

Cylinders that have been re-qualified can be filled for the following periods:

Requalification Method	Identification Date (month - year)	Refill allowed for:
Visual	12-20	5 years
Proof Pressure	12-20 S	7 years
Volumetric Expansion	12-20 E	12 years

This applies only to refilling, not use from cylinders.

Offer to sell the customer a new cylinder or refer them to a location that requalifies cylinders. (Note that it may cost more to requalify a 20 lb. cylinder than to purchase a new one.

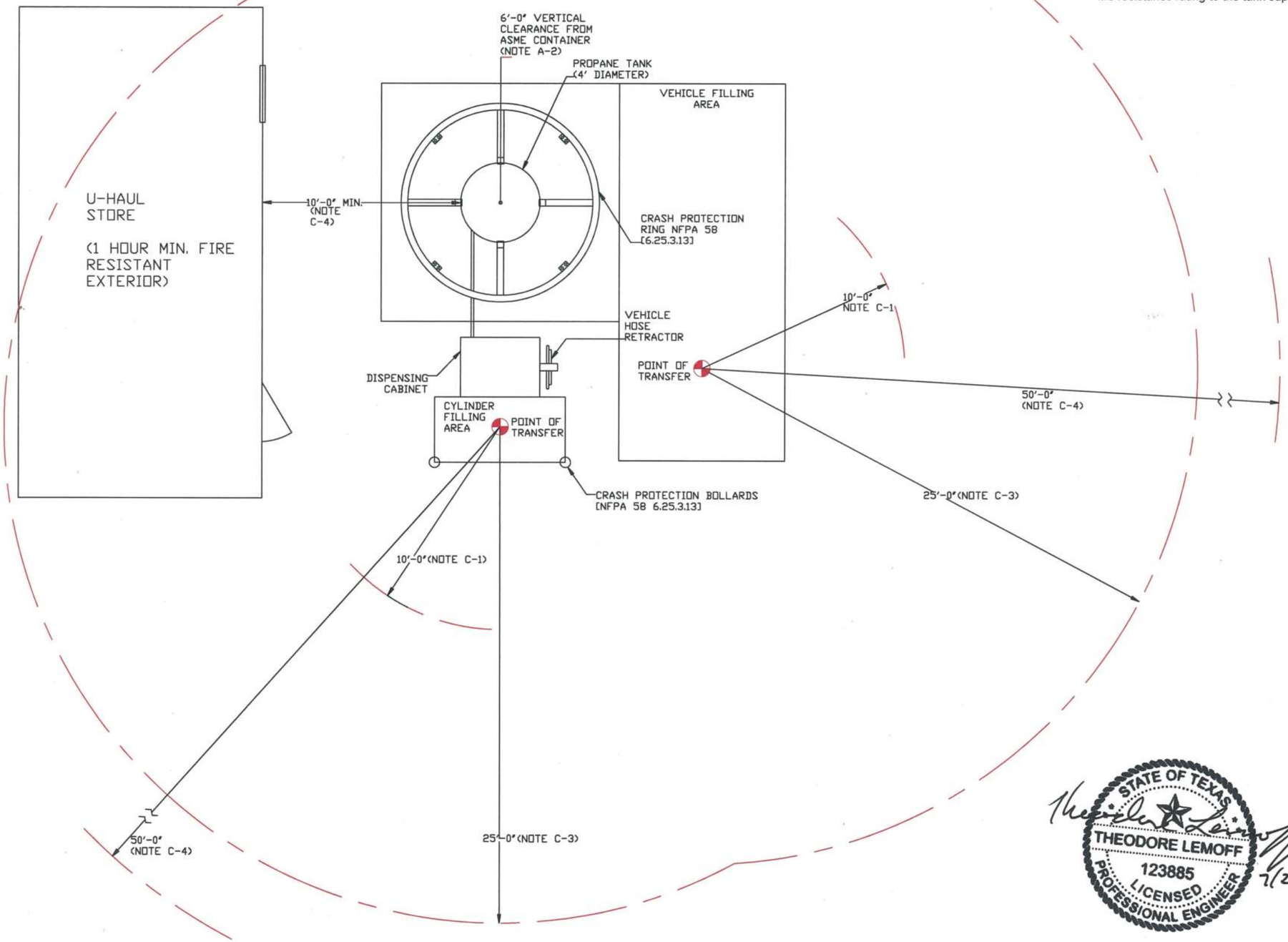
Cylinders with any of the following should not be filled.

Dented Cylinder

Fire Damaged, bulged Cylinder

Excessive Corrosion

Also, do not fill cylinders that lean, cylinders with welded attachments, and gouged cylinders



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6. Install galvanized metal lath and 3/8" Pyrocrete to vertical tank legs per tank installation instructions to provide a 2 hour fire resistance rating to the tank supports. [NFPA 58: 5.2.7.1 (B)]

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2. Minimum of 15 ft. from the points of transfer to:
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STATE OF TEXAS
THEODORE LEMOFF
123885
LICENSED
PROFESSIONAL ENGINEER
7/25/16

ALL WORK TO BE PERFORMED IN ACCORDANCE WITH NFPA 58 2014 EDITION

DO NOT SCALE DRAWING

REVISIONS				
REV.	DESCRIPTION	DATE	DRV	ENG
0	ISSUED FOR REVIEW	07/24/15	CH	TL
1	ISSUED FOR REVIEW	07/29/15	CH	TL
2	CHANGE NOTES	08/7/15	CH	TL
3	ISSUED FOR CLIENT APPROVAL	08/19/15	CH	TL

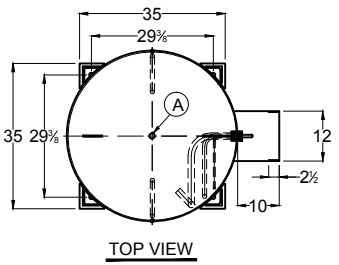
TLemoff Engineering
Naples, Florida
Tlemoffengineering@gmail.com
617 308-0159

UHAUL VERTICAL PROPANE TANK SITE INSTALLATION LAYOUT

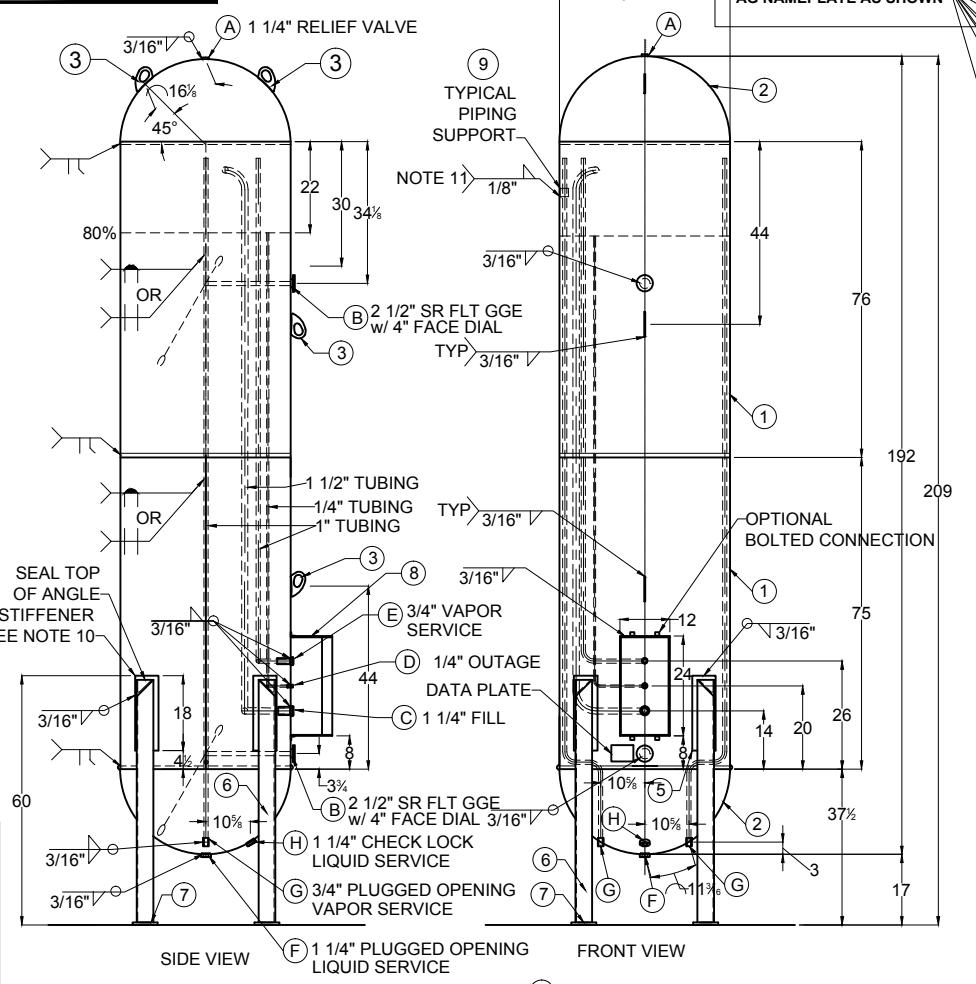
DWG #: TLE 151

SHEET 1 OF 1 REV: 3

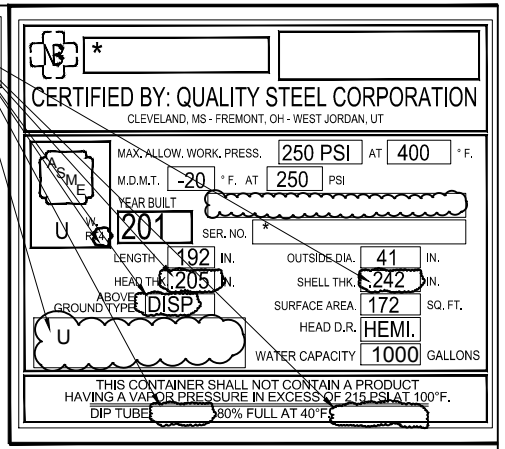
THIS VESSEL IS DESIGNED FOR THE STORAGE
OF LIQUEFIED PETROLEUM GAS ONLY



TOP VIEW



EDIT/ETCH 1000 AG or BLANK
AG NAMEPLATE AS SHOWN



DATA PLATE DETAIL

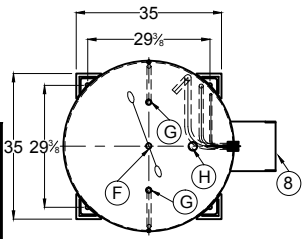
GENERAL NOTES:

1. A SINGLE STAMPED LIFTING LUG IS DESIGNED FOR A TOTAL LIFTING WEIGHT OF 7,795#.
2. TOTAL EMPTY WEIGHT IS 2330# WITH 0.272 PLATE
3. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.
4. COMPLETE TANK DRIED TO REMOVE ALL MOISTURE
5. EXTERIOR OF TANK TO BE GRIT BLASTED.
6. PAINT PER SHOP ORDER
7. VACUUM PURGE TANK.
8. DIMENSIONS ARE SUBJECT TO CHANGE WITH OUT NOTICE. (NON-PRESSURE RETAINING COMPONENTS ONLY)
9. THREADS OF ALL FITTINGS TO BE COATED WITH COMPOUND SUITABLE FOR USE WITH LP GAS.
10. DO NOT STOP OR START WELD AT CORNER OF PA.
11. WELD ON INSIDE OF TANK MUST BE INSPECTED
12. ALL WEIGHT AND CAPACITIES ARE APPROXIMATE

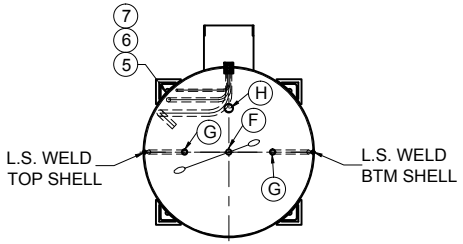
REV.	BY:	DESCRIPTION	DATE:
0	wlo	ORIGINAL ISSUE	05/22/07
1	RGA	REVISED COMPANY NAME	12/08/07
2	wlo	CORRECTED WELD SYMBOLS	08/12/08
3	wlo	CHANGED TO NARROW SHELL	05/29/09
4	wlo	ADDED ADDITION LIFTING LUGS AND OPTION TO BOLT ON PROTECTOR	06/28/11
5	bts	2 PLATE SHELL AND NEW DATA PLATE	10/10/13
6	bts	UPDATE FITTINGS AND PIPING	10/21/13
7	TWV	UPDT NAMEPLATE AND TO NEW STD	07/28/16

MARK	QTY.	DESCRIPTION	DWG. NO.
1	2	SHELL- 0.242" X 76" X 127 3/8" - SA455 or SA414G	
NOTE OPTIONAL SHELL MATERIAL FROM 1450 PLATE (0.272 THK SA-455)			
2	2	HEAD - 40 1/2" I.D. X 0.205" MIN - HEMI: SA414C	
3	4	LIFTING LUG	D - 63
4	1	DATA PLATE	D - 60
5	4	SHELL STIFFENER	VF-1000DET
6	4	LEGS	VF-1000DET
7	4	BASE PLATE	VF-1000DET
8	1	VALVE PROTECTOR	VF-1000DET
9	10	TUBING SUPPORT	VF-1000S

MARK	QTY.	SIZE	TYPE	FITTINGS REGO	SERVICE
A	1	1 1/4	XH FLG.	008685GT	RELIEF VALVE
B	2	2 1/2	SR ADAP	SQUIBB-TAYLOR - SD140A SR FG 41" END MT. - WITH 4" FACE DIAL ADDED	FLOAT GAUGE
C	1	1 1/4	FULL COUPLING w/ 1 1/2" TUBING (SEE VF-1000 C)	L007579T	FILL VALVE
D	1	1/4	FULL COUPLING w/ 1/2" TUBING (SEE VF-1000D)	003165DPT	OUTAGE VALVE
E	1	3/4	FULL COUPLING w/ 1" TUBING (SEE VF-1000E)	PT009102R1T	SERVICE VALVE
F	1	1 1/4	XH FLG.		PLUGGED OPENING
G	2	3/4	FULL COUPLING w/ 1" TUBING (SEE VF-1000G)		PLUGGED OPENING
H	1	1 1/4	XH FLG.	007591UT	CHEK LOK



BOTTOM VIEW



BOTTOM VIEW

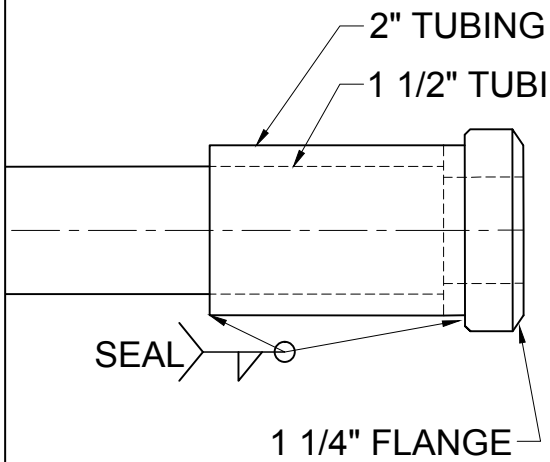
GENERAL SPECIFICATIONS	
WATER CAPACITY (GALLONS)	1000
ALLOWABLE WORKING PRESSURE (PSIG)	250
JOINT EFFICIENCY: ASME UW-51 LONG SEAM	100 %
ASME UW-52 HEAD TO SHELL	80 %
HYDROSTATIC TEST PRESSURE (PSIG)	325
SURFACE AREA (SQ. FT.)	172
RELIEF VALVE SETTING (PSIG)	250
RELIEF DISCHARGE RATE - (CFM REQ'D.)	3652
CODE: ASME SECTION VIII DIV. I	
CALC: C17	
HEAT TREATMENT NOT REQUIRED	
MATERIAL SPECS.:	
COUPLINGS SA-105 (3,000#)	
TANK FLANGES SA-105 or SA-181-70 (3,000#)	
ADAPTOR SA-105 or SA-181-70	

1000 W.G. VERTICAL ABOVEGROUND
PROPANE TANK-DISPENSER w/LEGS

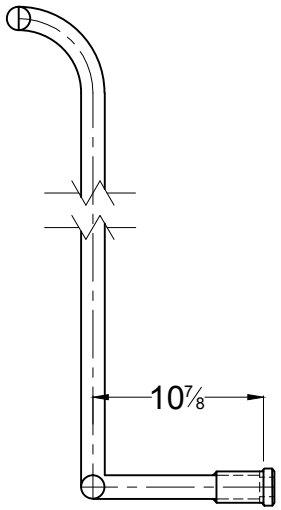
QUALITY STEEL CORPORATION

PART NO: 0110909X

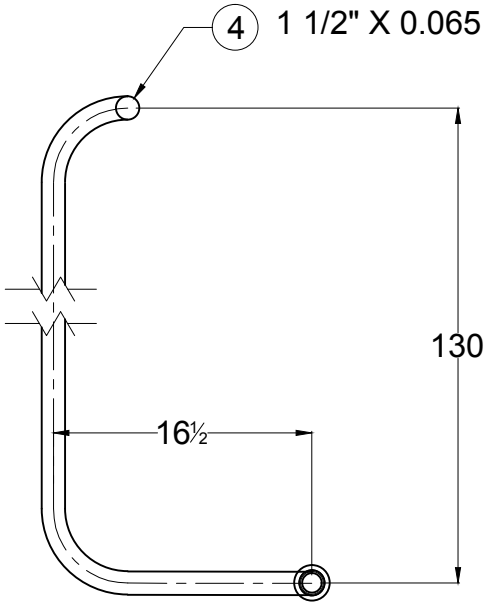
DATE:	DRAWN BY:	APPROVED BY:	REVISION:	DRAWING No.:
05/22/07	wlo	TWV	7	VF-1000



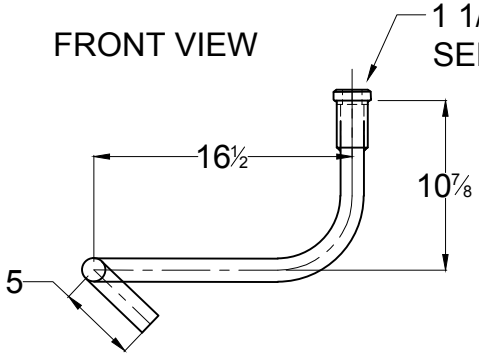
DETAIL "A"



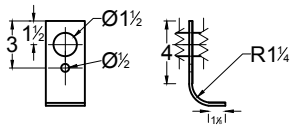
SIDE VIEW



FRONT VIEW



BOTTOM VIEW



SUPPORT BRACKET (x 5)
DETAIL

(C) 1 1/4" FILL VALVE WITH 1 1/2" TUBING
1 EACH (166" OF TUBING)

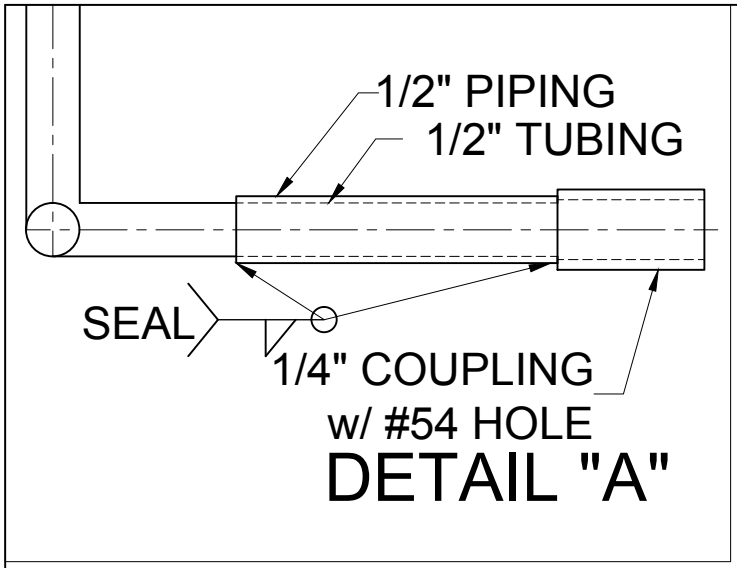
NOTE: SEE TANK DRAWING FOR REVISION BLOCK

MARK	QTY.	DESCRIPTION
1	1	1 1/4" XH FLANGE (SA-105)
2	1	1/4" COUPLING w/ #54 HOLE (SA-105)
3	3	3/4" XH FLANGE (SA-105)
4	1	1 1/2" TUBING X 0.065 X 166 (130" OAL AFTER BENDING)
5	2	1" TUBING X 0.065 X 175 (163" OAL AFTER BENDING)
6	1	1" TUBING X 0.065 X 144 (121" OAL AFTER BENDING)
7	1	1/2" TUBING X 0.049 X 128 (108" OAL AFTER BENDING)
8	10	L 1 1/2" x 1 1/2" x 3/16" (SA-36)
9	2	1/2" EMT ONE HOLE PIPE SUPPORT
10	6	1" EMT ONE HOLE PIPE SUPPORT
11	2	1 1/2" EMT ONE HOLE PIPE SUPPORT

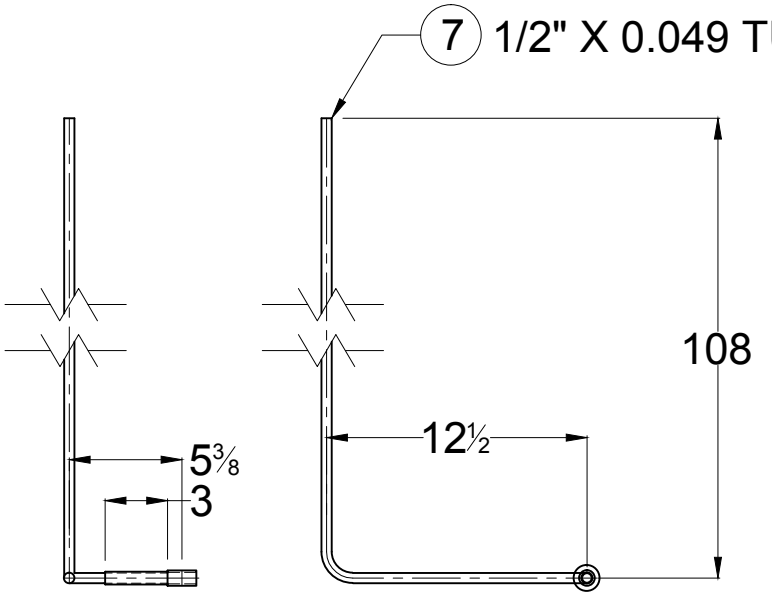
1000 W.G. VERTICAL ABOVEGROUND
PROPANE TANK-DISPENSER w/LEGS

QUALITY STEEL CORPORATION
PIPING DETAIL

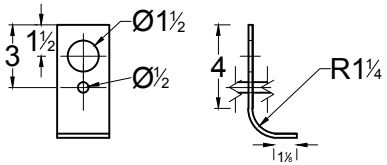
DATE:	DRAWN BY:	APPROVED BY:	REVISION:	DRAWING No.:
05/22/07	wlo	TWV	7	VF-1000 C



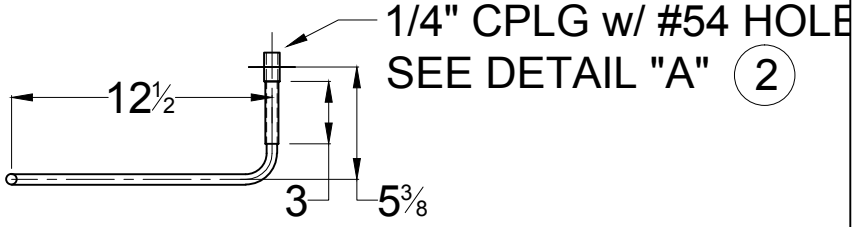
DETAIL "A"



SIDE VIEW FRONT VIEW



SUPPORT BRACKET (x 5)
DETAIL



BOTTOM VIEW

D 1/4" OUTAGE WITH 1/2" TUBING
1 EACH (128" OF TUBING)

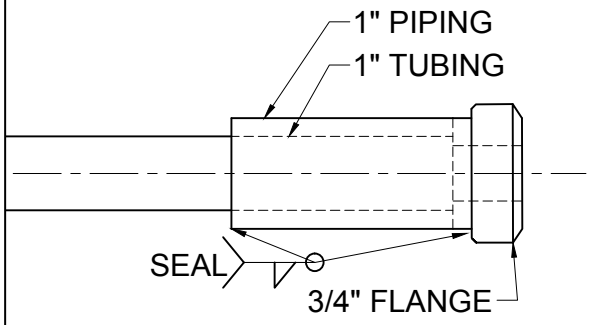
NOTE: SEE TANK DRAWING FOR REVISION BLOCK

