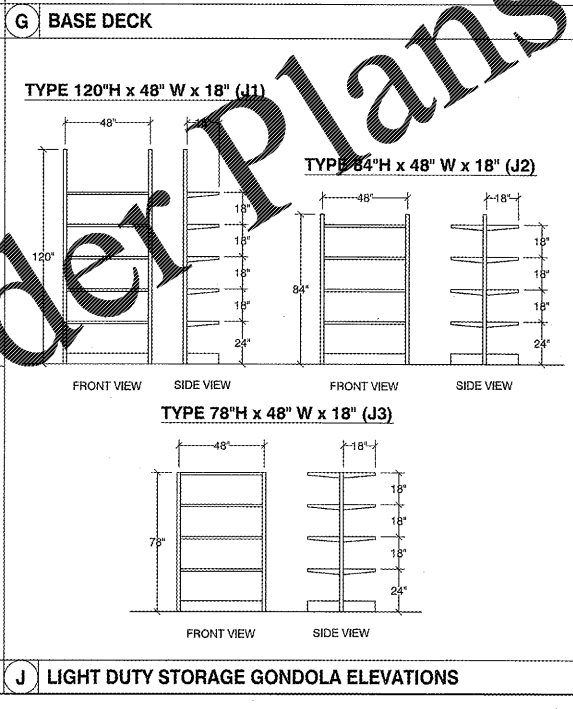
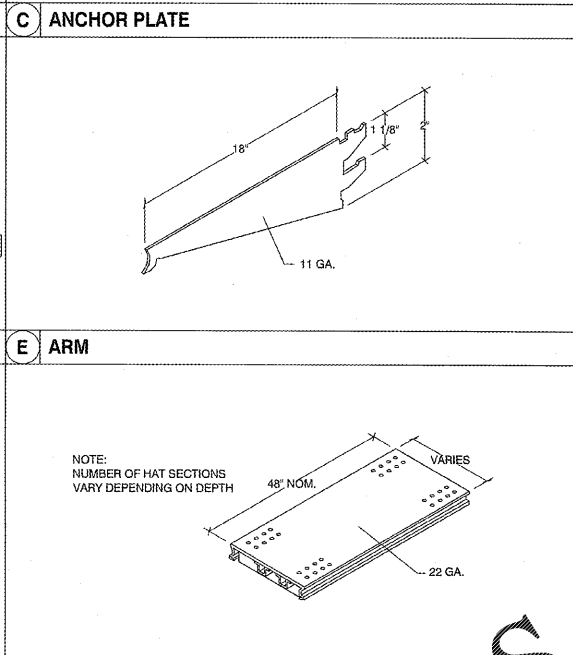
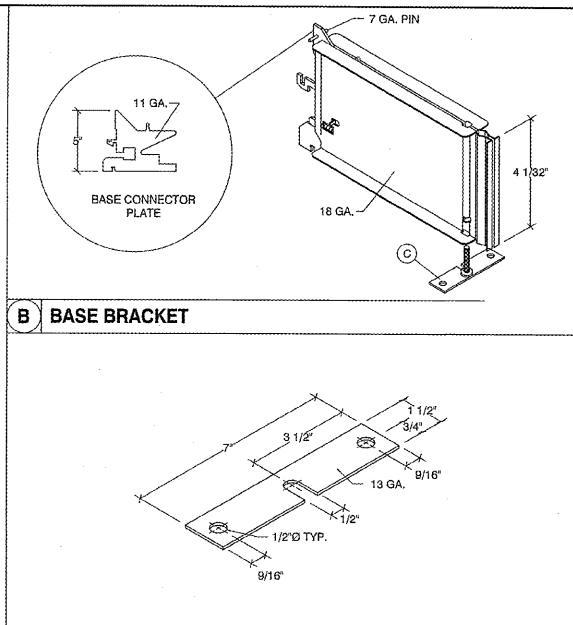
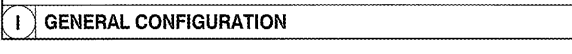
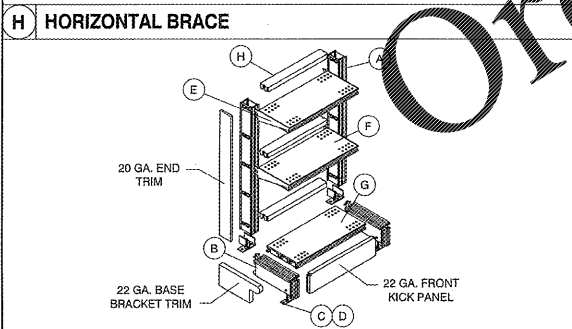
