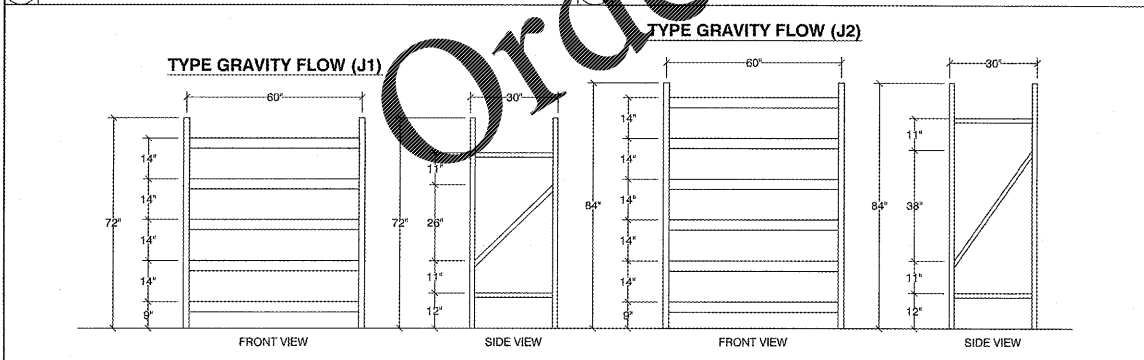
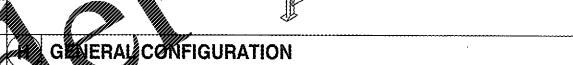
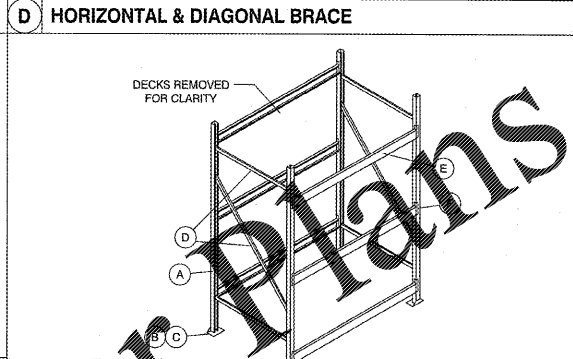
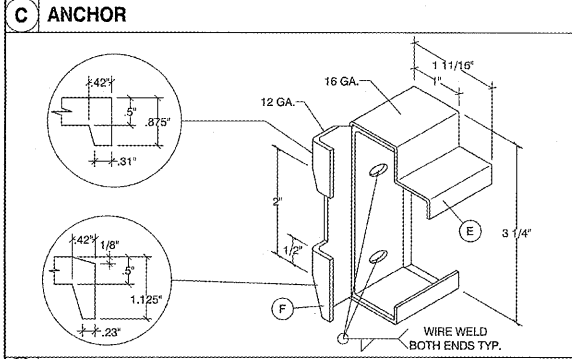
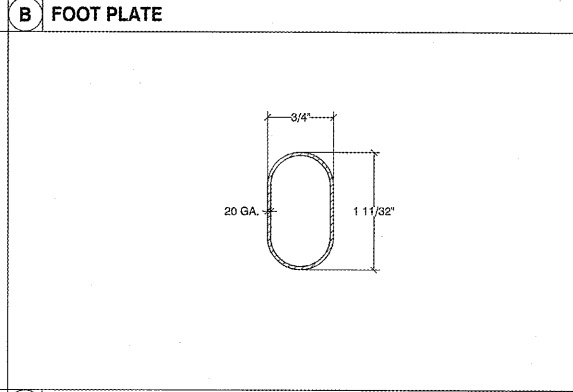
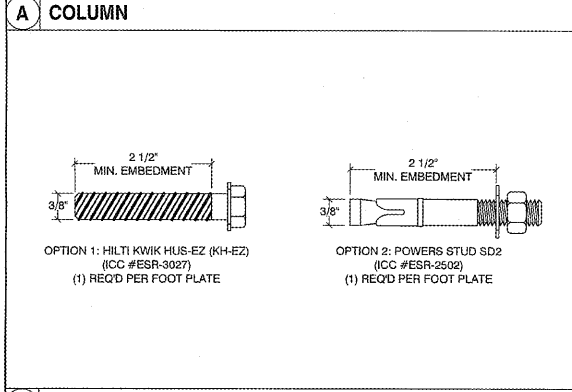
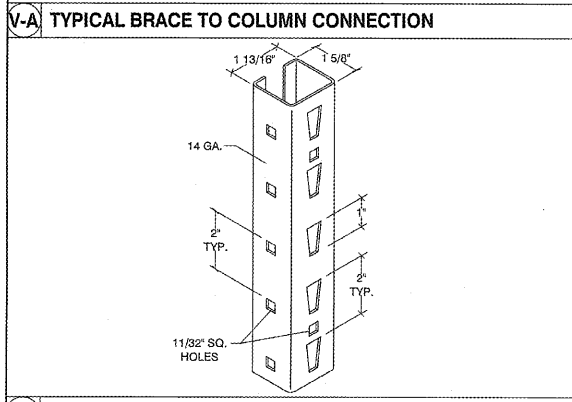
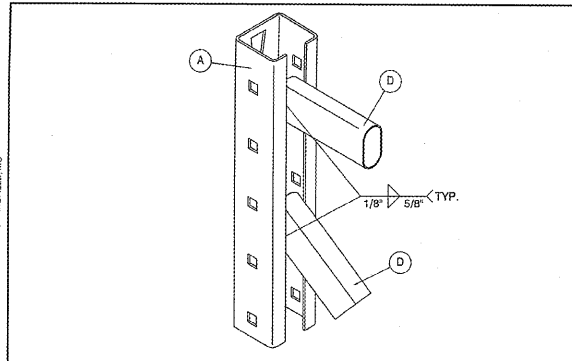