MARK	QTY.	DESCRIPTION
1	1	1 1/4" XH FLANGE (SA-105)
2	1	1/4" COUPLING w/ #54 HOLE (SA-105)
3	3	3/4" XH FLANGE (SA-105)
4	1	1 1/2" TUBING X 0.065 X 166 (130" OAL AFTER BENDING)
5	2	1" TUBING X 0.065 X 175 (163" OAL AFTER BENDING)
6	1	1" TUBING X 0.065 X 144 (121" OAL AFTER BENDING)
7	1	1/2" TUBING X 0.049 X 128 (108" OAL AFTER BENDING)
8	10	L 1 1/2" x 1 1/2" x 3/16" (SA-36)
9	2	1/2" EMT ONE HOLE PIPE SUPPORT
10	6	1" EMT ONE HOLE PIPE SUPPORT
11	2	1 1/2" EMT ONE HOLE PIPE SUPPORT

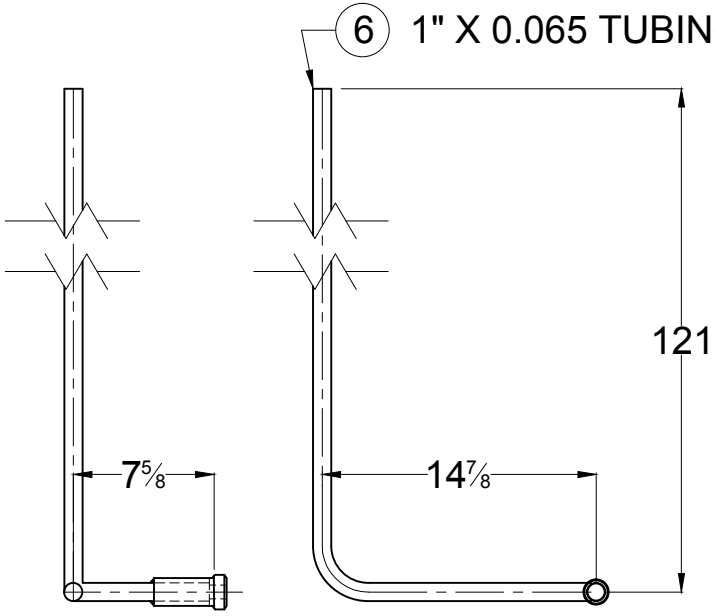
1000 W.G. VERTICAL ABOVEGROUND
PROPANE TANK-DISPENSER w/LEGS

QUALITY STEEL CORPORATION
PIPING DETAIL

DATE:	DRAWN BY:	APPROVED BY:	REVISION:	DRAWING No.:
05/22/07	wlo	TWV	7	VF-1000 D

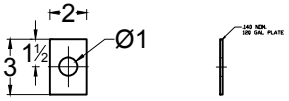


DETAIL "A"

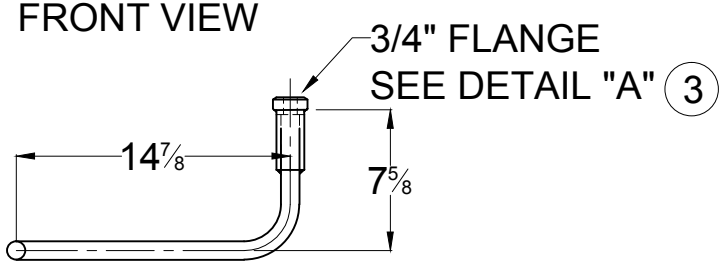


SIDE VIEW

FRONT VIEW



SUPPORT BRACKET (x 4)
DETAIL



BOTTOM VIEW

E 3/4" VAPOR SERVICE WITH 1" TUBING
1 EACH (144" OF TUBING)

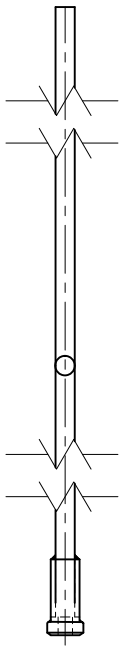
NOTE: SEE TANK DRAWING FOR REVISION BLOCK

MARK	QTY.	DESCRIPTION
1	1	1 1/4" XH FLANGE (SA-105)
2	1	1/4" COUPLING w/ #54 HOLE (SA-105)
3	3	3/4" XH FLANGE (SA-105)
4	1	1 1/2" TUBING X 0.065 X 166 (130" OAL AFTER BENDING)
5	2	1" TUBING X 0.065 X 175 (163" OAL AFTER BENDING)
6	1	1" TUBING X 0.065 X 144 (121" OAL AFTER BENDING)
7	1	1/2" TUBING X 0.049 X 128 (108" OAL AFTER BENDING)
8	10	L 1 1/2" x 1 1/2" x 3/16" (SA-36)
9	2	1/2" EMT ONE HOLE PIPE SUPPORT
10	6	1" EMT ONE HOLE PIPE SUPPORT
11	2	1 1/2" EMT ONE HOLE PIPE SUPPORT

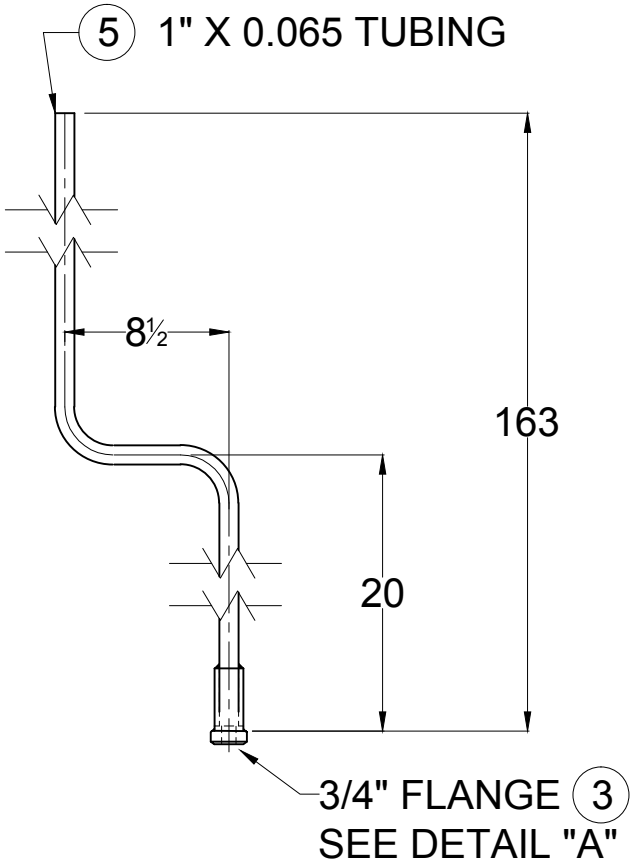
1000 W.G. VERTICAL ABOVEGROUND
PROPANE TANK-DISPENSER w/LEGS

QUALITY STEEL CORPORATION
PIPING DETAIL

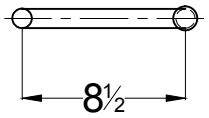
DATE:	DRAWN BY:	APPROVED BY:	REVISION:	DRAWING No.:
05/22/07	wlo	TWV	7	VF-1000 E



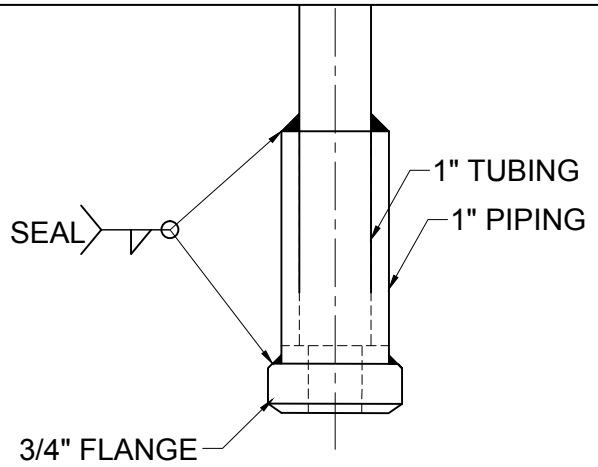
SIDE VIEW



FRONT VIEW



BOTTOM VIEW



DETAIL "A"

MARK	QTY.	DESCRIPTION
1	1	1 1/4" XH FLANGE (SA-105)
2	1	1/4" COUPLING w/ #54 HOLE (SA-105)
3	3	3/4" XH FLANGE (SA-105)
4	1	1 1/2" TUBING X 0.065 X 166 (130" OAL AFTER BENDING)
5	2	1" TUBING X 0.065 X 175 (163" OAL AFTER BENDING)
6	1	1" TUBING X 0.065 X 144 (121" OAL AFTER BENDING)
7	1	1/2" TUBING X 0.049 X 128 (108" OAL AFTER BENDING)
8	10	L 1 1/2" x 1 1/2" x 3/16" (SA-36)
9	2	1/2" EMT ONE HOLE PIPE SUPPORT
10	6	1" EMT ONE HOLE PIPE SUPPORT
11	2	1 1/2" EMT ONE HOLE PIPE SUPPORT

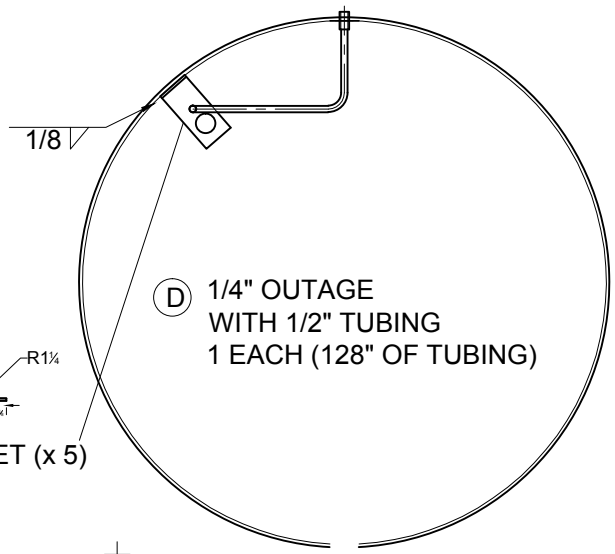
G 3/4" VAPOR SERVICE WITH 1" TUBING
2 EACH (175" OF TUBING)

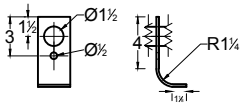
NOTE: SEE TANK DRAWING FOR REVISION BLOCK

1000 W.G. VERTICAL ABOVEGROUND
PROPANE TANK-DISPENSER w/LEGS

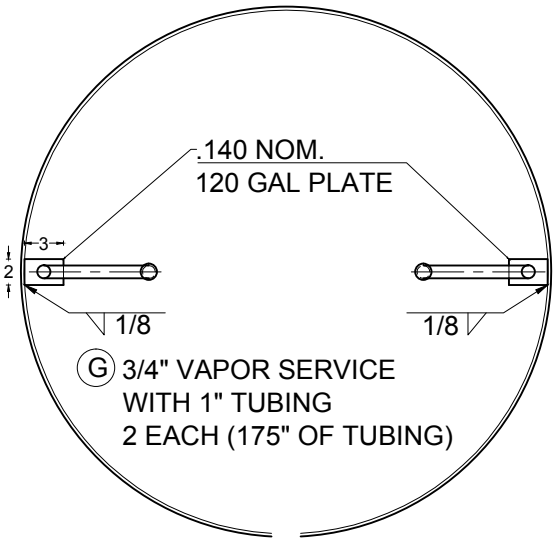
QUALITY STEEL CORPORATION
PIPING DETAIL

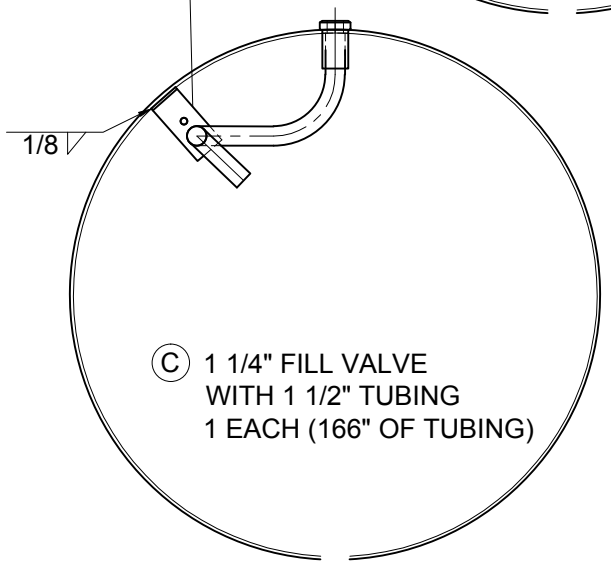
DATE:	DRAWN BY:	APPROVED BY:	REVISION:	DRAWING No.:
05/22/07	wlo	TWV	7	VF-1000 G

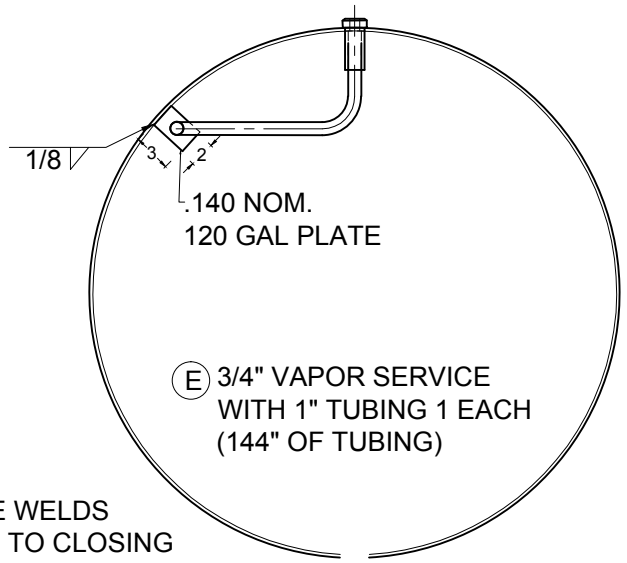




SUPPORT BRACKET (x 5)
DETAIL







NOTE: ALL INTERIOR CODE WELDS MUST BE EXAMINED PRIOR TO CLOSING TANK

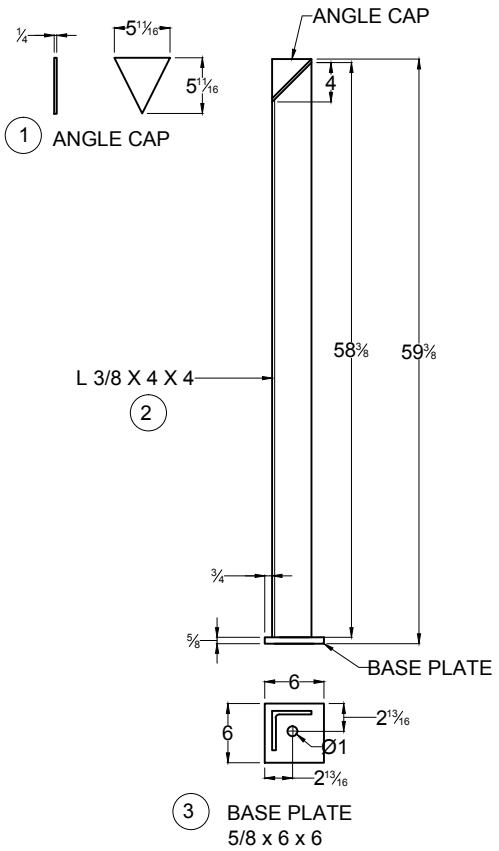
NOTE: SEE TANK DRAWING FOR REVISION BLOCK

MARK	QTY.	DESCRIPTION
1	1	1 1/4" XH FLANGE (SA-105)
2	1	1/4" COUPLING w/ #54 HOLE (SA-105)
3	3	3/4" XH FLANGE (SA-105)
4	1	1 1/2" TUBING X 0.065 X 166 (130" OAL AFTER BENDING)
5	2	1" TUBING X 0.065 X 175 (163" OAL AFTER BENDING)
6	1	1" TUBING X 0.065 X 144 (121" OAL AFTER BENDING)
7	1	1/2" TUBING X 0.049 X 128 (108" OAL AFTER BENDING)
8	10	L 1 1/2" x 1 1/2" x 3/16" (SA-36)
9	2	1/2" EMT ONE HOLE PIPE SUPPORT
10	6	1" EMT ONE HOLE PIPE SUPPORT
11	2	1 1/2" EMT ONE HOLE PIPE SUPPORT

1000 W.G. VERTICAL ABOVEGROUND
PROPANE TANK-DISPENSER w/LEGS

QUALITY STEEL CORPORATION
PIPING DETAIL

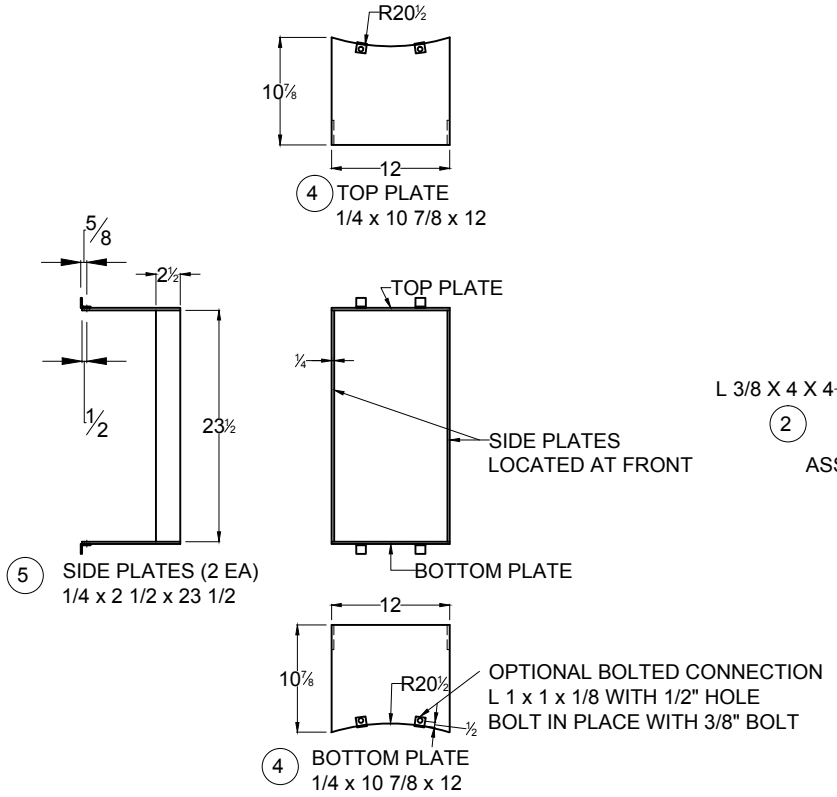
DATE:	DRAWN BY:	APPROVED BY:	REVISION:	DRAWING No.:
05/22/07	wlo	TWV	7	VF-1000 S



1 ANGLE CAP

3 BASE PLATE
5/8 x 6 x 6

LEGS
SA-36
4 EACH

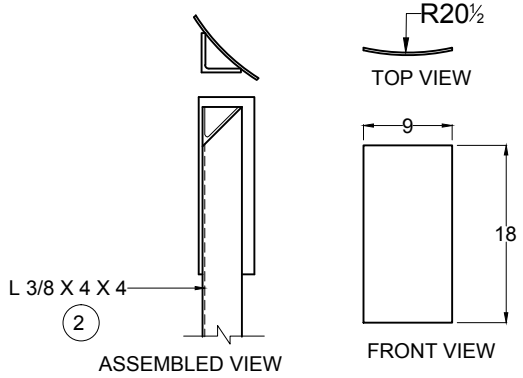


4 TOP PLATE
1/4 x 10 7/8 x 12

5 SIDE PLATES (2 EA)
1/4 x 2 1/2 x 23 1/2

4 BOTTOM PLATE
1/4 x 10 7/8 x 12

VALVE PROTECTOR
SA-36
1 EACH



SHELL STIFFENER
1/4" MIN THICKNESS
SA-36 OR SA-455
4 EACH

NOTE: SEE TANK DRAWING FOR REVISION BLOCK

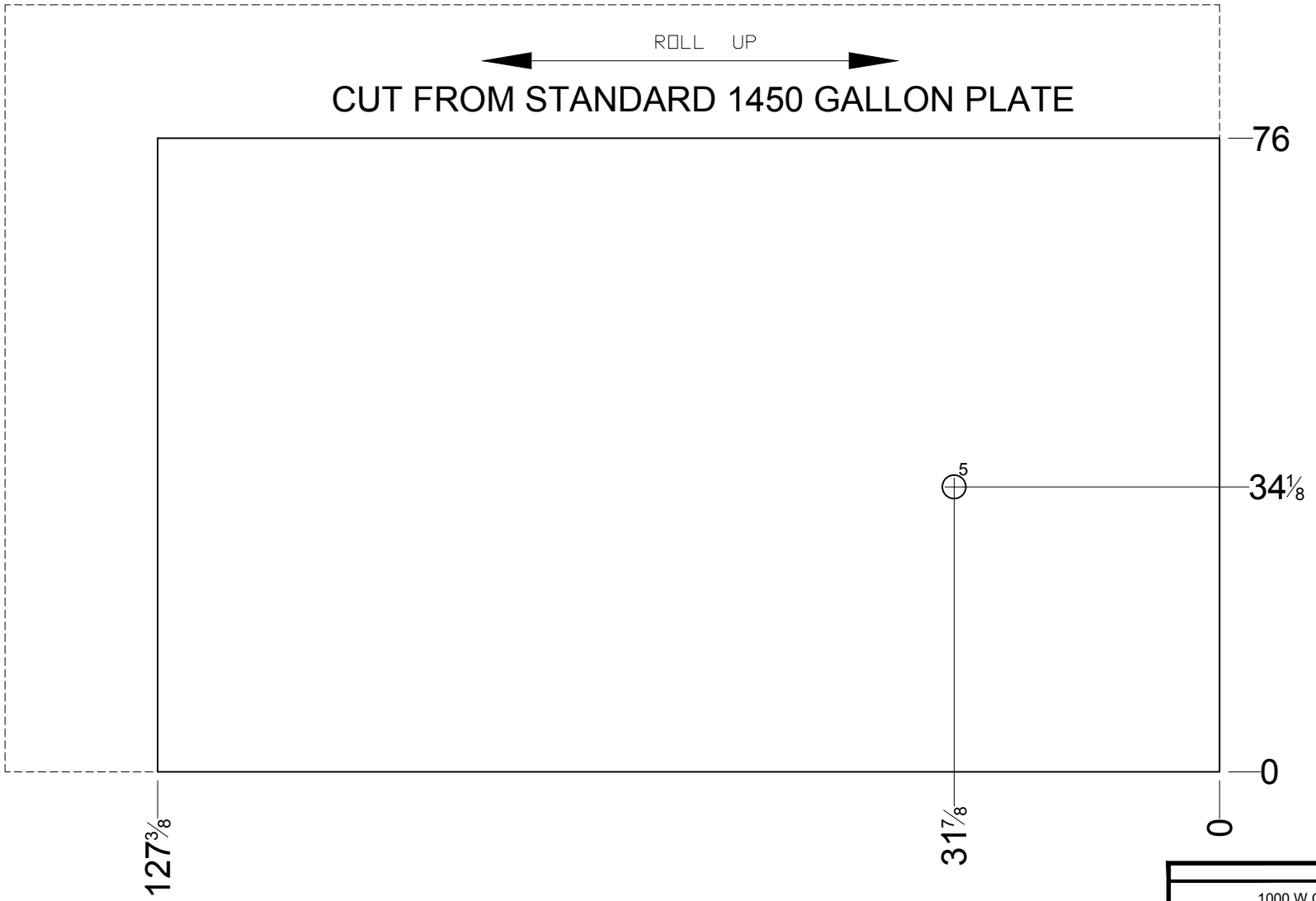
MARK	QTY.	DESCRIPTION
1	4	ANGLE CAPS (1/4 PLATE) SA-36
2	4	ANGLE 3/8 X 4 X 4 X 58 3/8 (SA-36)
3	4	BASE PLATE 5/8 X 6 X 6 (SA-36)
4	2	TOP & BOTTOM PLATE 1/4 X 10 7/8 X 12 (SA-36)
5	2	SIDE PLATE 1/4 X 2 1/2 X 23 1/2 (SA-36)
6	4	SHELL STIFFENER 1/4 MIN X 9 X 18 (SA-36 OR SA-455)

1000 W.G. VERTICAL ABOVEGROUND
PROPANE TANK-DISPENSER w/LEGS

QUALITY STEEL CORPORATION
DETAILS

DATE:	DRAWN BY:	APPROVED BY:	REVISION:	DRAWING No.:
05/22/07	wlo	TWV	7	VF-1000 - DET

HOLE SCHEDULE		
HOLE	DIA.	FITTING
1	1 5/8"	3/4"
2	1 3/4"	1"
3	2 1/8"	1 1/4"
4	1"	1/4"
5	2 13/16"	2 1/2"