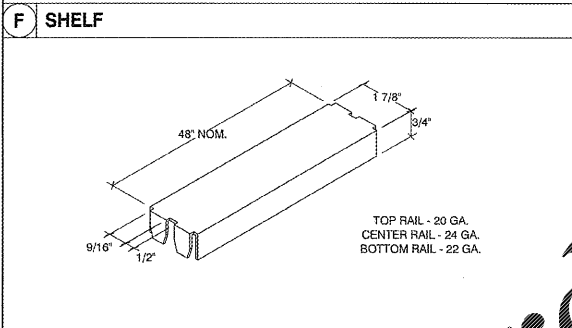
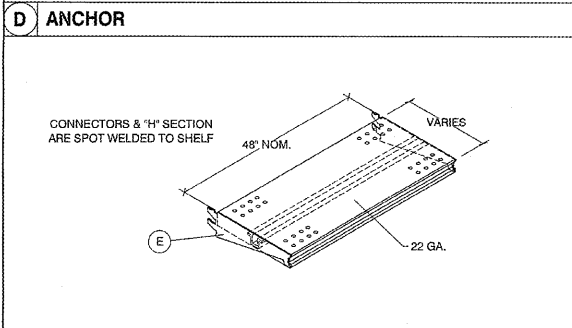
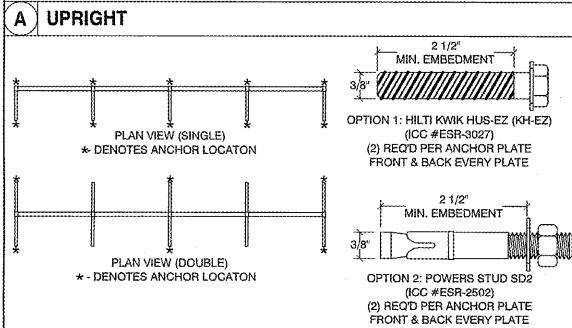
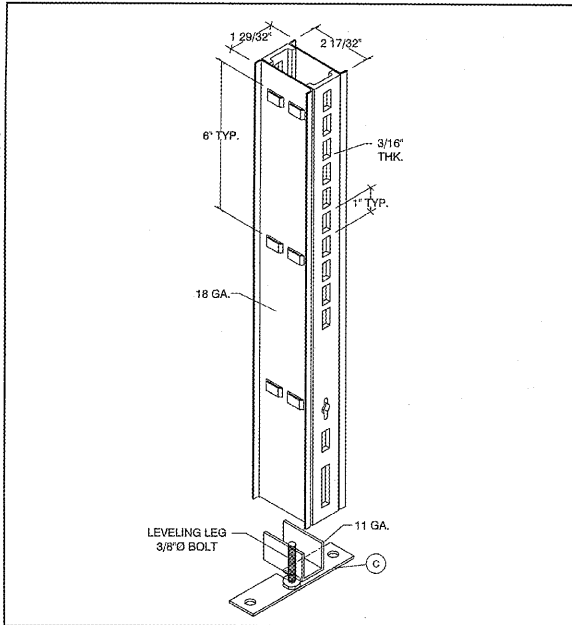