10/23/18
 LANCE SANDHURST, CIVIL ENGR
 SPRINGFIELD, MO



GRAVITY RACK ANALYSIS

SCOPE:
 THE PURPOSE OF THIS ANALYSIS IS TO SHOW THAT THE FOLLOWING GRAVITY RACK COMPLIES WITH REQUIREMENTS SET FORTH IN SECTION 1613 OF THE 2012 IBC WHERE THE LATERAL FORCES ARE DETERMINED IN ACCORDANCE WITH SECTION 15.5 OF THE ASCE 7-10.

PARAMETERS:

LATERAL FORCE:
 $V = C_s \cdot W_{total}$ WHERE $C_s = S_{ps}/(R \cdot I)$
 $= (1.2/3) \cdot F_a \cdot S_s \cdot I/R \cdot W$

NOTE: ANALYSIS WILL CHECK FOR OVERTURNING ONLY SINCE UNITS ARE UNDER 8 FT.

SPECIFICATIONS:

- MAIN STEEL $F_y = 50000$ PSI
- ANCHORS $3/8" \times 2-1/2"$ MIN. EMBED. HILTI KH-EZ SCREW ANCHOR (ICC ESR-3027) OR $3/8" \times 2-1/2"$ MIN. EMBED. POWERS STUD SD2 (ICC ESR-2502) PERIODIC SPECIAL INSPECTION REQUIRED FOR ANCHOR INSTALLATIONS.
- SLAB 4 IN (minimum required) \times 2500 PSI (minimum required)
- SOIL 1000 PSF

CONFIGURATIONS:

TYPE GRAVITY FLOW (84" H \times 60" W \times 30" D)
 NUMBER OF LEVELS = 6 LVL
 LOAD PER FLOW SHELF = 500 LB
 TOTAL LOAD ON BULK RACK SYSTEM = 3000 LB

TYPE GRAVITY FLOW (72" H \times 60" W \times 30" D)
 NUMBER OF LEVELS = 5 LVL
 LOAD PER FLOW SHELF = 500 LB
 TOTAL LOAD ON BULK RACK SYSTEM = 2500 LB

LOADS & DISTRIBUTION: TYPE GRAVITY FLOW (84" H \times 60" W \times 30" D) (SEE DETAIL J)
 ANALYZE PER SECTION 1613 OF THE 2012 IBC WHERE LATERAL FORCES ARE DETERMINED IN ACCORDANCE WITH SECTION 15.5 OF THE ASCE 7-10.

SITE CLASS = D
 $V = C_s \cdot W_{total}$ WHERE $C_s = S_{ps}/(R \cdot I)$
 AND $W_{total} = (0.67W_{PL} + w_{DL})$
 $S_{ps} = 2.5 Z^0.4 F_a S_s$ AND $F_a = 1.6 R S_s = 0.142$
 $= 0.15$
 $I = 1.50$ PUBLIC ACCESS
 $R = 4$

PRODUCT LOAD PER LEVEL, $w_{PL} = 500$ LB
 DEAD LOAD PER LEVEL, $w_{DL} = 25$ LB
 NO. OF LEVELS = 6 LVL
 DEPTH = 30 IN

LATERAL FORCE

FULLY LOADED: $V = [0.15 \cdot 1.5 \cdot (0.67 \cdot 3000 \text{ LB} + 150 \text{ LB})] / 4 = 123 \text{ LB}$

h	LEVEL	WEIGHT	HEIGHT	W X H	F1	Mot
9 IN	1	25 LB	9 IN	225 IN-LB	0.2 LB	2.14 LB
14 IN	2	25 LB	23 IN	575 IN-LB	0.5 LB	1.14 LB
14 IN	3	25 LB	37 IN	925 IN-LB	0.7 LB	27 IN-LB
14 IN	4	25 LB	51 IN	1,275 IN-LB	1.0 LB	52 IN-LB
14 IN	5	25 LB	65 IN	1,625 IN-LB	1.3 LB	85 IN-LB
14 IN	6	25 LB	79 IN	1,975 IN-LB	1.6 LB	1,264 IN-LB
79 IN	2 WVL	138,600 IN-LB	122.7 LB	36.9 LB	7,800 IN-LB	