NOTE: SEE TANK DRAWING FOR REVISION BLOCK

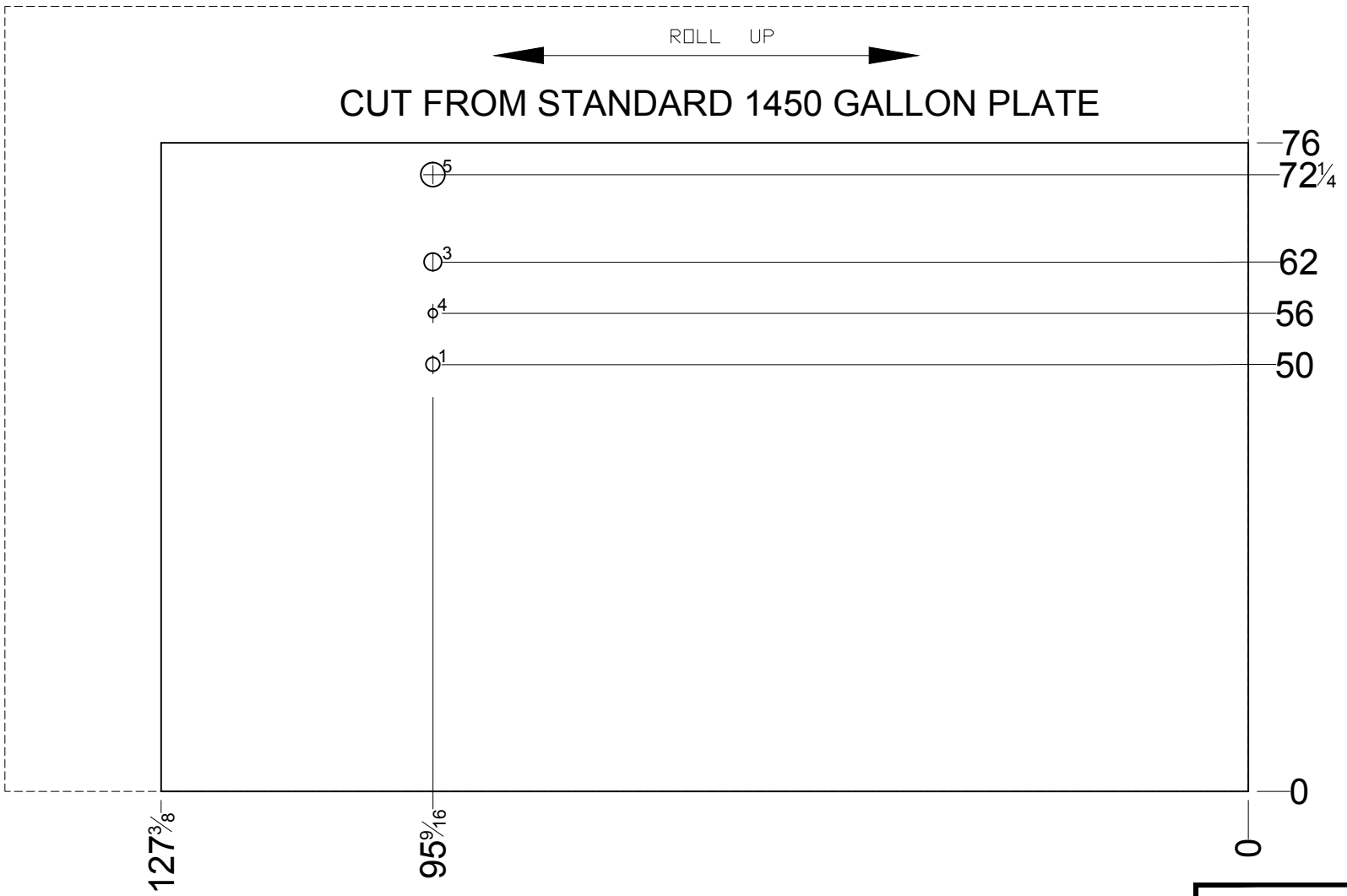
1000 W.G. VERTICAL ABOVEGROUND PROPANE TANK-DISPENSER w/LEGS

QUALITY STEEL CORPORATION

TOP FLAT PLATE DETAIL

DATE:	DRAWN BY:	APPROVED BY:	REVISION:	DRAWING No.:
05/22/07	wlo	TWV	7	VF-1000 (T)

HOLE SCHEDULE		
HOLE	DIA.	FITTING
1	1 5/8"	3/4"
2	1 3/4"	1"
3	2 1/8"	1 1/4"
4	1 1/16"	1/4"
5	2 13/16"	2 1/2"



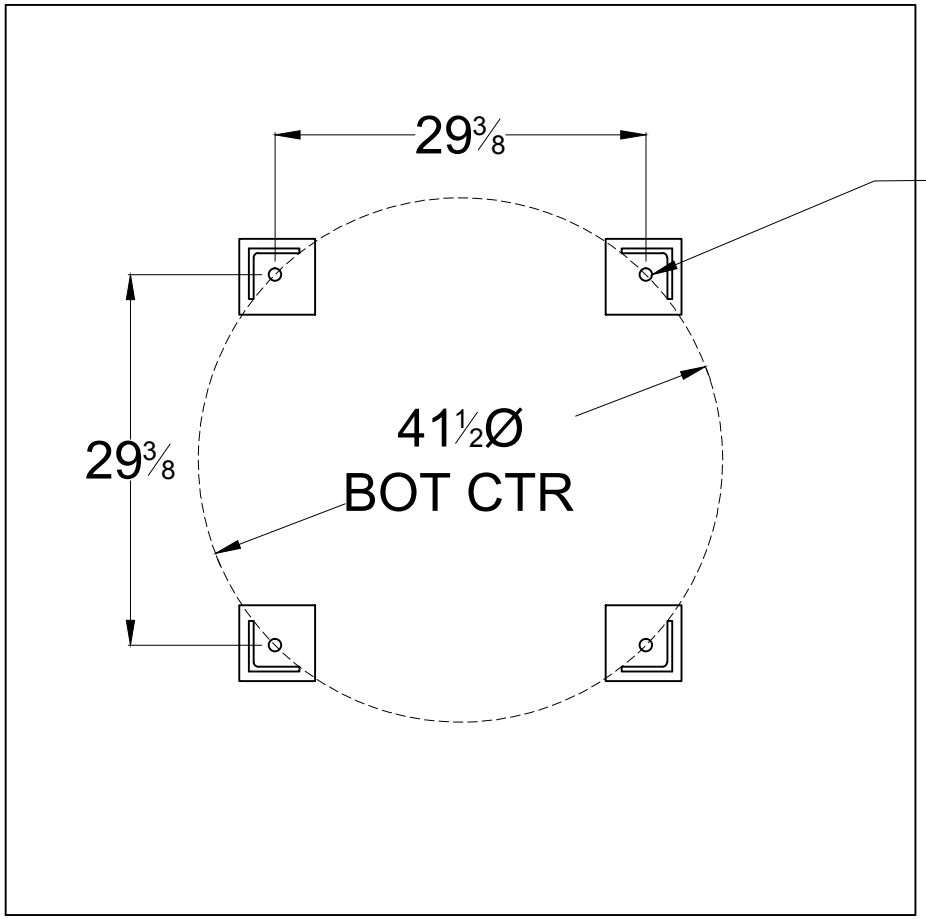
NOTE: SEE TANK DRAWING FOR REVISION BLOCK

1000 W.G. VERTICAL ABOVEGROUND PROPANE TANK-DISPENSER w/LEGS

QUALITY STEEL CORPORATION

BOTTOM FLAT PLATE DETAIL

DATE:	DRAWN BY:	APPROVED BY:	REVISION:	DRAWING No.:
05/22/07	wlo	TWV	7	VF-1000 (B)



7/8" Ø ANCHOR BOLT
TYPICAL 4 PLACES

TOP VIEW

NOTE: SEE
TANK DRAWING
FOR REVISION
BLOCK

1000 W.G. VERTICAL ABOVEGROUND
PROPANE TANK-DISPENSER w/LEGS

QUALITY STEEL CORPORATION
ANCHOR BOLT PATTERN

DATE:	DRAWN BY:	APPROVED BY:	REVISION:	DRAWING No.:
05/22/07	wlo	TWV	7	VF-1000 (BHP)

SAFETY

UNITED STRUCTURAL DESIGN LLC

I hereby certify that this engineering document was prepared by me or under
my direct personal supervision and that I am a duly licensed Professional Engineer
under the laws of the State of Iowa.

01/03/2024
(signature) (date)
SEAL
John Brittan Elder
License number #P25413
My license renewal date is December 31, 2024.
Pages or sheets covered by this seal:

Uhaul Propane IA

Structural Calculations

PROJECT ADDRESS

1100 EAST HICKMAN WAUKEE,
IA 50263

ISSUE DATE

1/2024

ENGINEER

SS

PROJECT NUMBER

23668

David Grapsas, P.E.
Principal
John Elder, P.E.
Principal

Phoenix, AZ
480-454-6408
www.unitedstr.com

STRUCTURAL CALCULATIONS

FOR

Uhaul Propane

ASCE 7-16 Seismic Base Shear

Project File: 23668.ec6

DESCRIPTION: Seismic Base Shear Analysis

Specific Description: Seismic Forces

Risk Category

Calculations per ASCE 7-16

Risk Category of Building or Other Structure : "III" : Buildings and other structures that represent a substantial hazard to human life in the event of a failure. *SCE 7-16, Page 4, Table 1.5-1*

Seismic Importance Factor = 1.25 *ASCE 7-16, Page 5, Table 1.5-2*

Gridded Ss & S1values from ASCE 7-16

ASCE 7-16 11.4.2

Max. Ground Motions, 5% Damping

S_S = 0.06092 g, 0.2 sec response

S_1 = 0.05083 g, 1.0 sec response

Location :Waukee, IA 50263

Latitude = 41.602 deg North

Longitude = 93.862 deg West

For the closest datapoint grid location . . .

Latitude = 41.600 deg North

Longitude = 93.860 deg West

Site Class, Site Coeff. and Design Category

Classification: "D" : Shear Wave Velocity 600 to 1,200 ft/sec = **D** (Based on Testing) *ASCE 7-16 Table 20.3-1*

Site Coefficients Fa & Fv — Fa = 1.60; Fv = 2.40 *ASCE 7-16 Table 11.4-1 & 11.4-2*

(using straight-line interpolation from table val

Maximum Considered Earthquake Accelerat

S_{MS} = Fa * Ss = 0.097 *ASCE 7-16 Eq. 11.4-1*

S_{M1} = Fv * S1 = 0.122 *ASCE 7-16 Eq. 11.4-2*

Design Spectral Acceleration

$S_{DS} = S_{MS} * 2/3$ = 0.065 *ASCE 7-16 Eq. 11.4-3*

$S_{D1} = S_{M1} * 2/3$ = 0.081 *ASCE 7-16 Eq. 11.4-4*

Seismic Design Category = **B** *\SCE 7-16 Table 11.6-1 & -2*

Resisting System

ASCE 7-16 Table 12.2-1

Basic Seismic Force Resisting System . . . **Cantilevered column systems detailed to conform to specific classification 2.Steel ordinary cantilever column systems**

Response Modification Coefficient " I " = 1.25

System Overstrength Factor " Wo " = 1.25

Deflection Amplification Factor " Cd " = 1.25

NOTE! See ASCE 7-16 for all applicable footnc

Building height Limits :

Category "A & B" Limit: Limit = 35

Category "C" Limit: Limit = 35

Category "D" Limit: Not Permitted ,i

Category "E" Limit: Not Permitted ,i

Category "F" Limit: Not Permitted ,i

Lateral Force Procedure

ASCE 7-16 Section 12.8.2

Equivalent Lateral Force Procedure

The "Equivalent Lateral Force Procedure" is being used according to the provisions of ASCE 7-16 12.8

Determine Building Period

Use ASCE 12.8-7

Structure Type for Building Period Calcul: All Other Structural Systems

" Ct " value = 0.020 " hn " : Height from base to highest leve 20.0 ft

" x " value = 0.75

" Ta " Approximate fundemental period using Eq. 12.8-7 : Ta = Ct * (hn ^ x) = 0.189 sec

"TL" : Long-period transition period per ASCE 7-16 Maps 22-14 -> 22-17 8.000 sec

Building Period " Ta " Calculated from Approximate Method sel= 0.189

" Cs " Response Coefficient

ASCE 7-16 Section 12.8.1.1

S_{DS} : Short Period Design Spectral Response	=	0.065	From Eq. 12.8-2, Preliminary Cs	=	0.065
" R " : Response Modification Factor	=	1.25	From Eq. 12.8-3 & 12.8-4 , Cs need not excee	=	0.430
" I " : Seismic Importance Factor	=	1.25	From Eq. 12.8-5 & 12.8-6, Cs not be less than	=	0.010

Cs : Seismic Response Coefficient = = 0.0650

ASCE 7-16 Seismic Base Shear

Project File: 23668.ec6

DESCRIPTION: Seismic Base Shear Analysis

Seismic Base Shear

ASCE 7-16 Section 12.8.1

Cs = 0.0650 from 12.8.1.1

W (see Sum Wi below) = 7.60 k

Seismic Base Shear V = Cs * W = 0.49 k

Vertical Distribution of Seismic Forces

ASCE 7-16 Section 12.8.3

" k " : hx exponent based on Ta = 1.00

Table of building Weights by Floor Level...

Level #	Wi : Weight	Hi : Height	(Wi * Hi^k)	Cvx	Fx=Cvx * V	Sum Story Shear	Sum Story Moment
1	7.60	10.00	76.00	1.0000	0.49	0.49	0.00

Sum Wi = 7.60 k Sum Wi * Hi = 76.00 k-ft Total Base Shear = 0.49 k

Base Moment = 4.9 k-ft

Diaphragm Forces : Seismic Design Category "B" to "F"

ASCE 7-16 12.10.1.1

Level #	Wi	Fi	Sum Fi	Sum Wi	Fpx : Calcd	Fpx : Min	Fpx : Max	Fpx	Dsgn. Force
1	7.60	0.49	0.49	7.60	0.49	0.12	0.25	0.25	0.49

Wpx . . . . . Weight at level of diaphragm and other structure elements attached to it.
Fi . . . . . Design Lateral Force applied at the level.
Sum Fi . . . . . Sum of "Lat. Force" of current level plus all levels above
MIN Req'd Force @ Level . . . $0.20 * S_{DS} * I * Wpx$
MAX Req'd Force @ Level . . . $0.40 * S_{DS} * I * Wpx$
Fpx : Design Force @ Level . Wpx * SUM(x->n) Fi / SUM(x->n) wi, x = Current level, n = Top Level

United Structural Design LLC
2058 S. Dobson Rd. Ste 10
Mesa, AZ
480-454-6408

Wind Loads - MWFRS all h (Except for Open Buildings)

Kh (case 2) =	0.90			GCpi =	+/-0.18
Base pressure (q_h) =	**27.3 psf**	Bldg dim parallel to ridge =	150.0 ft	G =	0.85
Roof Angle (θ) =	1.2 deg	Bldg dim normal to ridge =	100.0 ft	qi = qh	
Roof tributary area:		h =	20.0 ft		
Wind normal to ridge =(h/2)*L:	1500 sf	ridge ht =	21.0 ft		
Wind parallel to ridge =(h/2)*L:	1000 sf				

Ultimate Wind Surface Pressures (psf)

	Wind Normal to Ridge				Wind Parallel to Ridge				
	L/B = 0.67		h/L = 0.20			L/B = 1.50		h/L = 0.13	
Surface	Cp	q_hGC_p	w/+q_iGC_{pi}	w/-q_hGC_{pi}	Dist.*	Cp	q_hGC_p	w/ +q_iGC_{pi}	w/ -q_hGC_{pi}
Windward Wall (WW)	0.80	18.6	see table below			0.80	18.6	see table below	
Leeward Wall (LW)	-0.50	-11.6	-16.5	-6.7		-0.40	-9.3	-14.2	-4.4
Side Wall (SW)	-0.70	-16.3	-21.2	-11.3		-0.70	-16.3	-21.2	-11.3
Leeward Roof (LR)		**				Included in windward roof			
Neg Windward Roof: 0 to h/2*	-0.90	-20.9	-25.8	-16.0	0 to h/2*	-0.90	-20.9	-25.8	-16.0
h/2 to h*	-0.90	-20.9	-25.8	-16.0	h/2 to h*	-0.90	-20.9	-25.8	-16.0
h to 2h*	-0.50	-11.6	-16.5	-6.7	h to 2h*	-0.50	-11.6	-16.5	-6.7
> 2h*	-0.30	-7.0	-11.9	-2.0	> 2h*	-0.30	-7.0	-11.9	-2.0
Pos/min windward roof press.	-0.18	-4.2	-9.1	0.7	Min press.	-0.18	-4.2	-9.1	0.7

**Roof angle < 10 degrees. Therefore, leeward roof is included in windward roof pressure zones.

*Horizontal distance from windward edge

For monoslope roofs, entire roof surface is either windward or leeward surface.

Parapet

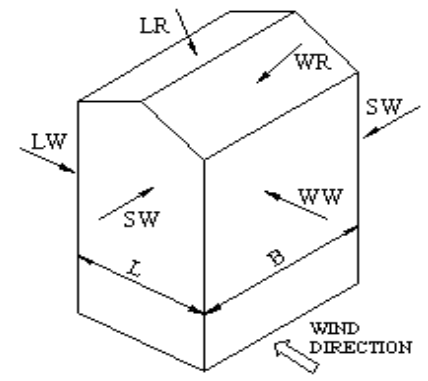
z	Kz	Kzt	qp (psf)
0.0 ft	0.85	1.00	0.0

Windward parapet: 0.0 psf (GCpn = +1.5)
Leeward parapet: 0.0 psf (GCpn = -1.0)

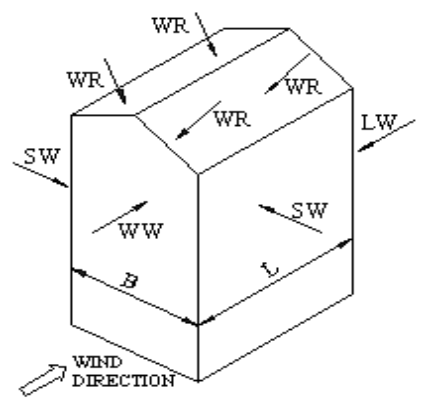
Windward roof overhangs : 18.6 psf (upward - add to windward roof pressure)

Windward Wall Pressures at "z" (psf)

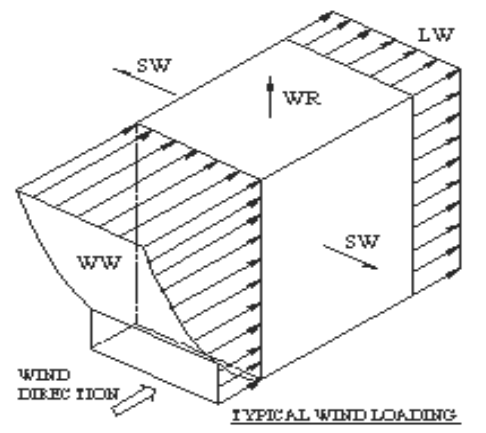
	z	Kz	Kzt	Windward Wall q_zGC_p	Windward Wall w/+q_iGC_{pi}	Windward Wall w/-q_hGC_{pi}	Combined WW + LW Wind Normal to Ridge	Combined WW + LW Wind Parallel to Ridge
	0 to 15'	0.85	1.00	17.5	12.6	22.4	29.1	26.8
h=	20.0 ft	0.90	1.00	18.6	13.7	23.5	30.2	27.9
ridge =	21.0 ft	0.91	1.00	18.8	13.9	23.7	30.4	28.1



WIND NORMAL TO RIDGE

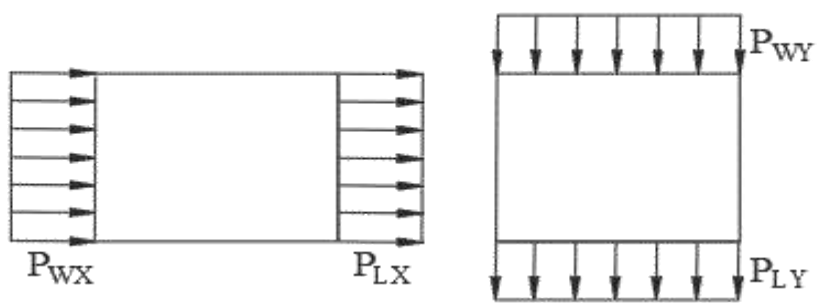


WIND PARALLEL TO RIDGE

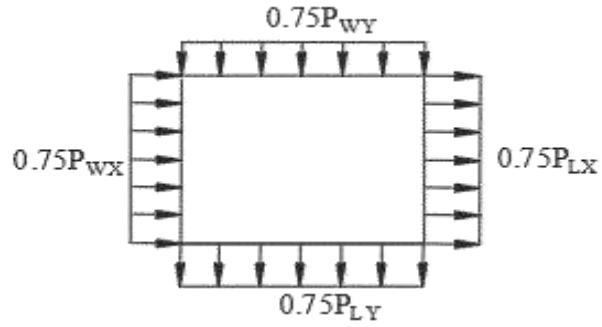


TYPICAL WIND LOADING

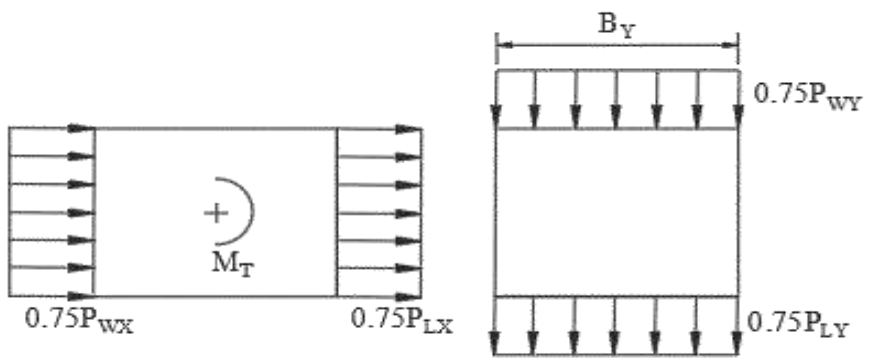
NOTE: ASCE 7 requires the application of full and partial loading of the wind pressures per the 4 cases below.



CASE 1



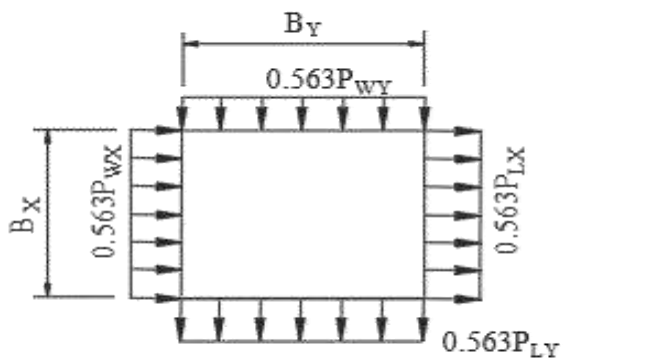
CASE 3



$M_T = 0.75(P_{WX}+P_{LX})B_X e_X$
$e_X = \pm 0.15\ B_X$

$M_T = 0.75(P_{WY}+P_{LY})B_Y e_Y$
$e_Y = \pm 0.15\ B_Y$

CASE 2



$M_T = 0.563(P_{WX}+P_{LX})B_X e_X + 0.563(P_{WY}+P_{LY})B_Y e_Y$
$e_X = \pm 0.15\ B_X$ $e_Y = \pm 0.15\ B_Y$

CASE 4

Wind Forces at Floors

Total Floors = 1
T/Fdn (dist below grade) = 2.0 ft

Building dimension (parallel with ridge) = 150.0 ft e = 22.50 ft
Building dimension (normal to ridge) = 100.0 ft e = 15.00 ft
L is the building dimension parallel to the wind direction

Level	Elevation Above Grade (ft)	Height of Centroid to Fdn (ft)	Wind Normal to Ridge L	B	Area (sf)	Applied Force (k)	Story Shear (k)	Overturning Moment ('k)	Wind Parallel to Ridge Area	Applied Force (k)	Story Shear (k)	Overturning Moment ('k)
Equip,etc		0.00	wind on equip, screenwalls, etc =					0.0				
Parapet	0.00	0.00				0.0		0.0		0.0		
T/Ridge	0.00	0.00			0.0	0.0		0.0	0.0	0.0		0.0
Roof	15.00	17.00	100.0	150.0	1,125.0	32.7	32.7	0.0	750.0	20.1	20.1	0.0
1	0.00	2.00	100.0	150.0	1,125.0	32.7	65.5	491.1	750.0	20.1	40.2	301.3
FDN		0.00						622.1				381.6

Uhaul Propane Tank Calcs

Loads
Empty tank weight = 2330#
Capacity = 1000 gallons
Weight = 4.25#*1000 = 4250#
Weight of tank legs + misc. = 170#
Total weight = 7600#

Seismic Loads
R = 2.5

Lateral seismic force = 0.196*weight = 1490#

Wind Loads
Wind Pressure = 31 psf (see attached printout)

Tank area = 3.5'*20' = 70 sq ft
Total wind load = 31*70 = 2170 #

Therefore wind load governs.