OCT 23 2018  
1736 E. SUNSHINE ST. SUITE 417  
SPRINGFIELD, MO



**LIGHT DUTY GONDOLA ANALYSIS**

**SCOPE:**  
THE PURPOSE OF THIS ANALYSIS IS TO SHOW THAT THE FOLLOWING LIGHT DUTY STORAGE FIXTURE IS IN COMPLIANCE WITH SECTION 1613 OF THE 2012 IBC AND THE ASCE 7-10.

**PARAMETERS:**  
THE STORAGE FIXTURE UNIT USED IN THIS PROJECT CONSISTS OF LOZGER GONDOLA TYPE COMPONENTS. FIXTURE UNITS WILL BE ANALYZED UTILIZING THE FOLLOWING LATERAL FORCE FORMULA:

**LATERAL FORCE:**  
 $V = C_s * W_s$  WHERE  $C_s = S_{DS}(R/I)$   
 $= (I/2) * F_a * S_s * (1/R) * W_s$

**SPECIFICATIONS:**  
- MAIN STEEL:  $F_y = 36000$  PSI MIN. YIELD STEEL  
- ANCHORS: 3/8"Ø x 2-1/2" MIN. EMBED. HILTI KH-EZ SCREW ANCHOR (ICC ESR-3027) OR 3/8"Ø x 2-1/2" MIN. EMBED. POWERS POWER STUD SD2 (ICC ESR-2502) PERIODIC SPECIAL INSPECTION REQUIRED FOR ANCHOR INSTALLATIONS.  
- SLAB: 4 IN (minimum required) x 2500 PSI (minimum required)  
- SOIL: 1000 PSF

**CONFIGURATIONS:**  
TYPE 120"Hx48"Wx18"D SINGLE SIDED  
TYPE 84"Hx48"Wx18"D SINGLE & DOUBLE SIDED  
TYPE 78"Hx48"Wx18"D DOUBLE SIDED

**STORAGE LOAD:**  
PRODUCT LOAD = 70 LB PER SHELF

**LOADS & DISTRIBUTION: TYPE 120"Hx48"Wx18"D** (SEE DETAIL J)

ANALYSIS BASED ON SECTION 1613 OF THE 2012 IBC AND THE ASCE 7-10.

SITE CLASS = D  
 $V = C_s * W_s$  WHERE  $C_s = S_{DS}(R/I)$   
 $S_{DS} = 2/3 * F_a * S_s$  WHERE  $S_s = 0.14Z$ ,  $F_a = 1.6$   
 $= 0.151$   
 $I = 1.50$  ← IN AREA OF PUBLIC ACCESS ← TABLE 15.4-2  
 $R = 3$  ← WORKING STRESS

REDUCTION = 0.7  
NO. OF LEVELS = 5 LIV  
PRODUCT LOAD, wPL = 70 LB/LEVEL  
DEAD LOAD, wDL = 5 LB/LEVEL

**LONGITUDINAL & TRANSVERSE DIRECTION**  
 $V = 0.7 * 1.51 * 1.5 * (0.67 * 350 LB + 25 LB/3)$   
 $= 24 LB$

LEVEL	WEIGHT	HEIGHT	W X H	FI	Mot	
24 IN	1	75 LB	24 IN	1.800 IN-LB	1 LB	26 IN-LB
18 IN	2	75 LB	42 IN	3,150 IN-LB	2 LB	81 IN-LB
18 IN	3	75 LB	60 IN	4,500 IN-LB	3 LB	155 IN-LB
18 IN	4	75 LB	78 IN	5,850 IN-LB	4 LB	279 IN-LB
18 IN	5	75 LB	96 IN	7,200 IN-LB	4 LB	423 IN-LB
96 IN		375 LB	Σ = 22,500 IN-LB	34 LB		974 IN-LB

$M_{col}(static) = \sum(V * h) = 974$  IN-LB  
 $M_{col}(static) = (wPL * wDL) * Depth * \# \text{ of levels} / 2 = 75 LB * 18 IN * 5 / 2 = 3,375$  IN-LB  
 $M_{col}(total) = M_{col}(static) + 0.75 * M_{col}(seismic) = 4,105$  IN-LB

**COLUMN ANALYSIS: TYPE 120"Hx48"Wx18"D** (SEE DETAIL A)

$P_{max} = (1 + 0.115 * C_u) * Pool = 381$  LB  
 $M_{max} = M_{col} = 4,105$  IN-LB  
 $K_{col}/F_c = 2.1 * 96 IN / 1,057 IN = 190.7$   
 $K_y/h_y = 1.24 IN / 0.484 IN = 49.6$   
 $C_c = (2 * \sqrt{2} * F_y) / S = 126.1$   
SINCE  $K_y/h_y < C_c$  USE  $F_c = [12 * \sqrt{2} * F_y] / (23(K_y/h_y)^2)$   
 $F_c = (12 * \sqrt{2} * 36,000) / (23 * 190.7^2) = 4,105$  PSI  
 $f_c = Pool / Area = 495$  PSI  
 $f_b = M_y / S_x = 4,105 IN-LB / 0.676 IN^3 = 6,073$  PSI  
 $f_c / F_c = 0.12$  USE  $f_c / F_c = 0.12$   
 $f_b / F_b = 0.28$   
COMBINED STRESS = 0.40 < 1.0 O.K.