TOP SHELF LOADED:
 $V_{top} = [0.15 \cdot 1.5 \cdot (0.67 \cdot 150 \text{ LB})] / 4 = 37$

h	LEVEL	WEIGHT	HEIGHT	W X H	F1	Mot
9 IN	1	25 LB	9 IN	225 IN-LB	0.2 LB	2.14 LB
14 IN	2	25 LB	23 IN	575 IN-LB	0.5 LB	1.14 LB
14 IN	3	25 LB	37 IN	925 IN-LB	0.7 LB	27 IN-LB
14 IN	4	25 LB	51 IN	1,275 IN-LB	1.0 LB	52 IN-LB
14 IN	5	25 LB	65 IN	1,625 IN-LB	1.3 LB	85 IN-LB
14 IN	6	25 LB	79 IN	1,975 IN-LB	1.6 LB	1,264 IN-LB
79 IN	2 WVL	46,100 IN-LB	36.9 LB	36.9 LB	7,800 IN-LB	

1 OVERTURNING ANALYSIS: TYPE GRAVITY FLOW (84" H \times 60" W \times 30" D) (SEE DETAIL B & C)
 DEPTH OF UNIT = 30 IN
 TOP SHELF HEIGHT = 79 IN

(A) FULLY LOADED:
 $0.7 \cdot V = 86 \text{ LB}$
 $Mot = \sum (F1 \cdot H)$
 $= 6,992 \text{ IN-LB}$
 $Mst = \sum [(0.6 - 0.145_{top}) \cdot w_{DL} + (0.6 - 0.145_{top}) \cdot 0.67 \cdot w_{PL}] \cdot \text{Depth} / 2$
 $= 18,753 \text{ IN-LB}$
 $Puplift = (0.7 \cdot Mot - Mst) / D$
 $= 0 \text{ LB} \leftarrow \text{NO UPLIFT}$

(B) TOP SHELF LOADED:
 $0.7 \cdot V_{top} = 26 \text{ LB}$
 $Mot = \sum (F1 \cdot H)$
 $= 2,300 \text{ IN-LB}$
 $Mst = \sum [(0.6 - 0.145_{top}) \cdot w_{DL} + (0.6 - 0.145_{top}) \cdot w_{PL}] \cdot \text{Depth} / 2$
 $= 5,643 \text{ IN-LB}$
 $Puplift = (0.7 \cdot Mot - Mst) / D$
 $= 0 \text{ LB} \leftarrow \text{NO UPLIFT}$

ANCHOR:
 QUANTITY = 1
 TENSILE CAPACITY = 30 LB
 SHEAR = 800 LB

EX/P1 + V1/W1 \leq 1.3
 COMBINED STRESS(A) = $(0 \text{ LB} / (1 \cdot 750 \text{ LB})) + (13 \text{ LB} / (1 \cdot 800 \text{ LB})) = 0.06$
 COMBINED STRESS(B) = $(0 \text{ LB} / (1 \cdot 750 \text{ LB})) + (13 \text{ LB} / (1 \cdot 800 \text{ LB})) = 0.06$

USE $(1/8" \times 2-1/2"$ MIN. EMBED. HILTI KH-EZ SCREW ANCHOR (ICC ESR-3027) PER FOOT PLATE
 OR
 USE $(3/8" \times 2-1/2"$ MIN. EMBED. POWERS STUD SD2 (ICC ESR-2502) AS AN OPTION.
 (FULLY CAPACITY = 800 LB, SHEAR CAPACITY = 800 LB, OK BY SIMPLE REVIEW)

2

3

4

OREILLY AUTO
 282 DEER CREEK ROAD
 FREDERICKSBURG, VA 22405

ADDRESS:

DESCRIPTION:

BY:

DATE:

REV:

SEIZMIC
 EST. 1965
 SEIZMIC
 ENGINEERING, INC.
 1130 E. Cypress St.
 Covina, California
 91724
 Tel. (609) 969-0989

DRAWN BY: A.N. / B.G.
 DATE: 10/18/18
 LAST REV. BY:
 REV. DATE:
 TYPE: LOZ
 SCALE: N.T.S.
 APRVD BY: SAL E. FATEEN

SAL E. FATEEN
 No. 30770
 PROFESSIONAL ENGINEER
 COMMONWEALTH OF VIRGINIA
 EXPIRES 02-28-2019

DESCRIPTION:
GRAVITY RACK (FIXTURE #3A)

DRAWING NUMBER:
18-2387-C