Worst case loads
Empty tank + Wind
Overturning moment = 2170*10' = 21700 #ft
Spacing between anchor locations = 15"
Resisting moment = 2300*15/12 = 2875 #ft
Net moment = 18825 #ft
Net uplift = 18825/(30/12) = 7530 #
Net uplift per bolt = 3765 #

Crash Post Design

Height = 4'
Loads = 3k at 3' height
Designed for vehicle crash loads

See attached detail and printout for crash post design

David Grapsas, P.E.
Principal
John Elder, P.E.
Principal

Phoenix, AZ
480-454-6408
www.unitedstr.com

Combined Footing

Project File: 23668.ec6

DESCRIPTION: Tank Footing

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2018

General Information

Material Properties

f'c : Concrete 28 day strength	3.0	ksi
fy : Rebar Yield	60.0	ksi
Ec : Concrete Elastic Modulus	3,122.0	ksi
Concrete Density	145.0	pcf
ϕ : Phi Values Flexure :	0.90	
Shear :	0.750	

Analysis/Design Settings

Calculate footing weight as dead load ?	Yes
Calculate Pedestal weight as dead load ?	No
Min Steel % Bending Reinf (based on 'd')	
Min Allow % Temp Reinf (based on thick)	0.00180
Min. Overturning Safety Factor	1.0: 1
Min. Sliding Safety Factor	1.0: 1

Soil Information

Allowable Soil Bearing	2.0	ksf
Increase Bearing By Footing Weight	No	
Soil Passive Sliding Resistance	250.0	pcf
(Uses entry for "Footing base depth below soil surface" for force)		
Coefficient of Soil/Concrete Friction	0.30	

Soil Bearing Increase

Footing base depth below soil surface	ft
Increases based on footing Depth	
Allowable pressure increase per foot	ksf
when base of footing is below	ft
Increases based on footing Width . . .	
Allowable pressure increase per foot	ksf
when maximum length or width is greater tha	ft
Maximum Allowed Bearing Pressure	10.0 ksf
(A value of zero implies no limit)	
Adjusted Allowable Soil Bearing	2.0 ksf
(Allowable Soil Bearing adjusted for footing weight and depth & width increases as specified by user.)	

Dimensions & Reinforcing

Distance Left of Column #1	=	1.250 ft
Between Columns	=	2.50 ft
Distance Right of Column #2	=	1.250 ft
Total Footing Length	=	5.0 ft
Footing Width	=	2.50 ft
Footing Thickness	=	42.0 in

Pedestal dimensions...

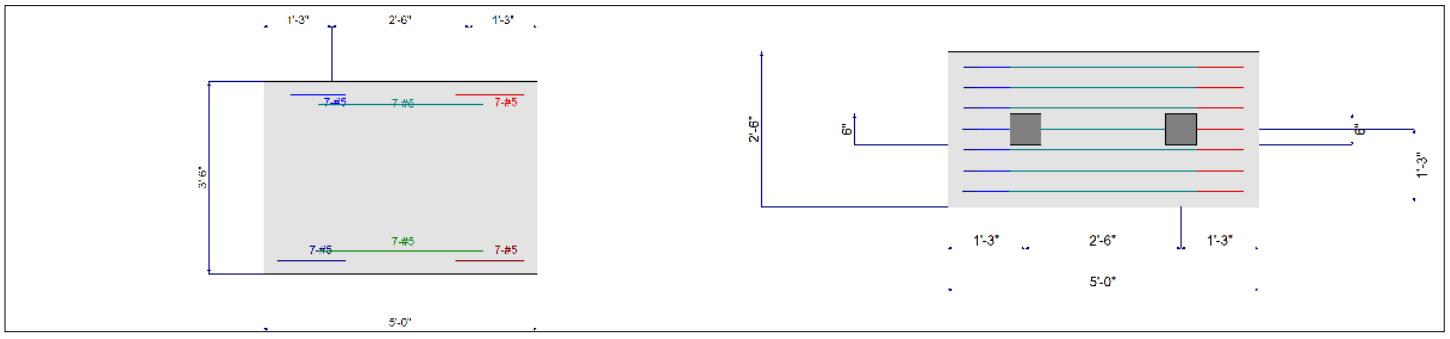
		Col #1	Col #2	
Sq. Dim.	=	6.0	6.0	in
Height	=			in

	=	
Rebar Center to Concrete Edge @ Top	=	3.0 in
Rebar Center to Concrete Edge @ Bottom	=	3.0 in

	Count	Size #	As Provided	As Req'd
Bars left of Col #1				
Bottom Bars	7.0	5	2.170	2.268 in^2
Top Bars	7.0	5	2.170	2.268 in^2
Bars Btwn Cols				
Bottom Bars	7.0	5	2.170	2.268 in^2
Top Bars	7.0	5	2.170	2.268 in^2
Bars Right of Col #2				
Bottom Bars	7.0	5	2.170	2.268 in^2
Top Bars	7.0	5	2.170	0.0 in^2

Applied Loads

Applied @ Left Column		**D**	**Lr**	**L**	**S**	**W**	**E**	**H**	
Axial Load Downward	=	-3.760							k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Applied @ Right Column									
Axial Load Downward	=	3.80							k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Overburden	=								



Combined Footing

Project File: 23668.ec6

DESCRIPTION: Tank Footing

DESIGN SUMMARY

Design OK

Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS 1.462	Overturning	14.10 k-ft	20.609 k-ft	D Only
PASS No Sliding	Sliding	0.0 k	1.915 k	No Sliding
PASS 2.698	Uplift	3.760 k	10.144 k	D Only

Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS 0.8330	Soil Bearing	1.666 ksf	2.0 ksf	D Only
PASS 0.01167	1-way Shear - Col #1	0.9588 psi	82.158 psi	+1.40D
PASS 0.01167	1-way Shear - Col #2	0.9589 psi	82.158 psi	+1.40D
PASS 0.002938	2-way Punching - Col #1	0.4827 psi	164.317 psi	+1.40D
PASS 0.003650	2-way Punching - Col #2	0.5997 psi	164.317 psi	+1.40D
PASS 0.002325	Flexure - Left of Col #1 - Top	-0.8661 k-ft	372.525 k-ft	+1.40D
PASS No Bending	Flexure - Left of Col #1 - Bottom	0.0 k-ft	0.0 k-ft	N/A
PASS 0.001832	Flexure - Between Cols - Top	-0.6823 k-ft	372.525 k-ft	+1.40D
PASS 0.005827	Flexure - Between Cols - Bottom	2.171 k-ft	372.525 k-ft	+1.40D
PASS No Bending	Flexure - Right of Col #2 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS 0.00450	Flexure - Right of Col #2 - Bottom	1.676 k-ft	372.525 k-ft	+1.40D

Soil Bearing

Load Combination...	Total Bearing	Eccentricity from Ftg CL	Actual Soil Bearing Stress @ Left Edge	@ Right Edge	Allowable	Actual / Allow Ratio
D Only	6.38 k	1.480 ft	0.00 ksf	1.67 ksf	2.00 ksf	0.833
+0.60D	3.83 k	1.480 ft	0.00 ksf	1.00 ksf	2.00 ksf	0.500

Overturning Stability

Load Combination...	Moments about Left Edge k-ft Overturning	Resisting	Ratio	Moments about Right Edg k-ft Overturning	Resisting	Ratio
D Only	4.70	30.11	6.406	14.10	20.61	1.462
+0.60D	2.82	18.07	6.406	8.46	12.37	1.462

Sliding Stability

Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio
D Only	0.00 k	1.92 k	999
+0.60D	0.00 k	1.15 k	999

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+0.60D	0.000	0.000	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.013	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.025	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.038	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.050	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.063	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.075	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.088	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.100	0	0.000	0	0.000	0.000	0.000
+1.40D	-0.011	0.113	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.014	0.125	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.017	0.138	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.020	0.150	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.023	0.163	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.027	0.175	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.031	0.188	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.036	0.200	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.040	0.213	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.045	0.225	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.050	0.238	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.056	0.250	Top	2.268	Min Temp %	2.170	372.525	0.000

Combined Footing

Project File: 23668.ec6

DESCRIPTION: Tank Footing

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.40D	-0.061	0.263	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.067	0.275	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.073	0.288	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.080	0.300	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.087	0.313	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.094	0.325	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.101	0.338	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.109	0.350	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.117	0.363	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.125	0.375	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.133	0.388	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.142	0.400	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.151	0.413	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.160	0.425	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.170	0.438	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.180	0.450	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.190	0.463	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.200	0.475	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.211	0.488	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.222	0.500	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.233	0.513	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.245	0.525	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.257	0.538	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.269	0.550	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.281	0.563	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.294	0.575	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.307	0.588	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.320	0.600	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.333	0.613	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.347	0.625	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.361	0.638	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.375	0.650	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.390	0.663	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.405	0.675	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.420	0.688	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.435	0.700	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.451	0.713	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.467	0.725	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.483	0.738	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.500	0.750	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.516	0.763	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.533	0.775	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.551	0.788	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.568	0.800	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.586	0.813	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.604	0.825	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.623	0.838	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.642	0.850	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.661	0.863	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.680	0.875	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.700	0.888	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.719	0.900	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.740	0.913	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.760	0.925	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.781	0.938	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.802	0.950	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.823	0.963	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.844	0.975	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.866	0.988	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.888	1.000	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.910	1.013	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.930	1.025	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.949	1.038	Top	2.268	Min Temp %	2.170	372.525	0.003

Combined Footing

Project File: 23668.ec6

DESCRIPTION: Tank Footing

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.40D	-0.966	1.050	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-0.982	1.063	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-0.997	1.075	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.010	1.088	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.022	1.100	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.033	1.113	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.042	1.125	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.050	1.138	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.056	1.150	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.061	1.163	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.065	1.175	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.067	1.188	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.068	1.200	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.068	1.213	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.066	1.225	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.063	1.238	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.059	1.250	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.053	1.263	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.046	1.275	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.037	1.288	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.027	1.300	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.016	1.313	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-1.003	1.325	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-0.989	1.338	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-0.974	1.350	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-0.957	1.363	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-0.939	1.375	Top	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	-0.919	1.388	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.898	1.400	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.876	1.413	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.853	1.425	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.828	1.438	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.801	1.450	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.774	1.463	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.745	1.475	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.714	1.488	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.682	1.500	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.650	1.513	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.618	1.525	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.586	1.538	Top	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	-0.555	1.550	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.523	1.563	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.492	1.575	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.462	1.588	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.431	1.600	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.401	1.613	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.371	1.625	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.342	1.638	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.312	1.650	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.283	1.663	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.255	1.675	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.226	1.688	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.198	1.700	Top	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	-0.170	1.713	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.142	1.725	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.115	1.738	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.088	1.750	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.061	1.763	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	-0.035	1.775	Top	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.000	1.788	0	0.000	0	0.000	0.000	0.000
+1.40D	0.018	1.800	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.043	1.813	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.069	1.825	Bottom	2.268	Min Temp %	2.170	372.525	0.000

Combined Footing

LIC# : KW-06012847, Build:20.23.10.02 United Structural Design (c) ENERCALC INC 1983-2023

DESCRIPTION: Tank Footing

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.40D	0.094	1.838	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.119	1.850	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.143	1.863	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.168	1.875	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.192	1.888	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.215	1.900	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.239	1.913	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.262	1.925	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.285	1.938	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.308	1.950	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.330	1.963	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.352	1.975	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.374	1.988	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.396	2.000	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.417	2.013	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.438	2.025	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.459	2.038	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.479	2.050	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.500	2.063	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.520	2.075	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.539	2.088	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.559	2.100	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.578	2.112	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.598	2.125	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.616	2.137	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.635	2.150	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.654	2.162	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.672	2.175	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.690	2.187	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.708	2.200	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.725	2.212	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.743	2.225	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.760	2.237	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.777	2.250	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.794	2.262	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.811	2.275	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.827	2.287	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.844	2.300	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.860	2.312	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.876	2.325	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.892	2.337	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.908	2.350	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.923	2.362	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.938	2.375	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	0.954	2.387	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	0.969	2.400	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	0.984	2.412	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	0.999	2.425	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.013	2.437	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.028	2.450	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.042	2.462	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.057	2.475	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.071	2.487	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.085	2.500	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.099	2.512	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.113	2.525	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.126	2.537	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.140	2.550	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.154	2.562	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.167	2.575	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.180	2.587	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.194	2.600	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.207	2.612	Bottom	2.268	Min Temp %	2.170	372.525	0.003

Combined Footing

DESCRIPTION: Tank Footing

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.40D	1.220	2.625	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.233	2.637	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.246	2.650	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.259	2.662	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.272	2.675	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.285	2.687	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.298	2.700	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.310	2.712	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.323	2.725	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.336	2.737	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.348	2.750	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.361	2.762	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.373	2.775	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.386	2.787	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.398	2.800	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.411	2.812	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.423	2.825	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.435	2.837	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.448	2.850	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.460	2.862	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.473	2.875	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.485	2.887	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.497	2.900	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.510	2.912	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.522	2.925	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.535	2.937	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.547	2.950	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.559	2.962	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.572	2.975	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.584	2.987	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.597	3.000	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.610	3.012	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.622	3.025	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.635	3.037	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.648	3.050	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.660	3.062	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.673	3.075	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.686	3.087	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.699	3.100	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.712	3.112	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.725	3.125	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.739	3.137	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.752	3.150	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.765	3.162	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.779	3.175	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.792	3.187	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.806	3.200	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.819	3.212	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.833	3.225	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.847	3.237	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.861	3.250	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.875	3.262	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.890	3.275	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.904	3.287	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.919	3.300	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.933	3.312	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.948	3.325	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.963	3.337	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.978	3.350	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.993	3.362	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	2.009	3.375	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	2.024	3.387	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	2.040	3.400	Bottom	2.268	Min Temp %	2.170	372.525	0.005

Combined Footing

DESCRIPTION: Tank Footing

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.40D	2.055	3.412	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.071	3.425	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.088	3.437	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.104	3.450	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.120	3.462	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.137	3.475	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.154	3.487	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.171	3.500	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.187	3.512	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.202	3.525	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.216	3.537	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.228	3.550	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.238	3.562	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.247	3.575	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.255	3.587	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.261	3.600	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.266	3.612	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.269	3.625	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.271	3.637	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.271	3.650	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.270	3.662	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.268	3.675	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.264	3.687	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.258	3.700	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.252	3.712	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.243	3.725	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.234	3.737	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.223	3.750	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.211	3.762	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.197	3.775	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.182	3.787	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.165	3.800	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.147	3.812	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.128	3.825	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.107	3.837	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.085	3.850	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.062	3.862	Bottom	2.268	Min Temp %	2.170	372.525	0.006
+1.40D	2.037	3.875	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	2.011	3.887	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.984	3.900	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.955	3.912	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.924	3.925	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.893	3.937	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.860	3.950	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.826	3.962	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.790	3.975	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.753	3.987	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.715	4.000	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.676	4.012	Bottom	2.268	Min Temp %	2.170	372.525	0.005
+1.40D	1.638	4.025	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.600	4.037	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.562	4.050	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.525	4.062	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.488	4.075	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.451	4.087	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.415	4.100	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.379	4.112	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.344	4.125	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.308	4.137	Bottom	2.268	Min Temp %	2.170	372.525	0.004
+1.40D	1.274	4.150	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.239	4.162	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.205	4.175	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.172	4.187	Bottom	2.268	Min Temp %	2.170	372.525	0.003

Combined Footing

LIC# : KW-06012847, Build:20.23.10.02 United Structural Design (c) ENERCALC INC 1983-2023

DESCRIPTION: Tank Footing

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.40D	1.138	4.200	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.106	4.212	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.073	4.225	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.041	4.237	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	1.010	4.250	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	0.978	4.262	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	0.948	4.275	Bottom	2.268	Min Temp %	2.170	372.525	0.003
+1.40D	0.917	4.287	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.887	4.300	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.858	4.312	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.829	4.325	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.800	4.337	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.772	4.350	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.744	4.362	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.717	4.375	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.690	4.387	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.663	4.400	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.637	4.412	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.612	4.425	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.587	4.437	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.562	4.450	Bottom	2.268	Min Temp %	2.170	372.525	0.002
+1.40D	0.538	4.462	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.514	4.475	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.491	4.487	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.469	4.500	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.446	4.512	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.425	4.525	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.403	4.537	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.383	4.550	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.363	4.562	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.343	4.575	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.324	4.587	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.305	4.600	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.287	4.612	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.269	4.625	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.252	4.637	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.235	4.650	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.219	4.662	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.204	4.675	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.189	4.687	Bottom	2.268	Min Temp %	2.170	372.525	0.001
+1.40D	0.174	4.700	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.161	4.712	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.147	4.725	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.134	4.737	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.122	4.750	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.110	4.762	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.099	4.775	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.089	4.787	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.079	4.800	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.069	4.812	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.061	4.825	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.052	4.837	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.045	4.850	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.038	4.862	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.031	4.875	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.025	4.887	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.020	4.900	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.015	4.912	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.011	4.925	Bottom	2.268	Min Temp %	2.170	372.525	0.000
+1.40D	0.000	4.937	0	0.000	0	0.000	0.000	0.000
+1.40D	0.000	4.950	0	0.000	0	0.000	0.000	0.000
+1.40D	0.000	4.962	0	0.000	0	0.000	0.000	0.000
+1.40D	0.000	4.975	0	0.000	0	0.000	0.000	0.000

Combined Footing

Project File: 23668.ec6

DESCRIPTION: Tank Footing

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+1.40D	0.000	4.987	0	0.000	0	0.000	0.000	0.000
+1.40D	0.000	5.000	0	0.000	0	0.000	0.000	0.000

One Way Shear

Punching Shear

Load Combination...	Phi Vn	vu @ Col #1	vu @ Col #2	Phi Vn	vu @ Col #1	vu @ Col #2
+1.40D	82.16 psi	0.96 psi	0.96 psi	164.32 psi	0.48 psi	0.60 psi
+1.20D	82.16 psi	0.82 psi	0.82 psi	164.32 psi	0.41 psi	0.51 psi
+0.90D	82.16 psi	0.62 psi	0.62 psi	164.32 psi	0.31 psi	0.39 psi

Pole Footing Embedded in Soil

Project File: 23668.ec6

DESCRIPTION: Crash Post footing

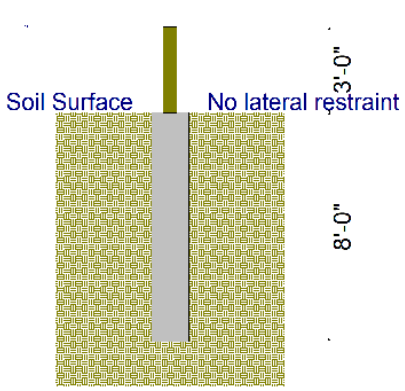
Code References

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2018

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	16.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	350.0 pcf
Max Passive	1,500.0 psf

Point Load



Controlling Values

Governing Load Combination	D Only
Lateral Load	3.0 k
Moment	9.0 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	**930.31** psf
Allowable	**930.86** psf
Minimum Required Depth	**8.0 ft**
Footing Base Area	1.396 ft^2
Maximum Soil Pressure	0.0 ksf

Applied Loads

Lateral Concentrated Load (k)		Lateral Distributed Loads (k		Vertical Load (k)	
D : Dead Load	3.0 k		k/ft		k
Lr : Roof Live	k		k/ft		k
L : Live	k		k/ft		k
S : Snow	k		k/ft		k
W : Wind	k		k/ft		k
E : Earthquake	k		k/ft		k
H : Lateral Earth	k		k/ft		k
Load distance above ground surface	3.0 ft	TOP of Load above ground surface	ft		
		BOTTOM of Load above ground surface	ft		

Load Combination Results

	Forces @ Ground Surface		Required	Pressure at 1/3 Depth		Soil Increase
Load Combination	Loads - (k)	Moments - (ft-k)	Depth - (ft)	Actual - (psf)	Allow - (psf)	Factor
D Only	3.000	9.000	8.00	930.3	930.9	1.000
+0.60D	1.800	5.400	6.50	745.7	746.8	1.000

SIMPSON Strong-Tie Anchor Designer™ Software
Version 3.0.7947.0

Company:		Date:	10/18/2023
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Cast-in-place
Material: AB
Diameter (inch): 0.875
Effective Embedment depth, h_{ef} (inch): 5.000
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 7.38
C_{min} (inch): 5.25
S_{min} (inch): 5.25

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 12.00
State: Uncracked
Compressive strength, f'_c (psi): 3000
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: No
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: No
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 6.00 x 6.00 x 0.25

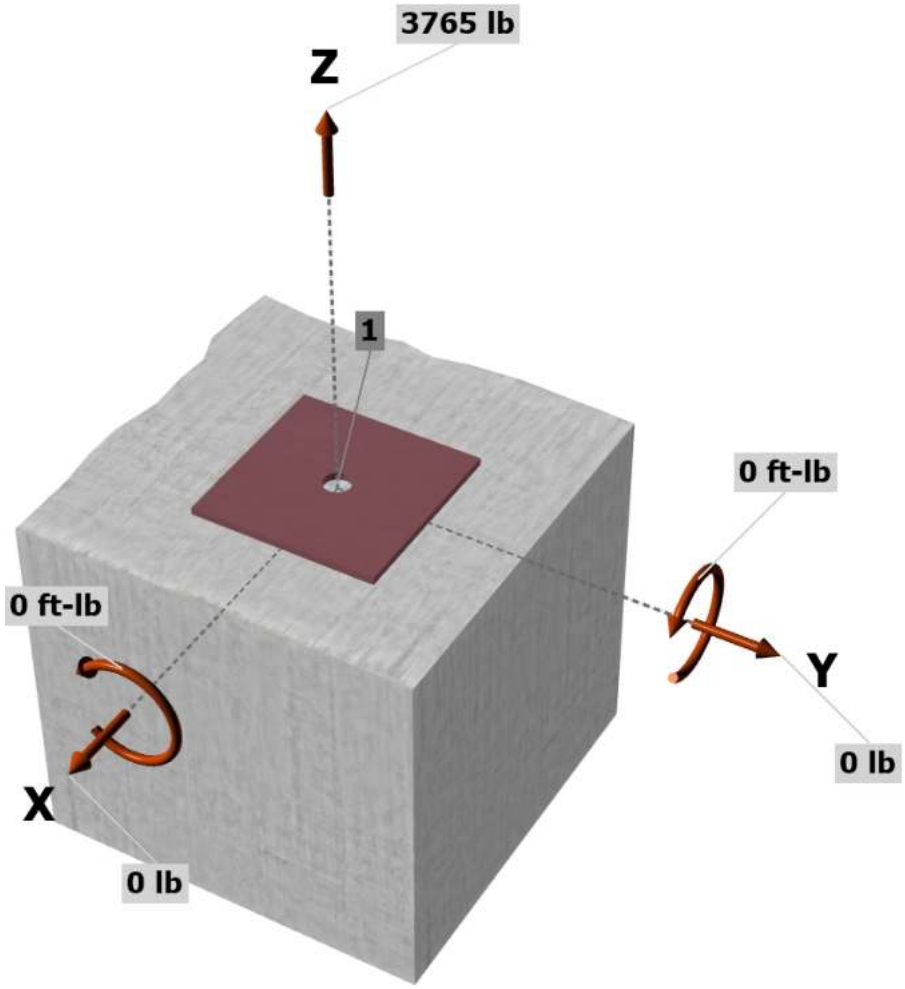
Recommended Anchor
Anchor Name: PAB Pre-Assembled Anchor Bolt - PAB7 (7/8"Ø)

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

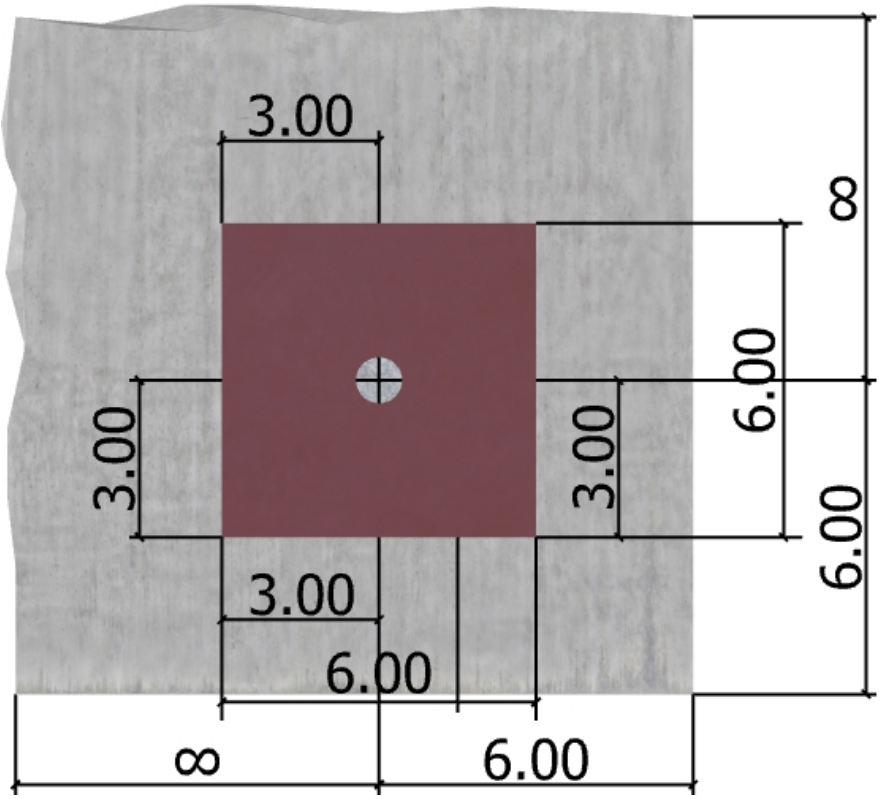
Strength level loads:

N_{ua} [lb]: 3765
V_{uax} [lb]: 0
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0

<Figure 1>



<Figure 2>



SIMPSON Strong-Tie Anchor Designer™ Software
Version 3.0.7947.0

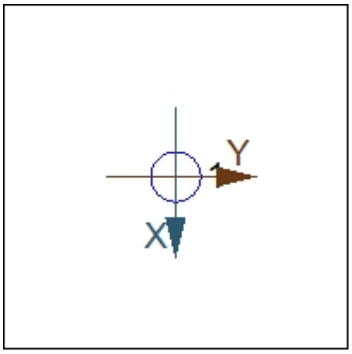
Company:		Date:	10/18/2023
Engineer:		Page:	4/5
Project:			
Address:			
Phone:			
E-mail:			

3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	3765.0	0.0	0.0	0.0
Sum	3765.0	0.0	0.0	0.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 3765
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
26795	0.75	20096

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.4.2.2a)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
24.0	1.00	3000	5.000	14697

$\phi N_{cb} = \phi \, (A_{Nc} / A_{Nco}) \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1a)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cb} (lb)
216.64	225.00	6.00	0.940	1.25	1.000	14697	0.70	11639

6. Pullout Strength of Anchor in Tension (Sec. 17.4.3)

$\phi N_{pn} = \phi \Psi_{c,P} N_p = \phi \Psi_{c,P} 8 A_{brg} f'_c$ (Sec. 17.3.1, Eq. 17.4.3.1 & 17.4.3.4)

$\Psi_{c,P}$	A_{brg} (in^2)	f'_c (psi)	ϕ	ϕN_{pn} (lb)
1.4	4.07	3000	0.70	95609

11. Results

11. Interaction of Tensile and Shear Forces (Sec. D.7)?

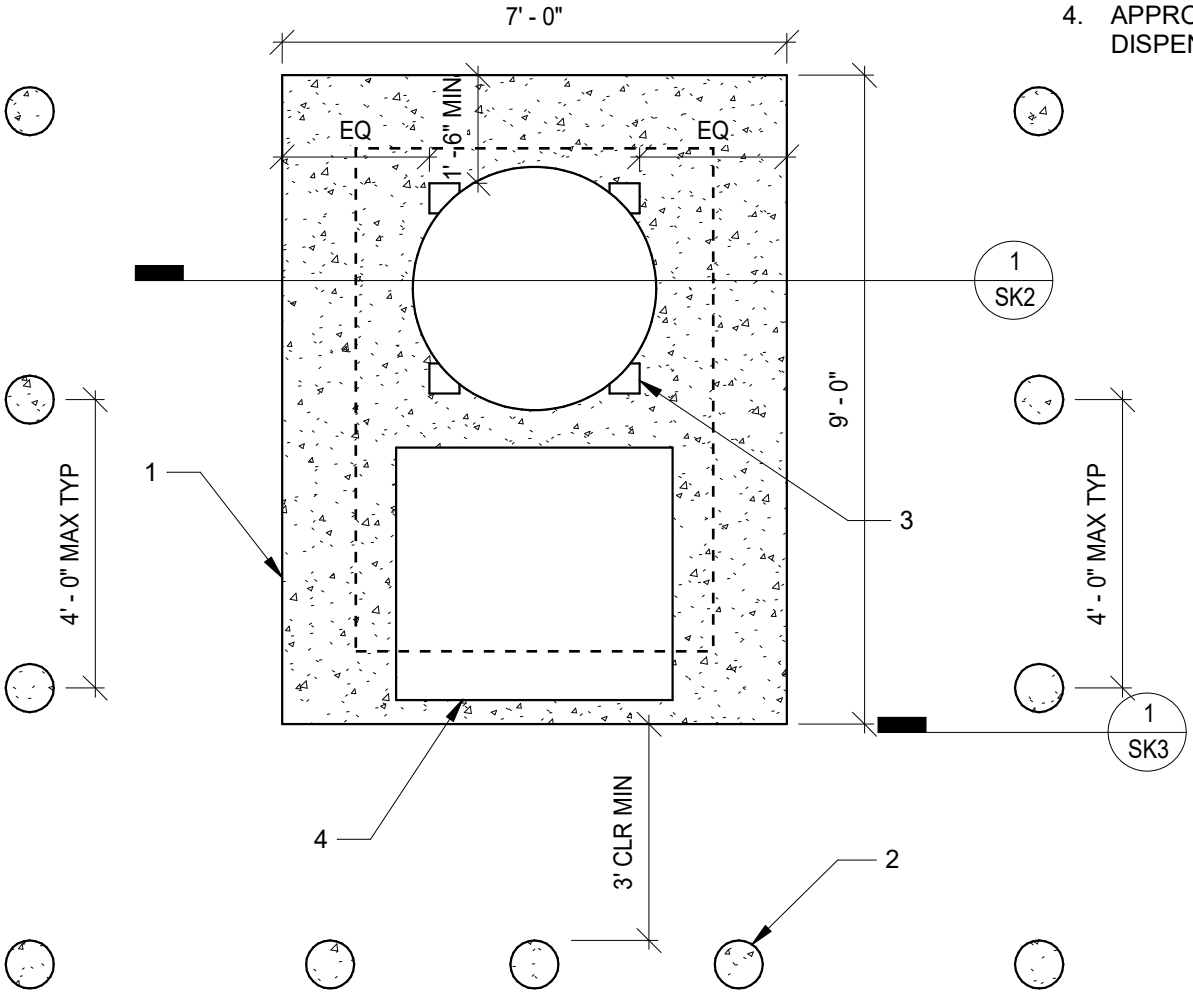
Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	3765	20096	0.19	Pass
Concrete breakout	**3765**	**11639**	**0.32**	**Pass (Governs)**
Pullout	3765	95609	0.04	Pass

PAB7 (7/8"Ø) with hef = 5.000 inch meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.

1. TANK FOOTING. SEE SK2.
2. STEEL CRASH BOLLARDS AT 3' O.C. SEE SK3.
3. TANK POSTS. SEE SK2.
4. APPROXIMATE LOCATION OF DISPENSER CABINET.



1 TANK FOOTING AND CRASH BOLLARDS
NO SCALE

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

01/03/2024
(signature) (date)

SEAL
John Brittan Elder
License number #P25413
My license renewal date is December 31, 2024.
Pages or sheets covered by this seal:

UHAUL PROPANE IA

SHEET NUMBER

SK1

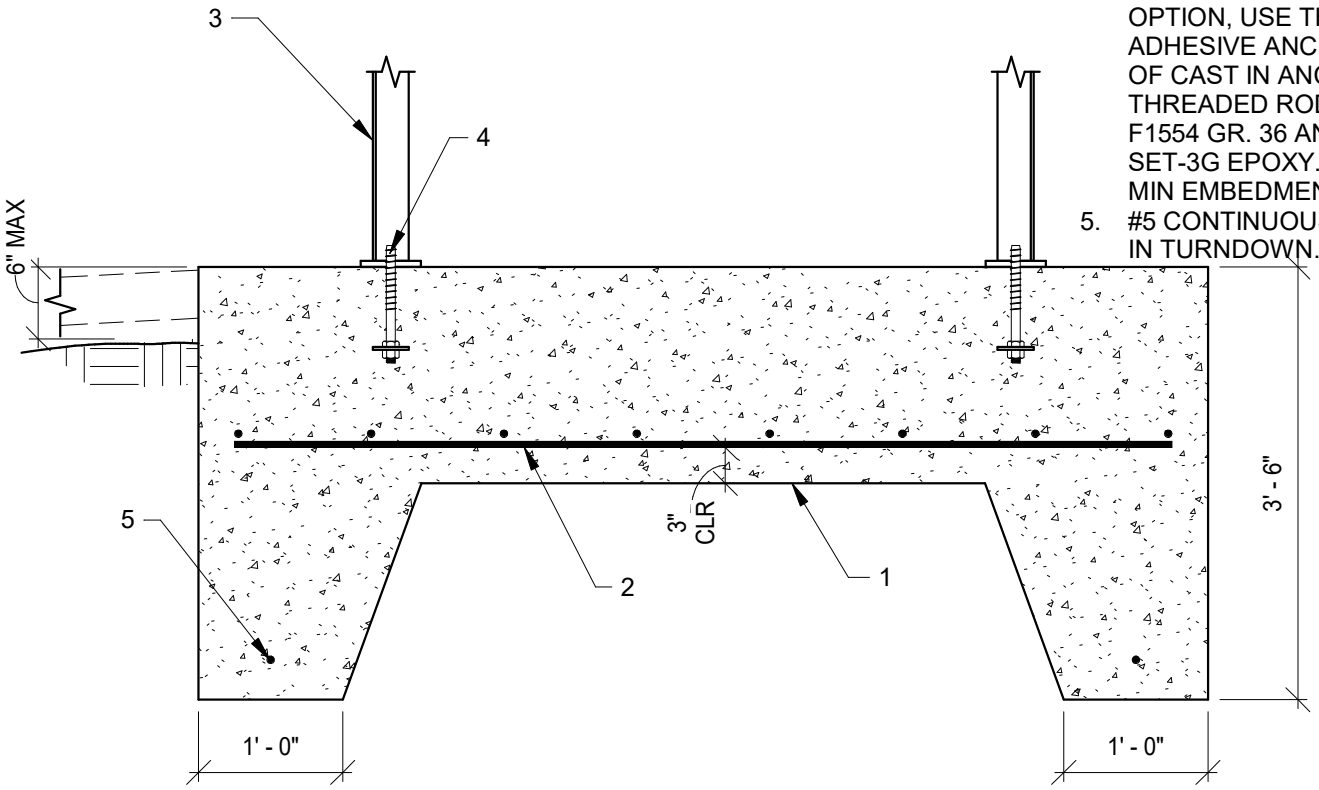
UNITED STRUCTURAL DESIGN LLC
2058 S. DOBSON RD. SUITE 10, MESA, AZ 85202
OFFICE: (480) 454-6408 | www.unitedstr.com
USD Project No.:-
Project No.:-

1100 EAST HICKMAN
WAUKEE, IA 50263

DESIGN CRITERIA:

f'c= 4,500 PSI
Fy = 60.000 KSI
soil bearing pressure = 1,500 PSF

1. 7'-0"x9'-0"x1-6" THICK SQUARE FOOTING.
2. (8) #5 REINFORCING IN LONG DIRECTION AND (10) #5 REINFORCING IN SHORT DIRECTION BOTTOM OF FOOTING.
3. TANK COLUMNS AND BASE PLATE BY OTHERS.
4. 7/8" DIA. ANCHOR BOLT AT EACH COLUMN. MIN. 12" EMBEDMENT.(2) STANDARD NUTS AND 1/4"x6"x6" PLATE WASHER AT END OF EACH BOLT. AT CONTRACTOR'S OPTION, USE THREADED ROD ADHESIVE ANCHORS IN LIEU OF CAST IN ANCHORS. THREADED RODS SHALL BE F1554 GR. 36 AND SIMPSON SET-3G EPOXY. PROVIDE 12" MIN EMBEDMENT.
5. #5 CONTINUOUS REINFORCING IN TURNDOWN.



1 PROPANE TANK FOOTING
NO SCALE

SK1

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under the laws of the State of Iowa.

01/03/2024
(signature) (date)
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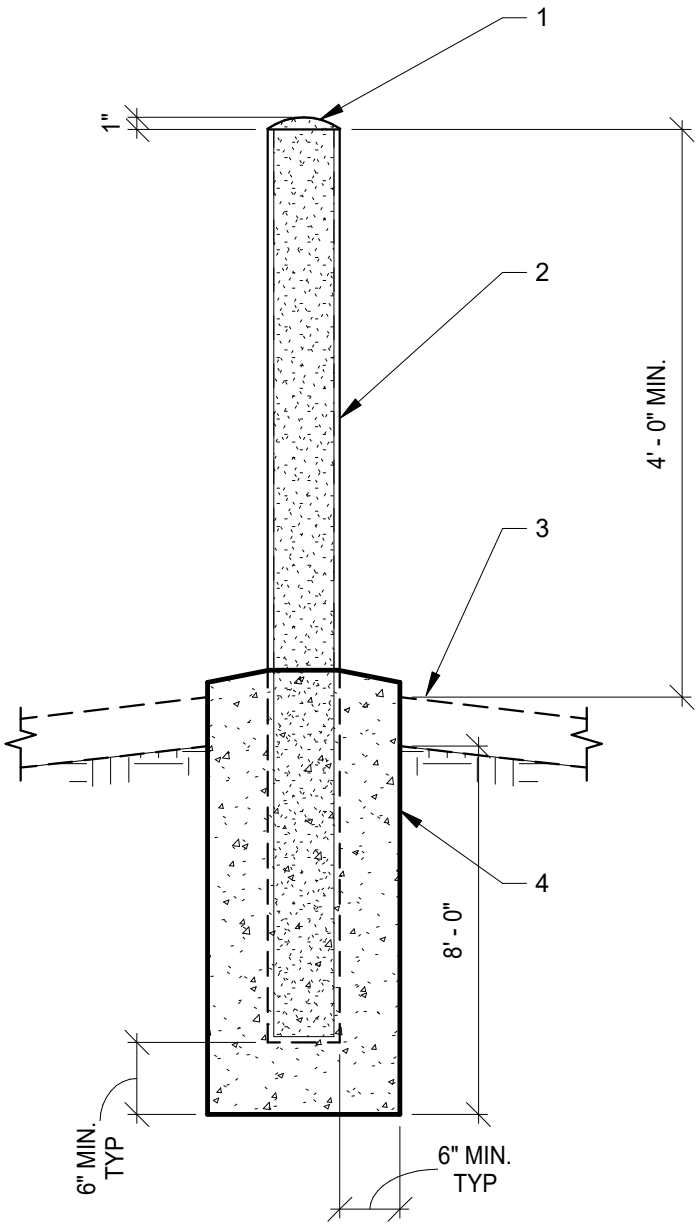
UHAUL PROPANE IA

SHEET NUMBER

SK2

UNITED STRUCTURAL DESIGN LLC
2058 S. DOBSON RD. SUITE 10, MESA, AZ 85202
OFFICE: (480) 454-6408 | www.unitedstr.com
USD Project No.:-
Project No.:-

1100 EAST HICKMAN
WAUKEE, IA 50263



1. FILL WITH GROUT AND CROWN TOP.
2. 4" STD STEEL POST. SCHEDULE 40; GALVANIZED.
3. FINISHED GRADE, CONCRETE SLAB, OR ASPHALT AS OCCURS.
4. 16" DIA. CONCRETE FOOTING (CLASS B) F'c = 2,500.

NOTES:

- SAFETY POST SHALL COMPLY WITH THE MINIMUM REQUIREMENTS OF NFP 58, CITY, AND AHJ.
- BOLLARD SPACING SHALL NOT EXCEED 4 FEET BETWEEN POSTS ON CENTER.
- BOLLARDS SHALL BE LOCATED MINIMUM 3 FEET CLEAR FROM PROPANE TANK.

1 STEEL CRASH POST (BOLLARD)

NO SCALE

3251-1S-07
192-01

SK1

LICENSED PROFESSIONAL ENGINEER
JOHN BRITTAN ELDER P25413
IOWA

I hereby certify that this engineering document was prepared by me or under
my direct personal supervision and that I am a duly licensed Professional Engineer
under the laws of the State of Iowa.

01/03/2024
(signature) (date)
SEAL
John Brittan Elder
License number #P25413
My license renewal date is December 31, 2024.
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UHAUL PROPANE IA

UNITED STRUCTURAL DESIGN LLC
2058 S. DOBSON RD. SUITE 10, MESA, AZ 85202
OFFICE: (480) 454-6408 | www.unitedstr.com
USD Project No.:-
Project No.:-

1100 EAST HICKMAN
WAUKEE, IA 50263

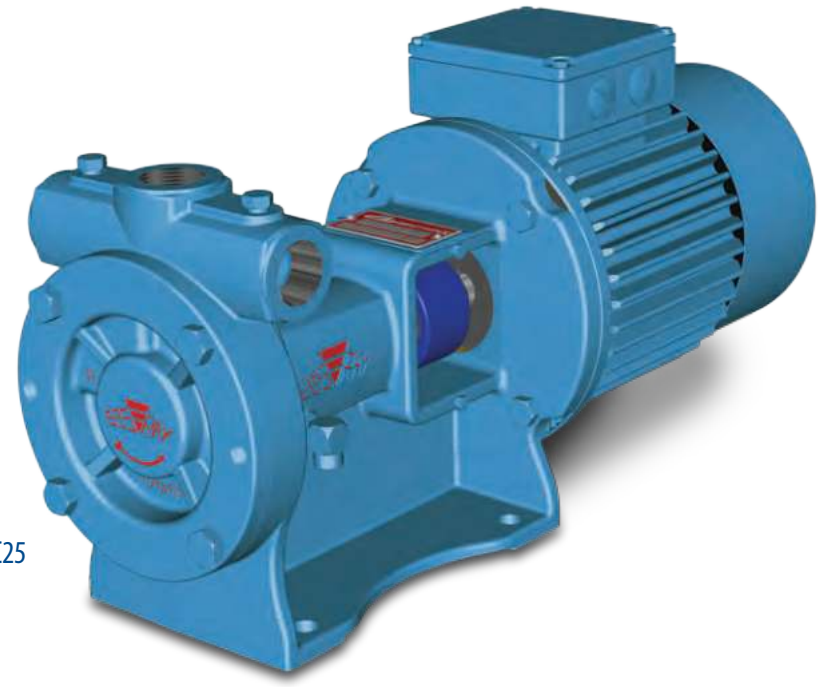
SHEET NUMBER
SK3

PUMP

Spec Sheet 551-001
Section: **551**
Effective: **April 2015**
Replaces: **October 2014**

Ebsray RC Series – Models RC20 & RC25

Regenerative Turbine Pump for LPG Applications



Model RC25

Design

The Ebsray RC Series Regenerative Turbine Pumps are designed and precision-built for high-pressure transfer of LPG, autogas, propane, and butane.

Applications

- LPG Autogas dispensers, single or two hoses (RC25)
- Industrial dispensing
- Autogas refueling
- Marine dispensing
- Portable tanks
- Cylinder filling
- Forklift refueling
- Direct burner or vaporizer feed

Features & Benefits

- Quiet, vibration-free operation
- Low maintenance, single-stage impeller
- Close coupled to standard NEMA C-face motors. IEC C-face adapters available.
- Simple installation with C-face close coupled mounting
- Versatile 3-port arrangement, self-venting design
- Bypass valve connection port direct on pump
- Balanced mechanical seal, unique cartridge design for simplicity of assembly/maintenance
- Throttle bushing for secondary sealing

Assured Quality & Performance

ISO 9001 Quality System assures compliance with the high safety and quality standards demanded by the LPG industry

Pumps are listed by Underwriters Laboratories for LP-gas service.

Ebsray RC Series – Models RC20 & RC25

Regenerative Turbine Pump for LPG Applications

Maximum Operating Limits

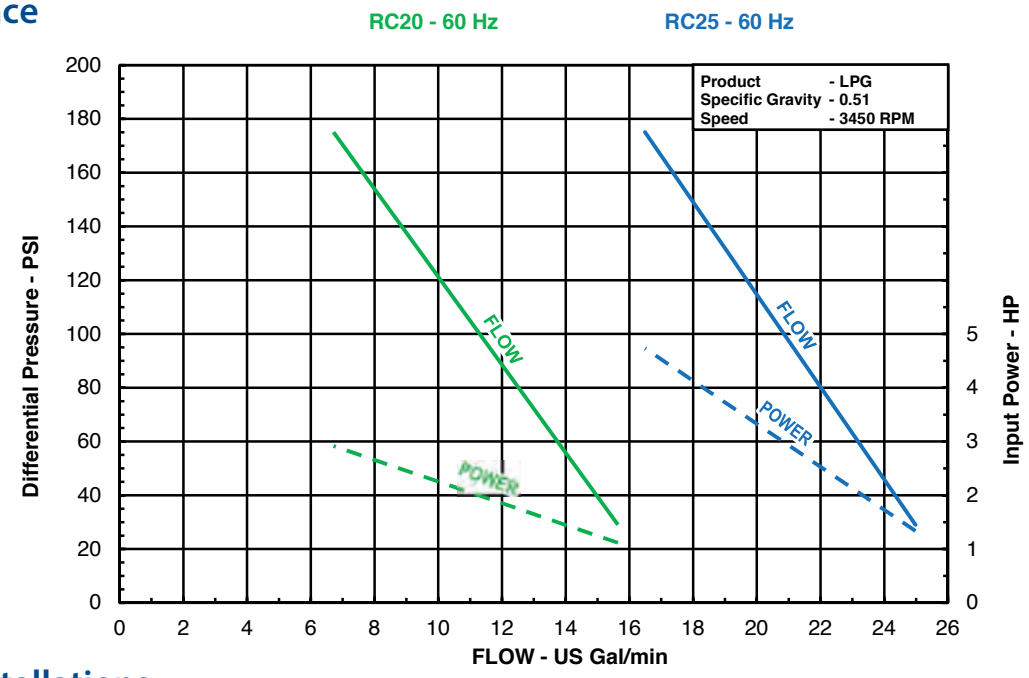
Pump Model	Flow Rate (at 3,500 rpm)		Differential Pressure (at 3,500 rpm)		Hydrostatic Test Pressure		Power		Pump Speed	Weight	
	gpm	L/min	psi	bar	psi	bar	HP	kW	rpm	lbs	kg
RC20	15	58	175	12	1,015	70	2.9	2.2	3,500	43	19.5
RC25	25	94	175	12	1,015	70	4.8	3.6	3,500	43	19.5

Porting:

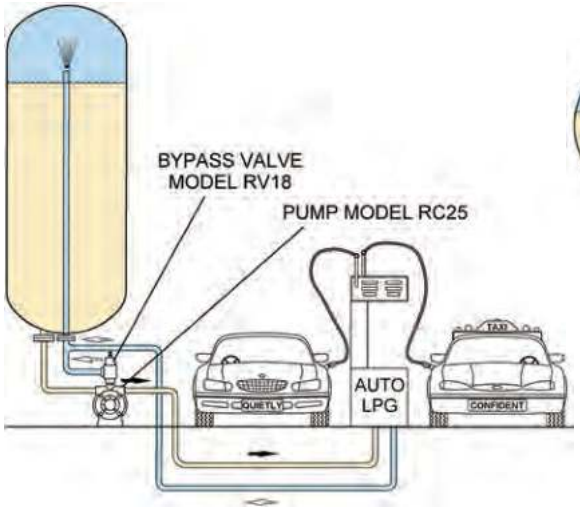
Inlet: NPT 1" 90˚ and/or 180˚

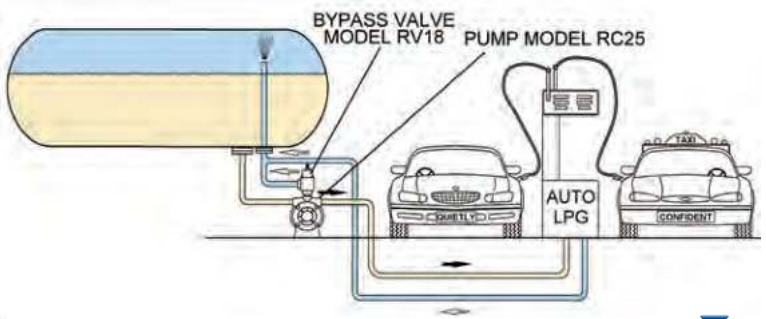
Discharge: NPT 1" 90˚ and/or 180˚

Performance



Typical Installations





Blackmer®

PSG® a DOVER company

551-001

Blackmer®

Spec Sheet 551-007
Section: **551**
Effective: **April 2015**
Replaces: **October 2014**

Ebsray RV Series – Model RV18

Bypass Valve for LPG Applications

Model RV18

Design

In-line design Bypass/Pressure Relief Valves are used for a wide variety of LPG services. Adjustable differential pressure is attained for accurate and repeatable performance in return-to-tank or bypass systems. This enables full pump flow while maintaining controlled preset maximum pressure.

Features & Benefits

- CBS – Constant Bleed System
- Chatter-free quiet operation
- 90º porting arrangement
- 1" NPT tapped ports. 1" ANSI 300 flanged option.
- Adjustable pressure setting
- Low pressure rise
- VRS – Vapor Removal System

Assured Quality & Performance

ISO9001 Quality System assures compliance with the high safety and quality standards demanded by the LPG industry

Pumps are listed by Underwriters Laboratories for LP-gas service.

Ebsray RV Series – Model RV18
Bypass Valve for LPG Applications

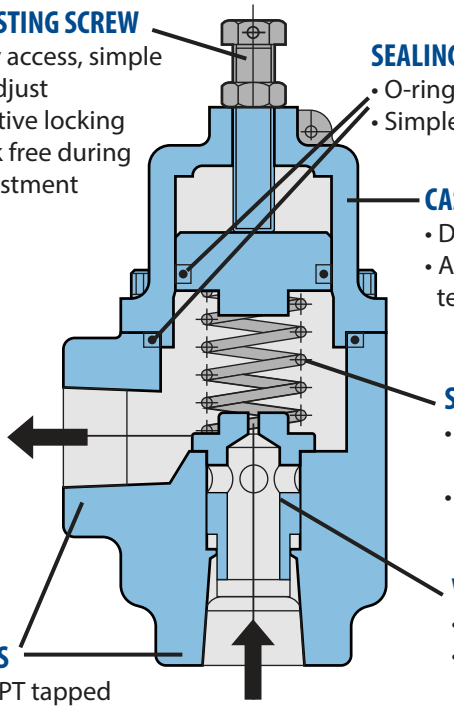
Maximum Operating Limits

Pump Model	Flow Rate		Differential Pressure		Hydrostatic Test Pressure	
	gpm	L/min	psi	bar	psi	bar
RV18	52	200	203	14	1,015	70

Porting:
1" NPT tapped

1 Downstream system resistance will affect differential pressure.
2 Spring selection to suit required pressure range.
3 Pressure rise is dependent upon flow through Bypass Valve

NOTE: All specifications and illustrations are typical only and subject to revision without notice. Certified data available upon request.



ADJUSTING SCREW
- Easy access, simple to adjust
- Positive locking
- Leak free during adjustment

SEALING
- O-ring
- Simple to service

CASING
- Ductile iron to ASTM A395
- Assembled valve hydrostatically tested to 1,015 psi (70 bar)

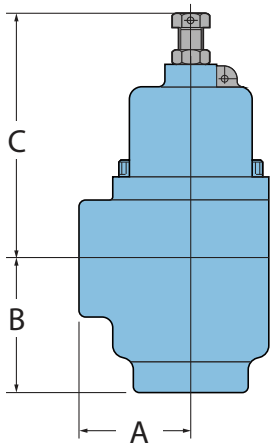
SPRING
- Adjustable within spring pressure range [1,2]
- High quality spring steel

VALVE
- Spool type quiet operation
- CBS (Constant Bleed System) *Standard (optional VRS)*

PORTS
- 1" NPT tapped
- Ease of installation service

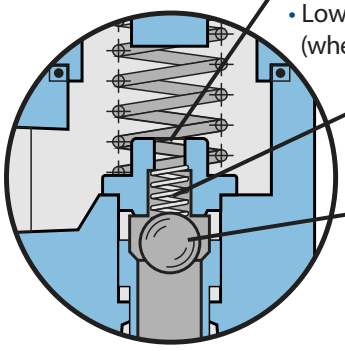
Dimensions

Pump Model		A	B	C	Ports	Weight
RV18	in	2.17	2.6	5.3	1" NPT Tapped	13.9 lbs
	mm	55	66	135		6.3 kg



Optional
Integral "excess flow" type VRS. (Vapor Removal System)

- Rapid Vapor Clearing
- Efficiency – after vapor clearing is completed "excess flow" valve closes fully. This ensures full pump outlet is available at discharge point.
- Interchangeable with standard Spool Valve. (CBS)



VAPOR PATH
- Low Resistance (when in priming mode)

SPRING
- Stainless steel

BALL
- Non-metallic for quiet actuation and positive sealing

PSG a DOVER company

551-007

Blackmer

MOTOR / ELECTRIC

This document is to serve as a guideline to assist in the installation, startup, and troubleshooting of the following pump and motor units – LGL1.25, LGL1.5 and LGL150 Series pumps. Only qualified personnel trained in the safe installation and operation of the equipment should install the unit. When connecting a unit to power please follow NEC (National Electric Code) and any other (country specific) local electrical codes that may apply during installation. Please verify all electrical information prior to startup of unit. This document is not intended to be used as a reference or authority for design, construction, or application of electrical systems.

Motor Wire Sizing:

Figure 1 contains a table of motor sizes and the respective recommended wire size depending upon the distance between the source and the load. As the distance increases from the source to the load, the voltage drops, caused by the resistance and reactance of a particular size of the wire. The wire must be sized properly to allow for this voltage drop to remain within an acceptable range. This is especially important for single phase motor applications. The following guidelines are minimums.

Recommended Motor Wiring						
Motor				Recommended Wire Size, AWG		
HP	Motor Phase	Voltage	Full Load Amperes	Length of Run in Feet		
				0-100	To 200	To 300
3	1	120	42.5	4	2	1/0
		240	21.25	10	8	6
	3	240	12	12	12	10
		480	6	12	12	12
5	1	120	70	3	1/0	2/0
		240	35	8	6	4
	3	240	19	12	10	8
		480	9.5	12	12	12
7.5	3	240	27.5	10	8	6
		480	13.75	12	12	12

***Figure 1**: Recommended Motor Wiring**

* Information collected from standard voltage drop calculator, with a 3% allowable decrease in voltage drop or less using standard conditions. For conditions other than listed, consult NEC handbook, local standards, or engineering handbook. Wire sizes are expressed in AWG (American Wire Gauge). For other distances consult the Blackmer factory.

Phased Power:

It is recommended to use three phase power where applicable. The three phase motor is a simpler design, more efficient by design, and also less costly than the single phase motor. The three phase motor allows for a higher starting torque, smoother operation, and allows the use of a smaller wire size over greater distances. Single phase power can be converted to three phase power by using a phase converter, which is readily available and inexpensive.

System Design:

Systems shall be designed according to NFPA standards and local codes. It is recommended that a Blackmer manufactured bypass valve be used in the system as they are designed to allow the optimum system performance and stability. Below is a list of informational bulletins that also guide installation of a Blackmer pump and bypass valve.

Application Bulletin 500-001: Liquefied Gas Handbook

Installation, Operation, and Maintenance 501-K00: LGL150 Series Pumps

Installation, Operation, and Maintenance 501-B00: LGL1.25 & LGL1.5 Series Pumps

Installation, Operation, and Maintenance 505-A01, A02, A03: Bypass Valves

SIEMENS

NEMA Motor Data

Ordering data : **1MB2221-1CB11-4AA3**

Client order no. :
Order no. :
Offer no. :
Remarks :

Item no. :
Consignment no. :
Project :

Nameplate Data

Type	XP100 ID1 - Class I, Group D, Division 1		
HP	3.0	Rating	Cont.
Voltage	(14) 208-230/460V STD	Ins. Class	Insulation class F
Amps	8.0 / 4.0 A	S.F.	1.15
FL RPM	1760	Amb. Temp.	55 deg C
FL Efficiency	89.5 %	Temp. Rise	Class B
FRAME	182T	kVA Code	K
DE AFBMA	30BC02JPP30	NEMA Des	B
ODE AFBMA	30BC02JPP30	Mtr WT	120
60 Hertz	3 Ph TEFC	IP	65

Mounting and motor protection

Type of construction	(A) Foot mounted - End shield
Motor protection	(A) No winding protection
Terminal box design	(3) Mounting - F-1

Bearing Data

	DE	ODE
Bearing Size	6206 ZZ C3 S0	6206 ZZ C3 S0
Bearing Type	Ball Bearing	Ball Bearing
AFBMA	30BC02JPP30	30BC02JPP30

Typical Performance Data

Load	No Load	1/2	3/4	Full Load	LRC
Efficiency		87.8 %	89.4 %	89.5 %	
Power Factor		59.5	71.7	78.5	
Current (A)	2.1 A	2.7 A	3.3 A	8.0 / 4.0 A	33.0 A

Inverter Duty	VT	20:1	CT	4:1

Mechanical Data

SAFE STALL TIME	HOT (s)	17	COLD (s)	29	
Rtr wt (lbs)	23.7	Rtr WK2	0.3000		
FLT (ft-lbs)	9.0	LRT	21.0	BDT	32.0
Ext Load Inertia (WK2) Capability			17.0		

Typical Noise Data

A-weighted Sound	Octave Band Center Frequencies Hertz (Hz)									
Pressure Level	63	125	250	500	1000	2000	4000	8000	SPL	63
at 3 feet		33	51	54	60	58	48	39	SPwrL	72

Wiring Connection Information

Description 3 PHASE - 9 LEAD - WYE

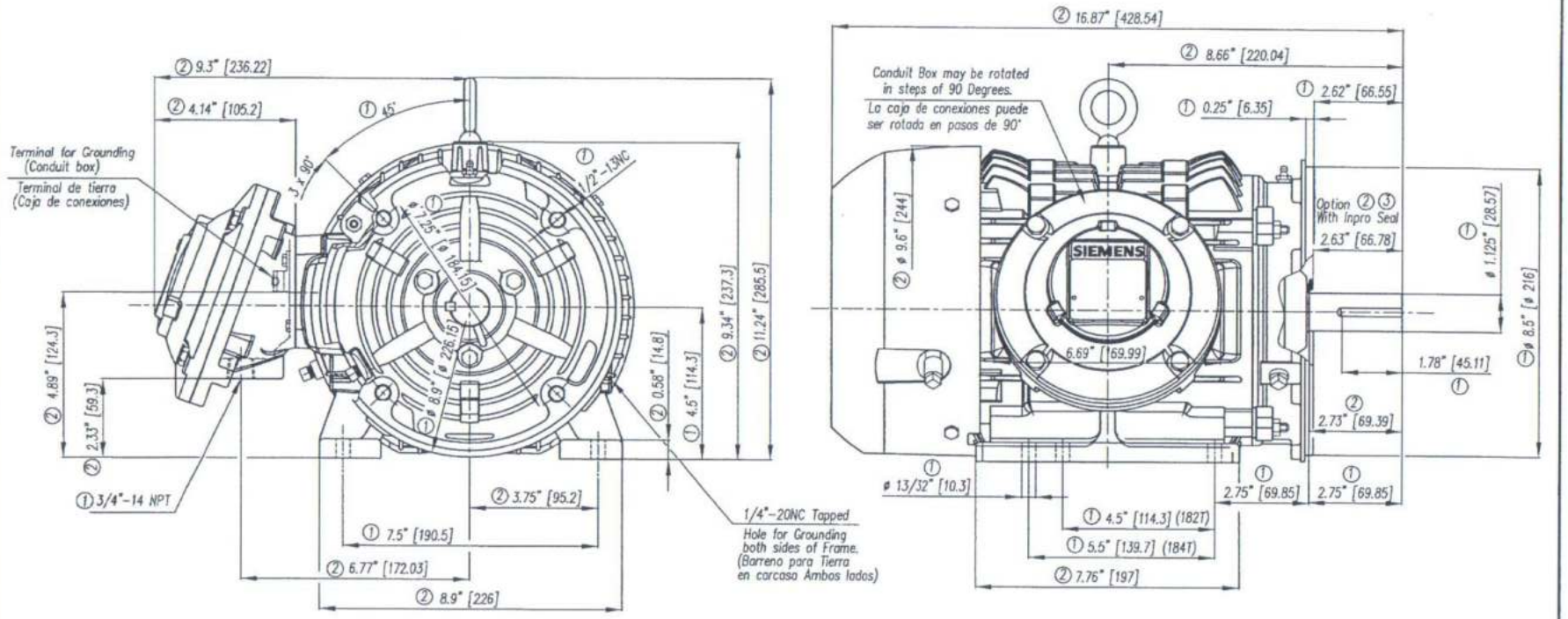
Voltage	L1	L2	L3	Connected together	
LOW	T1 T7	T2 T8	T3 T9	T4 T5 T6	Y Y
HIGH	T1	T2	T3	T4 T7-T5 T8-T6 T9	Y

Special design :

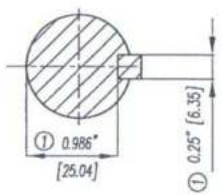
Lubrication Information

Manufacturer	Mobil Polyrex EM or equal
Type	Polyurea (standard)
DE Capacity (oz.)	0.20
ODEnd Capacity (oz.)	0.20

Relubricate bearings every six months (more frequent if conditions require). See Instruction Manual.



① Tolerances According to NEMA Std.	① Tolerancias acorde a NEMA Std.
② All these dimensions corresponding to assemblies and castings shall have a tolerance as per DIN standard 1686-GTB 19.	② Todas estas dimensiones correspondientes a ensambles y fundición en bruto tendrán una tolerancia según DIN 1686-GTB-19
③ Not According to NEMA Std.	③ No Acorde a NEMA Std.



Keyseat detail
Detalle Cuñero

CERTIFIED PRINT/CERTIFICACION

CUSTOMER/CLIENTE						
PO#/ORDEN COMPRA		SO#/ORDEN CLIENTE#				
HP	RPM	FRAME/CARC.	TYPE/TIPO	VOLTS	PHASES	HZ

② Tol. in mm. acc. to/Tol. en mm. segun DIN-1686-GTB-19

Over/desde	to/hasta	
---	18	± 4.5
18	30	± 4.7
30	50	± 5
50	80	± 5.5
80	120	± 6
120	180	± 6.5
180	250	± 7
250	315	± 7.5
315	400	± 8
400	500	± 8.5
500	630	± 9.5
630	800	± 10

European Projection/ Proyeccion Europea

Modific.

Dim. in inches/Dim. en pulg.

	Date/Fecha	Name/Nombre
Drawn/Elab.	16/06/10	F. LOMELI
Check/Rev.	09/08/10	A. Real
Std.Ckd./Aut		

Outline/Dimensiones

Hazardous Duty Division 1

Type/ Tipo: Class I, Group D & C, Class II Group F & G, XP100 Motor 182/184TC Frame/Arm. (F1)

Scale/ Escala: ---

SIEMENS
GUADALAJARA FACTORY
FABRICA GUADALAJARA

3MSE 211 0559

Ref.

Rep./ Sdo.

-/-

F260/1-0310

File E120739
Project 09NK16907

January 24, 2011

REPORT

on

Motors for Use in Hazardous Locations

Siemens S A De C V
Guadalajara, Mexico

DESCRIPTION

PRODUCT COVERED:

USL, CNL XP100 Series Electric motors for use in Hazardous Locations, Class I, Groups C and D; Class II, Groups E, F, and G, Frame sizes 143, 145, 182, 184, 213, 215.

USL, CNL XP100 ID1 Series Electric motors for use in Hazardous Locations, Class I, Group D, Frame sizes 143, 145, 182, 184, 213, 215.

Motors are followed by suffixes T, TC, or TZ which denote length of shaft or length of shaft and flange design, respectively.

GENERAL:

These motors are squirrel cage TEFC electric motors for use in hazardous locations. The XP100 ID1 Series motors are identical to the XP100 Series motors except that they are provided without temperature limiting devices. Ratings and Markings differences are detailed in the description below.

RATINGS:

Maximum Horsepower	See Table 1 below
Maximum rpm	3600
Number of poles	2, 4, 6, 8
Service Factor	1.0 and 1.15 on sinusoidal power 1.0 on inverter power
Duty Rating	Continuous
Insulation Class	When marked Class F on nameplate, lead wires are Class F and the remaining components are Class H When marked Class H on nameplate, all components are Class H
Temperature Rise By Resistance	80°C by resistance
Ambient Temperature Rating	XP100 Series - 40°C XP100 ID1 Series - 60°C Maximum
Operating Temperature or Operating Temperature Code (External Surfaces)	T3C when motor has temperature limiting devices installed T2A when motor has no temperature limiting devices
Maximum Voltage Rating	600

EFS Non–Sealed Tumbler Switches

Explosionproof, Dust-Ignitionproof

Malleable Iron Body and Cover. Furnished with Internal Ground Screw.

Class I, Division 1 and 2, Groups C, D
Class II, Division 1 and 2, Groups E, F, G
Class III
NEMA 7CD, 9EFG

Applications

- Designed to prevent arcing of enclosed switches in ignitable atmospheres during connect and disconnect operation of lighting and light power loads.
- For use in classified areas where ignitable vapors, gases or highly combustible dusts are present.
- For installation in:
  - Chemical plants
  - Petrochemical plants
  - Refineries
  - Other process industries

Features

- Enclosures have external mounting lugs for ease of mounting.
- Smooth, rounded integral bushing in each hub protects conductor insulation.
- Enclosures furnished with internal ground screw.
- 20 Amp and 30 Amp units available for use with 120-277 Vac.
- Smooth ground mating surfaces assure flame-tight joint between cover and mounting enclosure.
- Stainless steel hex head cap screws for attaching cover to mounting enclosure.
- Choice of front-operating or side rocker arm handle—each may be locked in ON or OFF position.
- Each handle has close-tolerance threaded stainless steel shaft to meet explosionproof requirements.
- Enclosures furnished with internal ground screw.

Options

- 1- or 2-gang copperfree (4/10 of 1% max.) aluminum bodies and covers available. Add suffix – **A**.
- **NPBRKT** nameplate mounting bracket to make circuit description/identification easy.
  - Pre-drilled holes in bottom of bracket allow direct mounting to control stations with existing cover bolts.
  - Pre-drilled holes in middle of bracket allow mounting of customer's circuit identification nameplate; epoxy glue may also be used for mounting (phenolic nameplate not included).
  - Bracket eliminates costly field installation of drilling and tapping to accommodate circuit identification nameplate.
  - Brackets fit side-by-side on 2-, 3- and 4-gang boxes and 3-devices.

Standard Materials

- Body and cover: malleable iron
- Handle: nylon 6/6
- Optional nameplate mounting bracket: corrosion resistant stainless steel

Standard Finishes

- Tumbler switch body: triple-coat—(1) zinc electroplate, (2) chromate, and (3) epoxy powder coat

Certifications and Compliances

- UL Standards: UL 894, UL 1203
- UL Listed: E10523, E81751

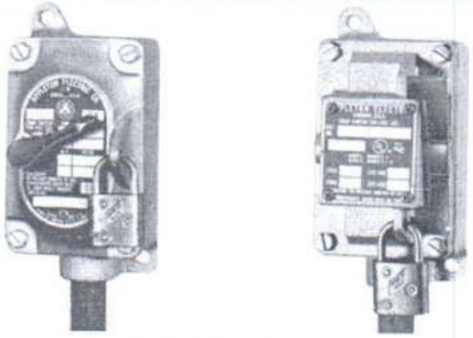
Ordering Information for "Custom" Units

- Devices, covers and bodies may be ordered separately so that a different EFS switch may be used in each gang.
- Order components separately as follows:
  (1) select body catalog number,
  (2) select cover catalog number, and
  (3) select switch or switch assembly catalog number (1-pole, 2-pole, 3-way or 4-way available in listings).

Front Operated

Rocker Arm Operated

Illustrated Features



Handles may be locked in ON or OFF position

How to Order Hub Arrangements

- Simply send sketch indicating sizes and locations for brazed hubs on body or bodies selected from catalog listings. Orient sketch so that cover opening faces front and mounting lugs face upward and downward (box wall opposite cover should be referred to as the *back* of box).

Bodies and Hubs Available

- Tumbler switches may be ordered in single thru five gang deep malleable iron blank bodies with brazed hubs as specified at any location.
- Tumbler switches may be ordered with tandem malleable iron boxes with additional brazed hubs as specified.
- Standard malleable iron single and 2-gang tumbler switches may be ordered with additional brazed hubs as specified.
- Single and 2-gang tumbler switches may be ordered with aluminum boxes with additional brazed hubs as specified.

Related Products

- For classified-location push button, pilot light and selector switch control stations, see *Explosionproof Control Stations Section*.

TS-510
Rev. B
Mechanical Flowmeter Transmitters
Digital: Models VR and VRHR

ACTARIS
metering systems

neptune

ELECTRONIC DIGITAL PULSE TRANSMITTERS FOR MECHANICAL FLOWMETERS

DIGITAL TRANSMITTERS

Digital transmitters produce signals that exist only in one of two states: ON or OFF. These states may also be referred to as HIGH or LOW, or 1 or 0 (zero).

MODEL VR7697 (Models 35 & 45)
This economical and versatile bidirectional digital pulse transmitter provides 10 pulses per revolution with excitation power of 115-250 VAC or 12-36 VDC, making it compatible with most remote read-out equipment.

MODEL VR7671 (HR) (Models 35 HR & 45 HR)
This solid state Hall Effect digital pulse transmitter provides 100 pulses per revolution. Note that input (excitation) power is limited to 10-15 VDC.

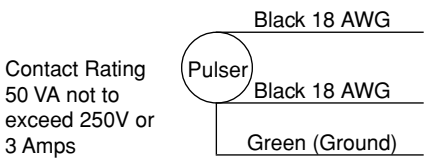
NEPTUNE DIGITAL PULSE ELECTRONIC TRANSMITTER DATA

Model No.	Type Of Device	Contact	Pulses per Revolution	Max Speed: Hz (RPM) (2)	Contact Rating (2)	Enclosure Rating	Input Voltage	Remarks
VR7697	Dry Reed Bi-directional	SP/ST	10	50 (300)	50 VA resistive (not to exceed 250v or 3 amp)	U.L., CSA X-proof Class I, Div 1 Groups C&D	110 & 250 VAC 12-36 VDC	Models 35 and 45
VR7671 (HR)	Hall Effect Uni-directional	Solid State	100	1000 (600)	.75 VA max. non-inductive (not to exceed 15VDC or .05A)	U.L., CSA X-proof Class 1, Div. 1 Groups C&D	10-15 VDC	Models 35 HR and 45 HR

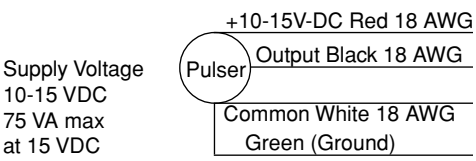
Notes:
(1) All above units are compatible with Batchmate 1500 Solid State Controller (see TS 500)
(2) a. Max speed in pulses per revolution, Hz, and RPM limits from Manufacturers' data

WIRING DIAGRAMS

Model VR7697
(35 & 45)



Model VR7671 (HR)
(35 HR & 45 HR)

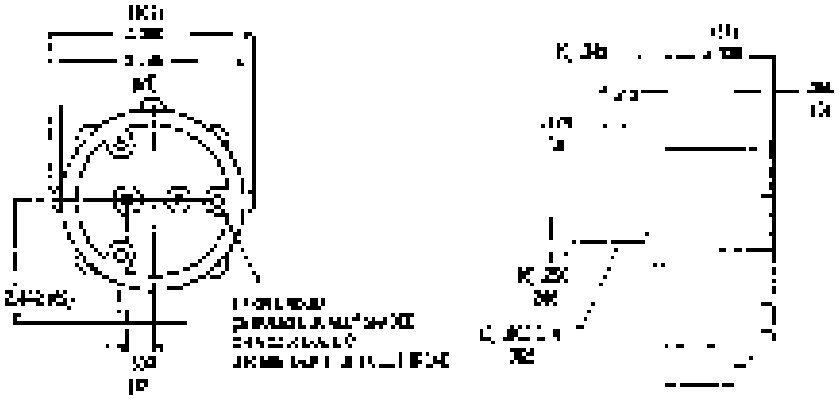


NEPTUNE ELECTRONIC TRANSMITTER Operating and Storage Temperature Data

Model No. Environment		VR7697 (35 & 45)	VR 7671 (HR) (35 HR & 45 HR)
Operating	**°C**	-40 to +71	-40 to +82
	°F	**-40 to +160**	**-40 to +180**
Storage	**°C**		-55 to +125
	°F		**-67 to +257**

DIMENSIONS in (mm)

Model VR7697 & VR7671 (HR)
(35 & 45) (35 HR & 45 HR)



CURRENT SOURCING -vs- CURRENT SINKING

Current Sourcing: sensor supplies the voltage to the count input. Sourcing sensors are PNP transistor outputs or a contact closure to V+.

Current Sinking: sensor provides a path to DC common for the count input. Sinking sensors are NPN transistor outputs or a contact closure to DC common.

Compatibility: Both sourcing and sinking digital pulse transmitters offered by Neptune are fully compatible with the Neptune BATCHMATE 1500™ electronic batch controllers, which can be set by DIP switches in the device at the factory or in the field to match the transmitter.

ISO 9001: 2000
TÜV CERT
Certificate Reg. No. 74 100 2708

U.S.A./International
1310 Emerald Road
Greenwood, SC 29646-9558
Tel.: Toll-Free (800) 833-3357
(864) 223-1212
Fax: (864) 223-0341

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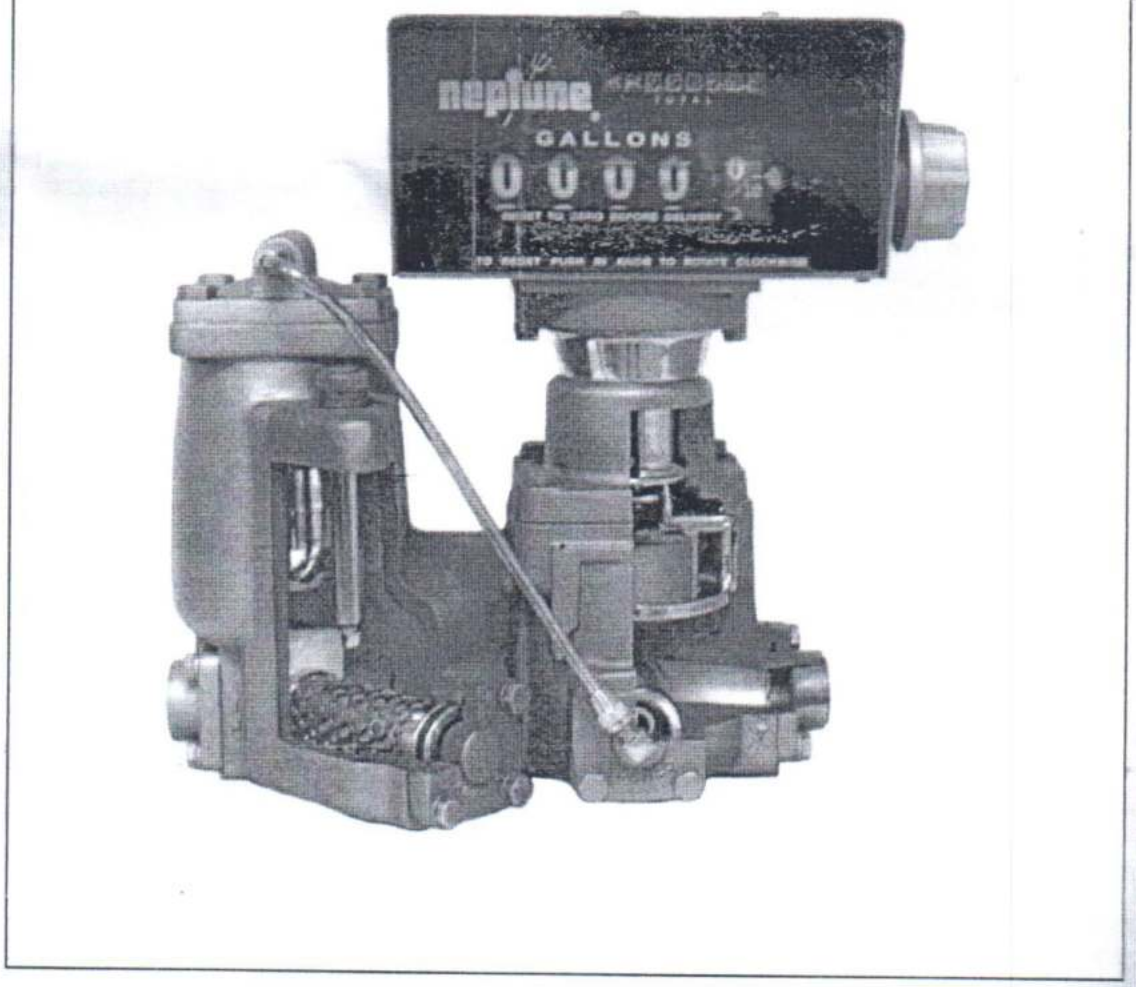
METER

M-285
Rev. H
P.D. Oscillating Piston Flowmeter
1" 4D-MD LP Gas

RED SEAL
MEASUREMENT

Operating and Maintenance Manual LPG



GENERAL INFORMATION

GENERAL INFORMATION

This manual covers the installation and maintenance of the Type 4D-MD LP-Gas Compact Flowmeter (Figure 1) which includes a Strainer, Vapor Release, Differential Valve and Automatic Temperature Compensator.

The housing and pressure components of the 4D-MD are constructed of A356 aluminum with T6 heat treatment. Nominal line connections of 3/4" and 1" (ductile iron connections) are available. The meter is fully rated to 350 psi and has been approved by UL.

The strainer, housed in the Vapor Release at the intake of the flowmeter, is of a fine (either an 80-84 mesh or special 30 micron) mesh double sleeve construction with O-rings for positive sealing. It is accessible by removing the strainer cover.

The Vapor Release, which prevents entrapped vapor from passing through the flowmeter, has a float-operated valve. When vapor collects in the Vapor Release, the valve opens venting vapor to the supply tank establishing pump pressure to close the Differential Valve. The vapor release employs a sleeve-type valve that permits a constant "leak" flow of approximately 0.2 gpm from the vapor vent back to the supply tank.

The Differential Valve is piston, plug type construction and opens when at least 15-psi pump pressure is established. This valve serves three functions to assure system measurement accuracy by requiring: (1) pump operation for delivery, (2) adequate back pressure to prevent product vaporization during measurement, and (3) blockage of flow when the Vapor Release valve opens.

The type 4D-MD is available with outlet/inlet flanges of 3/4" and 1" diameters to permit connection to varying pipe dimensions. Please refer to the current price list or your RSM distributor for additional information.

The optional temperature compensator, by sensing product temperature, controls the readout drive ratio to provide a registration compensated by 15°C (60°F).

The Type 4D-MD is available with a choice of 600 or 800 Series mechanical resettable totalizing registers. Pulse output is also optionally available.

The recommended temperature range for operation of the 4D-MD is -23° to 60°C (-10° to 140°F) or -23°C to 52°C (-10° to 125°F) for automatic temperature compensator equipped meter.

INSTALLATION

INSTALLATION

Before Installing the Flowmeter

1. Plan the installation for maximum rate of delivery, sizing the supply tank outlet, piping and valve for free gravity flow to the pump suction. To accomplish this, locate the pump as close as possible to the supply tank and use short inlet connections with few restrictions. Keep the number of elbows to a minimum, and use large radius elbows, wherever possible. To further reduce the likelihood of causing vapor in the pump suction line, install a pump bypass valve in a return line to the supply tank as shown in the installation drawing. (See Figure 2).
2. Locate the flowmeter at any convenient place in the pump discharge line. If the flowmeter is to be operated under extremes of environment (dirt, water, physical damage, etc.), an enclosure or other protection should be provided. Allow sufficient clearances for removal of the register, strainer and vapor release as shown in Figure 14. **Do not install any bypass around the flowmeter**; the valve in such a line might eventually leak, work open, or be left open causing improper measurement.

To conform with Weights and Measures requirements, install flowmeter so that the **flowmeter** nameplate is visible.

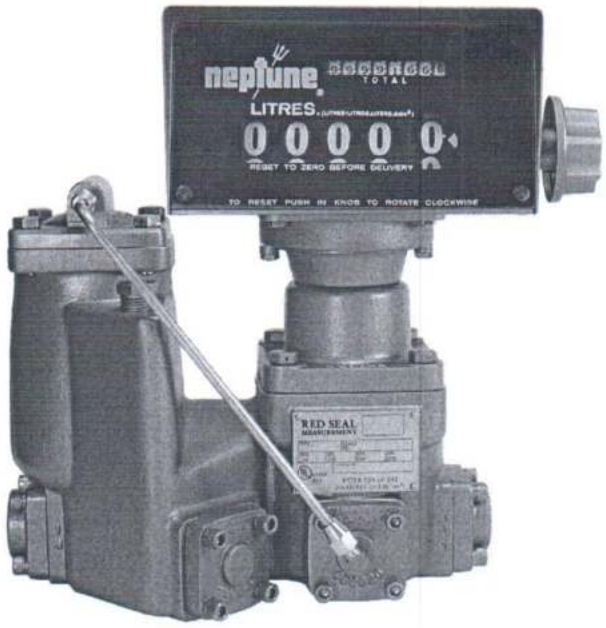
NOTE

All piping on the inlet side of the flowmeter should be very thoroughly cleaned out. Flush out all lines thoroughly before installing the flowmeter.

While the installation is still new, the strainer should be cleaned once per month minimally for the first three (3) months. After the system has been thoroughly flushed of foreign material, only periodic (minimum annually) cleaning is recommended.

The majority of service calls on new installations would be eliminated if these directions were followed.

TYPE 4D-MD
L.P. GAS FLOWMETER
1" ALUMINUM BODY DISPENSER METER



1" 4D-MD with 600 Series Register

DESCRIPTION

The Red Seal 1" Type 4D-MD meter, with double case design has been specifically designed for the custody transfer of liquefied propane and butane gas (LPG). This meter utilizes the oscillating piston positive displacement measuring chamber technology. The 1" Type 4D-MD is particularly suited for filling portable gas bottled and fuel containers for portable burners, pavement heaters, weed burners, fork lift trucks and motor fuel tanks.

The standard unit includes the base meter with the choice of either a 600 Series totalizing register with a resettable counter or an 800 Series printer register. A differential control valve, combination vapor eliminator/strainer, continuous bleed pressure relief valve and tubing kit are also included. An optional automatic temperature compensator (ATC) is available. The ATC senses product temperature and adjusts the readout to result in registration that is compensated to 15°C (60°F).

DESIGN FEATURES

SUPERIOR ACCURACY

The Neptune designed oscillating piston measuring chamber is both accurate and reliable. The piston is treated with a special coating which protects it from damage by impurities and adds lubricity for smooth performance at low flow and high operating pressures.

FLEXIBILITY

Rugged outer body components in a compact design make the 1" Type 4D-MD useable in a wide variety of installation configurations. The meter is also available with several different register options, and in temperature compensated and uncompensated versions.

UNITS OF MEASURE

Neptune 600 and 800 Series registers offer a full range of options for calibration in U.S. gallons, Litres and Imperial gallons, with 5 digit reset and an 8 digit non-resettable totalizer.

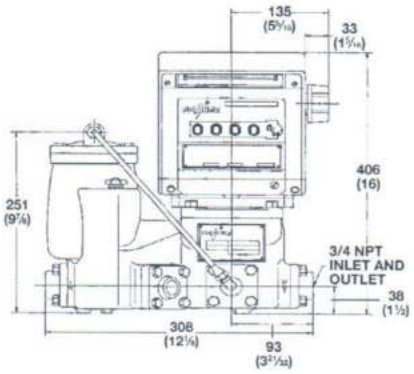
OPERATING SPECIFICATIONS

Flow Rate	**LPM**	**US Gal./Min.**
Maximum	68	18
Minimum	11	3
Operating Pressure	**Bars**	**PSI**
Maximum	24	350
Minimum	See Note	
Operating Temperature (without ATC)	**°C**	**°F**
Maximum	60	140
Minimum	-23	-10
Temperature Compensation (ATC)		
Compensates to a basepoint of 15°C (60°F)		
Range:	-23°C to 52°C (-10°F to 125°F)	
Connections		
Ductile iron companion flange tapped for 3/4" std. pipe		
Optional ductile iron companion flange tapped for 1" std. pipe		

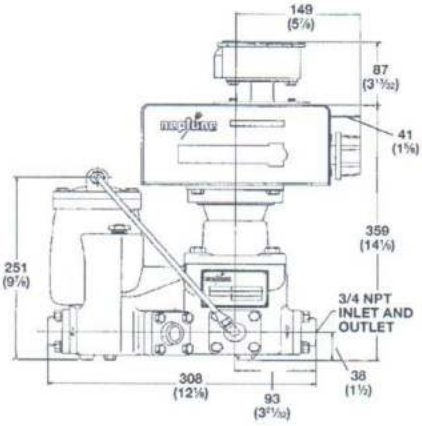
Note: A minimum of 1.034 bars (15 psi) is needed to open the differential control valve, plus pressure loss in the system.

DIMENSIONAL DATA, mm (in.)

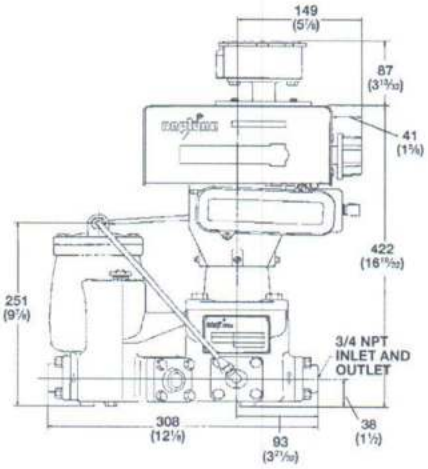
1" 4D-MD with 800 Series Register

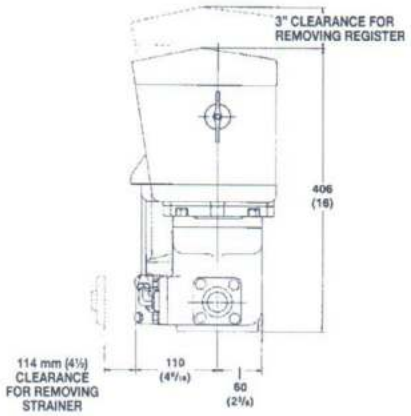


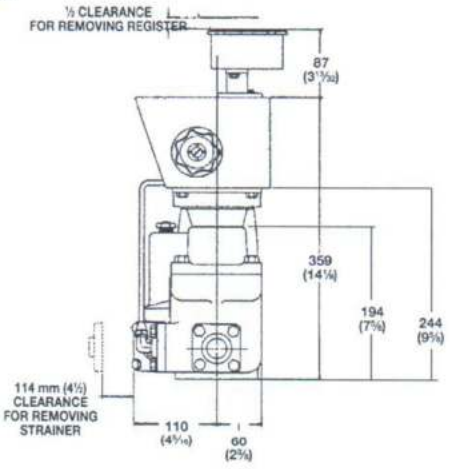
1" 4D-MD with 600 Series Register

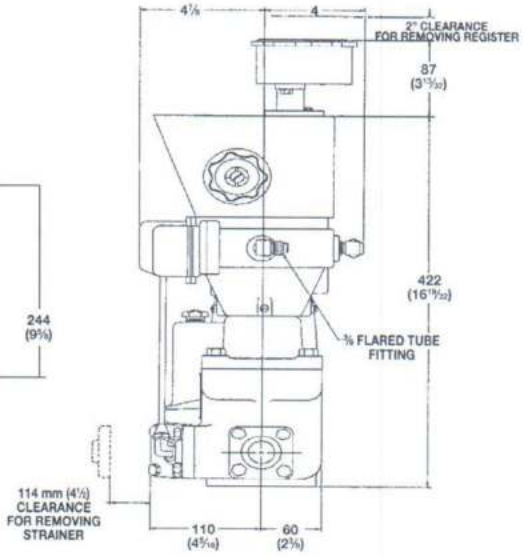


1" 4D-MD with 600 Series Register and ATC

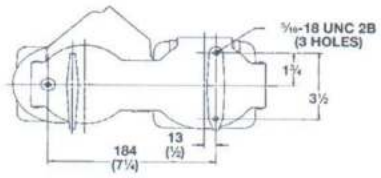








Bottom View All Configurations



Specify Genuine Neptune Replacement Parts

Accuracy of all Neptune Type 4D Custody Transfer Meters for use with L.P. Gas and Butane meets or exceeds N.I.S.T. Handbook 44 Parameters.

1310 Emerald Road
Greenwood, SC 29646
USA
Phone: 1.800.833.3357
Fax: 1.864.223.0341

RED SEAL MEASUREMENT

Certified to ISO 9001:2008


DISCOUNT
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CERTIFICATE

This is to certify that

Engineered Controls International, LLC

100 Rego Drive
Elon, NC 27244
United States of America

with the organizational units/sites as listed in the annex

has implemented and maintains a **Quality Management System**.

Scope:
The design and manufacture of valves, regulators and fittings for the L.P. Gas, Anhydrous Ammonia, LNG, and Compressed Gas Industries.

Through an audit, documented in a report, it was verified that the management system fulfills the requirements of the following standard:

ISO 9001 : 2008

Certificate registration no.	10001523 QM08
Date of original certification	1994-10-04
Date of revision	2013-12-08
Date of certification	2012-12-22
Valid until	2015-12-21

UL DQS Inc.

Ganesh Rao
Managing Director

Annex to Certificate
Registration No. 10001523 QM08

Engineered Controls International, LLC

100 Rego Drive
Elon, NC 27244
United States of America

Location

10003889
Engineered Controls International, LLC
3181 Lear Drive
Burlington, NC 27215
United States of America

10003890
Engineered Controls International, LLC
911 Industrial Drive S.W.
Conover, NC 28613
United States of America

This annex (edition: 2013-12-08) is only valid in connection with the above-mentioned certificate.

LP-Gas Excess Flow Valves

Safety Warnings

Purpose

In its continuing quest for safety, REGO® publishes a series of bulletins explaining the hazards associated with the use, misuse, and aging of LP-Gas valves and regulators. It is hoped that these factual bulletins will make clear to LP-Gas dealer managers and service personnel, that the utmost care and attention must be used in the installation, inspection, and maintenance of these products, or problems could occur which would result in injuries and property damage.

The National Fire Protection Association NFPA 58 Liquified Petroleum Gas Code - 2014 Edition states in Section 4 Qualification of Personnel; "Persons whose duties fall within the scope of this code shall be provided with training that is consistent with the scope of their job activities and that includes proper handling and emergency response procedures... Refresher training shall be provided at least every 3 years, initial and subsequent training shall be documented". These "RegO® Safety Warnings" may be useful in training new employees and reminding older employees of hazards that can occur. It is recommended that all employees complete the Propane Education Research Council's Certified Employee Training Program.

Nature of Warnings

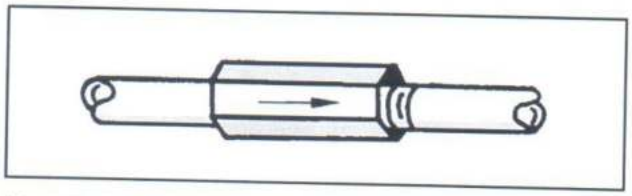
It is recognized that warnings should be as brief as possible, but the factors involved in excess flow valve failures to perform are not simple. They need to be fully understood. If there is a simple warning, it would be:

Make sure that the excess flow valve really closes when the flow exceeds normal transfer flow.

This bulletin is not intended to be an exhaustive treatment of excess flow valves, and certainly does not cover all safety practices that should be followed in installation, operation and maintenance of LP-Gas systems which include excess flow valves.

Selection and Installation

The selection of a given closing rating of an excess flow valve involves an analysis of the complete piping system and is beyond the scope of this bulletin.



It is sufficient to say that an excess flow valve must be installed in the correct direction and will close only if the flow of liquid or vapor exceeds its designed closing rating. Many valves have been installed with closing ratings considerably higher than any flow that could be obtained by a downstream rupture in piping or hoses and thus give none of the protection for which they are intended.

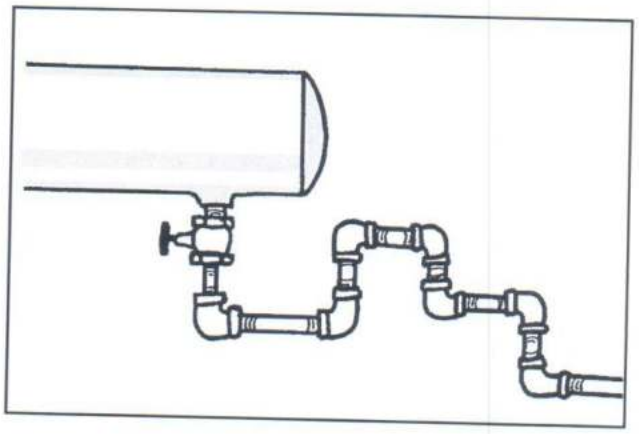
REGO® provides excess flow valves with a number of closing ratings. REGO® obviously can take no responsibility for the proper selection or correct installation of any valve.

Excess flow valves do not provide complete shut-off because there is a bleed at the check to permit pressure equalization.

Causes of Failure to Close

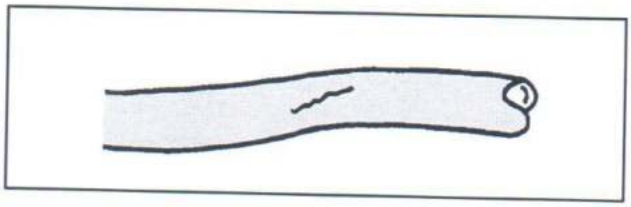
Installers, LP-Gas plant managers and service personnel should be aware that the excess flow valves may not close if these conditions are present.

1. The piping system restrictions (due to pipe length, branches, reduction in pipe size or number of other valves) decrease the flow rate to less than the valve's closing flow.

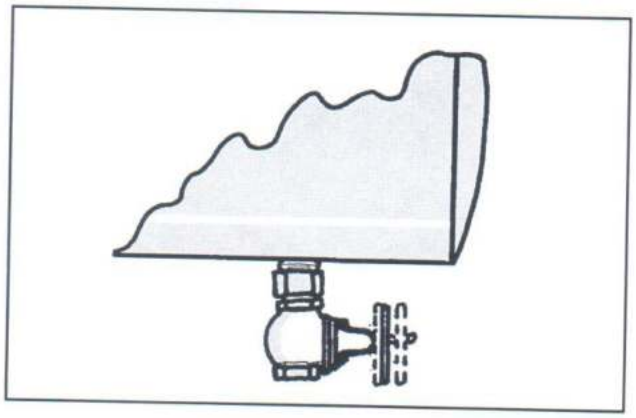


100 RegO Dr. P.O. Box 247 Elon, NC 27244 USA www.regoproducts.com Phone (336) 449-7707 Fax (336) 449-6594

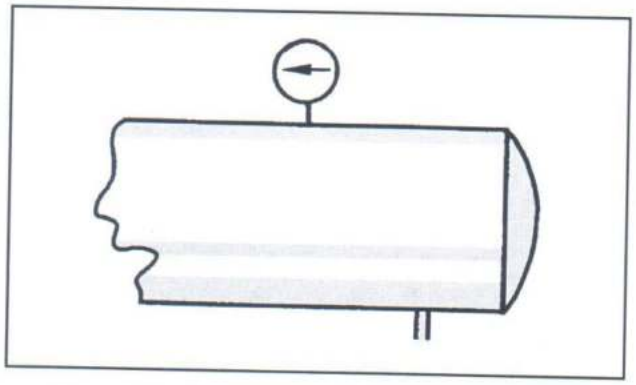
2. The break or damage to the downstream line is not large enough to allow enough flow to close the valve.



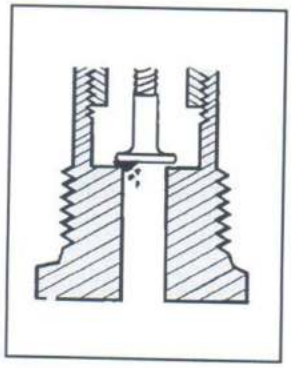
3. A shut-off valve in the line is only partially open and will not allow enough flow to close the excess flow valve.



4. LP-Gas pressure upstream of the excess flow valve, particularly due to low temperature, is not high enough to produce a closing flow rate.



5. Foreign matter (such as welding slag, scale or sludge) is lodged in the valve and prevents closing.



Because of these limitations, it is good industry practice to NOT rely entirely on excess flow valves for protection. Installation of emergency shut-off valves with remote controls is recommended in addition to excess flow valves.

Testing

The National Propane Gas Association Safety Bulletin #113-78 states:

> "In order to test an excess flow valve in a piping system, the flow through the valve must be made to exceed the valve's closing rating. This testing should only be attempted by trained personnel familiar with the process. If no one at the facility has experience in proper testing, outside expert help should be obtained. The exact procedure used may vary with the installation, advisability of gas discharge and availability of equipment.

In general, most testing makes use of the fact that excess flow valves are "surge sensitive" and will close quicker under a sudden flow surge than under steady flow. A sufficient surge can often be created by using a quick open/close valve to control sudden, momentary flow into a tank or piping section containing very low pressure. An audible click from the excess flow valve (and corresponding stoppage of flow) indicates its closure.

> A test involving venting gas to the atmosphere is hazardous and may be impractical, or illegal.

Any test of any excess flow valve will not prove that the valve will close in an emergency situation, due to reasons cited before. This test will only check the valve's condition, and the flow rate sizing for those test conditions."

General Warning

All REGO® products are mechanical devices that will eventually become inoperative due to wear, contaminants, corrosion and aging of components made of materials such as metal and rubber.

The environment and conditions of use will determine the safe service life of these products. Periodic testing at least once a year when tank pressures are low and maintenance, as required, are essential.

Because REGO® products have a long and proven record of quality and service, LP-Gas dealers may forget the hazards that can occur because an excess flow valve is used beyond its safe service life. Life of an excess flow valve is determined by the environment in which it "lives". The LPGas dealer knows better than anyone what this environment is.

NOTE: There is a developing trend in state legislation and in proposed national legislation to make the owners of products responsible for replacing products before they reach the end of their safe useful life. LPGas dealers should be aware of legislation which could effect them.

Excess Flow Valves

General Information
RegO® Excess Flow Valves have been designed, developed, and manufactured for a wide variety of industry needs for more than three decades.

Throughout the years, those concerned with installing and operating bulk plant facilities have looked to RegO® products with confidence for reliable, long-lasting valves as required by the National Fire Protection Association (NFPA) Standards 58 and 59, as well as any state, provincial, and local regulations.

It is a responsibility we have not taken lightly. RegO® products continue to not only assess the most effective designs, but anticipate and meet the industry's changing requirements. Toward that goal, RegO® products include over fifty different types and sizes of excess flow valves (most of which are listed by Underwriters Laboratories) to meet the needs of the LP-Gas and anhydrous ammonia industries.

An Explanation and Warning
An excess flow valve is a spring-loaded check valve which will close only when the flow of fluid through the valve generates sufficient force to overcome the power of the spring holding it open. Each valve has a closing rating in gallons per minute and CFH/air.

The selection of a proper closing rating is critical. It requires a technical understanding of the flow characteristics of the piping system, including restrictions of the piping and other valves and fittings downstream of the excess flow valve.

System designers and operating people must understand why an excess flow valve, which remains open in normal operations, may fail to close when an accident occurs.

Warning: A downstream break in piping or hoses may not result in sufficient flow to close the valve.

How They Work
Excess flow valves permit the flow of liquid or vapor in either direction. This flow is controlled in only one direction (the direction of the arrow stamped on the valve). If the flow in that direction exceeds a predetermined rate (shown in this catalog for each valve), the valve automatically closes.

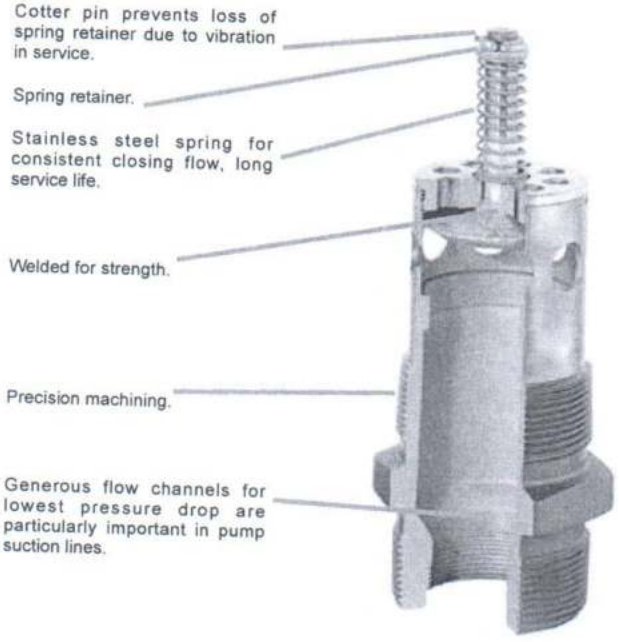
The valve disc is held in the open position by a spring. When the flow creates a pressure drop across the valve disc that overcomes the preset load on the spring, the valve disc moves to the closed position. It remains closed until the force on both sides of the valve disc are approximately equal (a small bleed hole in the disc of each valve permits equalization), then the spring automatically reopens the valve. When a line is completely broken, the pressure cannot equalize and the excess flow valve remains closed until the line is repaired. Because the bleed hole in each valve disc permits equalization of pressure, excess flow valves do not provide a 100 percent type shut-off.

Proper Installation
Since excess flow valves depend on flow in order to close, the line downstream of the excess flow valve should be large enough not to excessively restrict the flow. If the piping is too small, unusually long or restricted by too many elbows, tees and other fittings, consideration should be given to the use of larger size pipe fittings.

An excess flow valve in a pump suction line cannot be expected to close in the case of a clean break in the line beyond the pump, as the pump constitutes too great a restriction, even if running.

Good piping practices dictate the selection of an excess flow valve with a rated closing flow of approximately 50 percent greater than the anticipated normal flow. This is important because valves which have a rated closing flow very close to the normal flow may chatter or slug closed when surges in the line occur during normal operation, or due to the rapid opening of a control valve.

All installations must be in accordance with NFPA Standards 58 and 59, as well as state, provincial and local regulations.



100 RegO Dr. P.O. Box 247 Elon, NC 27244 USA www.regoproducts.com Phone (336) 449-7707 Fax (336) 449-6594

The Limitations of Excess Check Valves for LP-Gas

Excess flow check valves have been of help in limiting gas loss in many incidents involving breakage of hoses and transfer piping. Thus, they do provide a useful safety function in LP-Gas systems. However, there have also been transfer system accidents where excess flow valves have been ineffective in controlling gas loss due to a variety of conditions and to the inherent limitations of these valves. This bulletin explains what protection excess flow valves can offer, points out conditions which can interfere with that protection, and offers suggestions for effective excess flow valve installation.

An excess flow valve is a protective device to help control the discharge of product in the event of complete breakage of pipe lines or hose rupture. However, an excess flow valve can only offer limited protection from gas discharge, because it will only close under those conditions which cause the flow through the valve to exceed its rated closing flow, and even when closed it necessarily allows some "bleed" past the valve.

An excess flow valve is not designed to close and thus may not provide protection, if any of the following conditions are present:

1. The piping system restrictions (due to pipe length, branches, reduction in pipe size, or number of other valves) decrease the flow rate to less than the valve's closing flow. (Valve should be selected by closing flow rating — not just by pipe size).

2. The break or damage to the downstream line is not large enough to allow enough flow to close the valve.

3. A shut-off valve in the line is only partially open and will not allow enough flow to close the excess flow valve.

4. LP-Gas pressure upstream of the excess flow valve, particularly due to low temperature, is not high enough to produce a closing flow rate.

5. Foreign matter (such as welding slag) is lodged in the valve and prevents its closing.

6. A buildup of process material (sludge), which may be found in LPGas, may occur over a period of time and cause the valve to stick open.

7. The piping break or damage occurs upstream of an in-line excess flow valve, so the escaping product is not passing through the valve.

8. The flow through the valve is in the wrong direction. (Excess flow valves only respond to flow in one direction.)

9. The excess flow valve has been damaged, or is otherwise not in operating condition.

Because of these limitations of excess flow valves, they should not be relied upon as the only means of controlling the escape of product in the event of piping damage. When possible, shut-off protection by quick closing valves, with shut-off controls accessible in spite of likely line damage, should be provided in addition to, or instead of excess flow valves.

Where excess flow valves are installed, they should be checked to see that:

1. They are installed in the correct direction — the arrow on the valve indicates the shut-off direction.

2. The flow rating on the valve is proper for the installation. The rating must be above the normal system flow, but not higher than necessary to prevent "nuisance" closing in normal conditions. If the manufacturer's catalog information is not sufficient, the valve suppliers can provide sizing assistance.

3. In-line excess flow valves are installed so likely piping damage will occur downstream of the valve and will not separate the valve from the upstream piping.

When the excess flow valves can be examined separate from the line (before the installation or if removed for system maintenance), they should be checked to see that the parts are in good condition and that the poppet can be pushed fully closed.

Testing of Excess Flow Valves

In order to test an excess flow valve in a piping system, the flow through the valve must be made to exceed the valve's closing rating.
This testing should only be attempted by trained personnel familiar with the process. If no one at the facility has experience in proper testing, outside expert help should be obtained. The exact procedure used may vary with the installation, advisability of gas discharge, and availability of equipment.

In general, most testing makes use of the fact that excess flow valves are "surge sensitive" and will close quicker under a sudden flow surge than under steady flow. A sufficient surge can often be created by using a quick-closing valve to control sudden, momentary flow into a tank or piping section containing very low pressure. An audible click from the excess flow valve (and corresponding stoppage of flow) indicates its closure.

A test involving venting gas to the atmosphere is hazardous and may be impractical, or illegal.

Any test of any excess flow valve will not prove that the valve will close in an emergency situation, due to reasons cited before. This test will only check the valve's condition, and the flow rate sizing for those test conditions.

For additional information on excess flow valves and other means of
shut-off protection, contact REGO® and refer to NFPA 58.

Prepared by
NATIONAL PROPANE GAS ASSOCIATION
The purpose of this bulletin is to set forth general safety practices for the installation, operation, and maintenance of LP-Gas equipment. It is not intended to be an exhaustive treatment of the subject, and should not be interpreted as precluding other procedures which would enhance safe LP-Gas operations. The National Propane Gas Association assumes no liability for reliance on the contents of this bulletin.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Technical Advisory

PRODUCT UPDATE
LP Gas Hose/Assemblies — Permeation

Permeation of high-pressure gas (such as LP Gas/propane, anhydrous ammonia and steam) through a rubber hose is a common but often misunderstood phenomenon. During the manufacturing process, small perforations – sometimes called pinpricks – are applied to the cover of the hose. The perforations allow a path for the gas to safely permeate through the hose wall and into the atmosphere. Without this path, undesirable amounts of gas could accumulate in the hose body, blistering the cover and leading to premature hose failure.

The permeation process is invisible in most circumstances. However, when the hose is moist or sits in water, bubbles may be observed emerging from the pinprick holes in the cover. Or bubbles may be observed slowly escaping from the area where the ferrule attaches to the coupling stem. These emissions may be perceived as leakage.

The most common perceived leakage is the "normal" escape of permeating gas:

- Through the hose wall. The pinprick holes concentrate the permeation to specific areas of the cover. Due to the presence of moisture, this concentration of permeation may be observed as bubbling.
- Through the interface of the ferrule and coupling. In some instances the permeating gas may travel down the reinforcement of the hose and escape from the end of the hose encased by the coupling.

Another common perceived leakage is the escape of air from the hose reinforcement through the hose wall, most commonly noticed during the pressure testing of a hose assembly. During the manufacturing process, air may become trapped in the reinforcement of the hose. During the hose assembly testing process, the trapped air may be squeezed through the pinprick holes in the cover, or from the end of the hose encased by the coupling. In the presence of moisture, the venting air may be apparent as bubbling. The escape of trapped air through the pinprick holes and/or at the coupling should diminish over time, and should disappear after one to four hours of pressurization. Generally, air escaping from the pinprick holes will dissipate much more rapidly than air escaping at the coupling.

The question that remains: *How can one differentiate between a hose that is leaking or excessively permeating LP Gas, a hose that is appropriately permeating LP Gas, and a hose that is venting trapped air?*

When testing a new LP Gas hose assembly, only escaping air can be mistaken for leakage (because propane has not yet entered the hose). Two methods for assuring that the escaping air is not from a leak are:

1) Use water as the test media. A "true" leak will be a water leak and not an air leak.
2) Increase the test time. A test of sufficient duration will allow the escaping air to be purged. Note:
    a. The use of a rubber cement or epoxy to seal the hose end may eliminate air escaping from the stem/ferrule lock-on area of the coupling.
    b. The Parker 7661-LAR coupling in the 1-inch size is designed to prevent gas from escaping from the stem/ferrule lock-on area of the coupling.

When testing a hose in service, it is much more difficult to differentiate between a "true" leak and normal permeation. Generally, leaking propane will create a frosting or icing on the surface of the hose or coupling. On the other hand, permeation is generally at such a low rate that it can be detected only by the slow escape of bubbles. It is important to note that the rate of permeation is dependent on temperature. As the environmental temperature increases so does the rate at which the gas permeates through the hose. Therefore, on hot, rainy days, the likelihood of observing permeation is much higher. If the rate of escaping gas is enough to cause concern, the best way to determine whether a hose is leaking or not is to remove it from service and perform a hydrostatic pressure test.

In the transfer of LP Gas, the allowable permeation rate is controlled by the Underwriters Laboratories Standard UL 21 for LP Gas Hose. Per UL 21, the "Maximum Allowable Permeation Rate" for LP Gas hose is 171 cm^3/ft/hr. Testing of standard Parker LP Gas hose has produced permeation rates which are five times better than the allowed maximum.

If there are any questions please contact Parker Customer Service toll-free at:

866.810.HOSE (4673)
Wickliffe, OH • Eastern USA

800.242.HOSE (4673)
South Gate, CA • Western USA

Nozzles in the GasGuard "GG20" series are designed to reach into, and connect to, deep-seated filler valves, as associated with forklift truck cylinders and RV filler valves in similarly difficult locations. This is possible due to the extended connector on the outlet of the nozzle which allows customers to connect to fill points with a more difficult access point. There are three different nozzles in the UL listed GG20 range, the **GG20**, the **GG20H** and the **GG20DN**, which cater for differing customer needs. With a 35mm longer connector the nozzles are engineered with the same function as their shorter GG1E, GG1EH and GG1DN counterparts. With a lightweight & well balanced construction, the GG20 series design has seen significant improvements in operational performance and reduced maintenance requirements, and like all GasGuard nozzles, they are fully repairable.

Standard Specifications for GG1 series nozzles:

Connector thread coupling:	1¾" ACME x 6 TPI form
Swivel Inlet thread:	15mm (½") or 20mm (¾") N.P.T. female
Nett mass:	2.0kgs (4.4lbs)
Max. operating pressure:	2450 KPa (350 psi)
Operating temperature:	-40 to +110 deg. C

Standard features on all GasGuard Autogas Nozzles:

- Safety: Cannot discharge LPGas to the atmosphere when not coupled and lever is actuated.
- Safe connection: Nozzle will safely seal with filler valve, even if its sealing gasket is missing.
- Swivel: Option of either 15mm (½"), 20mm (¾") N.P.T. internal thread to the inlet swivel to the Nozzle.
- Latching: An optional lever hold-open latch is available (not UL listed).
- Robust: High strength aluminium alloy connector casting with a stainless steel ACME thread Insert provides long service without distortion.

GG20 Nozzle Characteristics

Nozzle is used for industrial refueling of forklift truck cylinders and RV filler valves in similarly difficult locations. It uses a single nose piece to achieve high flow rates.

- Flow rate of 63L/min at 12bar system pressure
- Release Volume on valve closure of 1.9cm³
- Customer experiences a low lever pressure
- Magnet option for dispensers with reed switch technology
- New guided extended thread assists with alignment and connection to fill point
- A fine filter comes standard in all nozzles
- Long Connector Nut to access "hard to reach" fill points
- UL Listed

GG20 Nozzle

GG20H Nozzle Characteristics

Nozzle is used for industrial refueling of forklift truck cylinders and RV filler valves in similarly difficult locations. It incorporates a new "hybrid" nose piece to reduce the lever pressure experienced by the customer.

- Flow rate of 60L/min at 12bar system pressure
- Release Volume on valve closure of 1.7cm ^{3}
- Customer experiences a lower lever pressure than GG20
- Magnet option for dispensers with reed switch technology
- New guided extended thread assists with alignment and connection to fill point
- A fine filter comes standard in all nozzles
- Long Connector Nut to access "hard to reach" fill points
- UL Listed

GG20H Nozzle

GG20DN Nozzle Characteristics

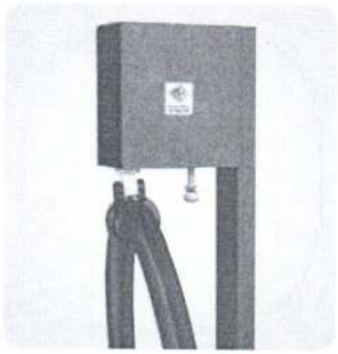
The GG20DN nozzle is suited for refueling of passenger vehicles by untrained personnel. It incorporates a patented Dual Nose piece which significantly reduces the amount of user error when operating the nozzle. It creates a positive seal to the customer's vehicles even if they have not tightly screwed the nozzle to the fill point. If the nozzle is not screwed on completely and the lever is pulled, there is no effect of flow rate as the Dual Nose piece compensates for the changed operating situation.

- Flow rate of 60L/min at 12bar system pressure
- Release Volume on valve closure of 1.7cm ^{3}
- A Dual Nose piece for added customer safety
- Customer experiences a lower lever pressure than GG20
- Magnet option for dispensers with reed switch technology
- New guided extended thread assists with alignment and connection to fill point
- A fine filter comes standard in all nozzles
- Long Connector Nut to access "hard to reach" fill points
- UL Listed

GG20DN

POMECO 102 Spring Balance Single Hose Retractors

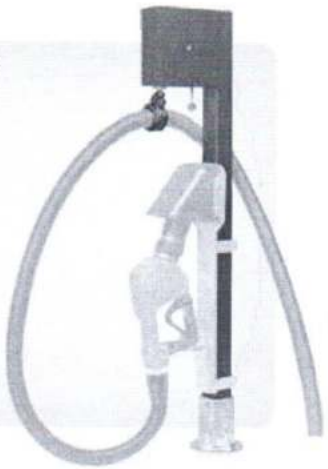
POMECO 102 Spring Balance Single Hose Retractors keep excess hose off the ground and out of the way, prolonging hose life and reducing potential hazards. The POMECO 102 is a California Air Resources Board (CARB) certified Stage II component for use with single and dual hose dispensers as per Executive Order G-70-52-AM.



Post Mounted

Materials

Housing: Cast aluminum
Cable: Black polyester
Post: Aluminum



Nozzle Hook and Hood Kit Not Sold by OPW.

Features

- Easy to Use – the spring-loaded reel and stretch-resistant cable provide smooth and steady tension throughout hose extension and return.
- Easy to maintain – the removable sideplate provides full access to the mechanism for easy tension adjustment and unit maintenance. A convenient safety thumb screw is provided to lock the reel in place during tension adjustment.
- Field Adjustable for Various Hose, Nozzle, Swivel, Breakaway Combinations – no need for upgrading components if a breakaway or swivel is added to the hose assembly. Simply change the tension setting on the spring-loaded hose reel.
- Multiple Mounting Options – the POMECO 102 retractor housing is tapped on the top for bolting to overhead crossbars, and on the side for mounting to vertical posts. The 102 is available as a retractor kit (including post, retractor and mounting hardware) or as separate components. Models are also available for aboveground storage tank (AST) applications. AST models include a 44" (112 cm) post with a freestanding base.

102 Spring Balance Hose Retractor Instruction Sheet Order Number: **H15853PA**

NOTE: See OPW's Website at www.opwglobal.com for product instruction sheets, trouble-shooting guides, how-to-use guide and to view the Do's & Don'ts at the Gas Pump video.

Ordering Specifications

Vertical Retractor Kits (Box, Post, Bracket, Foot & Hardware)

Model Number	Mounting Method	Clamp Fits	Weight	
			lbs.	kg
6102-1039P	39" Retractor/Post Kit	(Hose Clamp Not Included)	12	5.4
6102-1078P	78" Retractor/Post Kit	(Hose Clamp Not Included)	14	6.4
6102-1100	78" Retractor/Post Kit	(Hose Clamp Not Included)	14	6.4
6102-AST	AST	(Hose Clamp Not Included)	9	4.1

Ordering Specifications

Separate Retractor Components (Box Only)

Model Number	Mounting Method	Clamp Fits				Weight	
		Hose O.D.		Hose I.D.			
		in.	mm	in.	mm	lbs.	kg
6102-1000	Overhead Crossbar/Verticle Post	(Hose Clamp Not Included)				7	3.2
6102-4000	Overhead Crossbar/Verticle Post	1⅜"	35	1"	25	7	3.2
6102-6000	Overhead Crossbar	1 1/32"	26	⅜" or ¾"	16 or 19	7	3.2
6102-8000	Overhead Crossbar	1"	25	⅜"	16	7	3.2
6102-CNG	Hose Retractor Kit, CNG						
6102-CNG2	Hose Retractor Kit, CNG2						

*POMECO recommends using CO5238M, CO5261M or P100-3F/P100-44/P100-2AST for use with 102 Series retractors.
Other size tubes and clamps available upon request.

Hose Clamp

Ordering Specifications

Hose Clamps

Model Number	Hose Clamp Size †
PB-1396	Standard 1⅛" O.D. Hose (1" I.D.)
PB-1394	Standard 1⅛" O.D. Hose (¾" I.D.)
PB-1375	Standard 1 1/32" O.D.Hose (⅝" or ¾" I.D.)
PB-1373	Standard 1" O.D. Hose (⅝" I.D.)
PB-1344	Balanced Coaxial, Goodyear Premier

† Other sizes available upon request

Options Replacement Parts

Model Number	Hose Clamp Size
C05238M	Post Kit, 39"(99 cm), 1⅛" x 2"
C05261M	Post Kit, 78"(198 cm), 1⅛" x 2"
H15212M	10 ft. Replacement Cable
P338SPOOL	Spool of Retractor Cable, 338 ft.
H15210M (P102-02)	Replacement Cable Guide
H15211M	Replacement Reel
P100-3F	AST Replacement Base
P100-2AST	Sliding Bracket (AST)

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Resume

THEODORE C. LEMOFF

Current Position: Engineering Consultant

Education B.E. (Chemical Engineering), City College of New York, New York, NY, 1967
M.B.A. (Business Administration), Xavier University, Cincinnati, OH, 1979

Certifications Registered Professional Engineer, Florida and Massachusetts

Experience

2010 – Present Principal, TLemoff Engineering.

Code consultation: Provide opinions on the applicability of gas code provisions in specific cases. Work includes review of history of code text to identify the intent of code provisions, providing verbal and written explanations, and follow-up with officials and other parties as required.

Code expert in legal cases: Provide written explanation of the intent of code requirements, when cited by other parties. Incident site visits to determine code compliance or non-compliance and opinion as the relevance thereof. Review depositions for accuracy of code related statements. Provide testimony at depositions or trials as needed.

Product support: Provide assistance to manufacturers on product specific code requirements, and propane industry practices. Assist with liaison with approval laboratories. Work with local officials on product acceptance.

Seminars: Presented talks and seminars on NFPA 54 and NFPA 58 in the United States, Santa Cruz, Bolivia, and Doha, Qatar.

1985 - 2010 National Fire Protection Association, Quincy, MA

Principal Gases Engineer

Staff liaison to all gases committees administering LP-Gas, Fuel Gas, and Liquid Natural Gas, and Ovens and Furnaces committee. Duties in addition to the administration of the standards making process include information interpretations as requested, speaking engagements and technical advice to NFPA books, films and other products.

NFPA representative to technical committees of the American Gas Association, National Propane Gas Association, and Compressed Gas Association, and the U. S. Department of Transportation Pipeline Advisory Committee. Voting member of the Uniform Plumbing Code and Uniform Mechanical Code committees.

Developed and maintained formal training programs on NFPA 58, Liquefied Petroleum Gas Code and NFPA 54, National Fuel Gas Code. Seminars presented throughout the United States.

1980 - 1985 Badger Engineers, Inc., Cambridge, MA and The Hague, Holland

Senior Project Engineer

Various assignments in the Cambridge, MA and the Hague, Holland offices covering the full range of project engineering activities including coordination, design, flow diagrams, equipment bid evaluation and selection.

1978 - 1980 Table Talk Pies, Division of Squibb Corporation, Worcester, Ma

Plant Engineer

Responsible for all engineering and maintenance for the bakery, freezer warehouse, distribution centers, and truck fleet.

1973 - 1978 Sun Chemical Corporation, Staten Island, NY and Cincinnati, OH

Engineering Manager

Responsible for all fire protection engineering and maintenance for the manufacturing facilities and associated offices and laboratories.

1967 - 1973 The Proctor and Gamble Company. Cincinnati, OH

Process Engineer

Broad range of assignments in detergents R&D.

Memberships and Affiliations

NFPA Technical Committee on National Fuel Gas Code (NFPA 54)
NFPA Technical Committee on Liquefied Petroleum Gases (NFPA 58)
American Institute of Chemical Engineers, Member
Society of Fire Protection Engineers, Member
National Fire Protection Association, Member
National Propane Gas Association, Member

Publications

Editor, Liquefied Petroleum Gases Handbook, 8 editions
Editor, National Fuel Gas Code Handbook, 6 editions
Co Author, NFPA Pocket Guide to Fuel Gas Storage and Use

Patent

Spray-Dried Detergent Composition, US # 3,801,511 (Assigned to the Proctor and Gamble Company)

January, 2015