**COLUMN SECTION PROPERTIES**  
 $t_w = 3/8$  GA.  
 $F_y = 36,000$  PSI  
AREA = 0.77 IN<sup>2</sup>  
 $I_x = 897$  IN<sup>4</sup>  
 $S_x = 628$  IN<sup>3</sup>  
 $r_x = 37$  IN  
 $I_y = 107$  IN<sup>4</sup>  
 $S_y = 67$  IN<sup>3</sup>  
 $r_y = 4.24$  IN  
 $I_x = 96$  IN  
 $I_y = 24$  IN

**OVERTURNING ANALYSIS: TYPE 84"Hx48"Wx18"D** (SEE DETAIL D)

DOUBLE SIDED DEPTH (D) = 96 IN  
TOP SHELF HEIGHT = 78 IN  
# LEVELS = 4 LIV

**(A) FULLY LOADED/DOUBLE SIDED LOADED:**  
 $V_{total} = 22$  LB  
 $M_{ot} = \sum(V * h) * 0.75 = 973$  IN-LB  
 $M_{st} = \sum[(0.6 - 0.115 * C_u) * wDL + 0.75 * (0.6 - 0.145 * C_u) * wPL] * Depth / 2 = 3,352$  IN-LB  
 $P_{up/rt} = (Mot - Mst) / D = 0$  LB ← NO UPLIFT

**(B) TOP SHELF LOADED/DOUBLE SIDED LOADED:**  
 $V_{top} = [0.7 * 1.51 * 1.5 * (70 LB + 20 LB) * 2/3] = 10$  LB  
 $M_{ot} = V_{top} * h * 0.75 = 558$  IN-LB  
 $M_{st} = \sum[(0.6 - 0.115 * C_u) * wDL + 0.75 * (0.6 - 0.145 * C_u) * wPL] * Depth / 2 = 1,514$  IN-LB  
 $P_{up/rt} = (Mot - Mst) / D = 0$  LB ← NO UPLIFT

**ANCHOR:**  
QUANTITY = 1 PULLOUT = 750 LB SHEAR = 800 LB  
OCCURRENCE = 2  
 $P_u/P_n \leq V_u/V_n \leq 1.2$   
COMBINED STRESS(A) = (0 LB / (1 \* 750 LB)) + (22 LB / (1 \* 800 LB)) = 0.03 < 1.2 O.K.  
COMBINED STRESS(B) = (0 LB / (1 \* 750 LB)) + (10 LB / (1 \* 800 LB)) = 0.01 < 1.2 O.K.

USE (1) 3/8"Ø x 2-1/2" MIN. EMBED. HILTI KH-EZ SCREW ANCHOR (ICC ESR-3027) PER ANCHOR PLATE; ANCHOR PERIMETER ONLY, EVERY OTHER BAY.  
OR  
USE 3/8"Ø x 2-1/2" MIN. EMBED. POWERS POWER STUD SD2 (ICC ESR-2502) AS AN OPTION. (PULLOUT CAPACITY=750 LB, SHEAR CAPACITY=800 LB, OK BY SIMPLE REVIEW)

**ARM ANALYSIS: TYPE 120"Hx48"Wx18"D** (SEE DETAIL E)

(A) CHECK TENSION CAPACITY:  
ARM SPAN = 18.0 IN  
LOAD = 75 LB/LEVEL  
 $M = LOAD * (ARM SPAN / 2) = 75 LB/LEVEL * 18 IN / 2 = 675$  IN-LB  
ASSUME ONLY THE TOP CLIP IN TENSION  
TENSION CAPACITY =  $T_n = 0.6 F_y A$   
 $= 0.6 * 36000 PSI * 0.09 IN^2 = 1,944$  LB  
MOMENT CAPACITY =  $T_n * d$   
 $= 1944 LB * 1.125 IN = 2,187$  IN-LB > 675 IN-LB OK

(B) CHECK FOR SHEAR CAPACITY:  
 $V_{arm} = LOAD / 2 = (70 LB + 5 LB) / 2 = 38$  LB/LEVEL  
SHEAR CAPACITY =  $0.4 F_y A$   
 $= 0.4 * 36000 PSI * 0.09 IN^2 = 1,296$  LB > 38 LB OK

**BASE BRACKET ANALYSIS: TYPE 120"Hx48"Wx18"D** (SEE DETAIL B)

$M_{col}(MAX) = 405$  IN-LB  
 $f_b = M_{col}(total) / S_x = 4,105 IN-LB / 0.676 IN^3 = 6,073$  PSI  
 $f_b / F_b = 3479$  PSI / 21600 PSI = 0.16 < 1.0 OK

**OVERTURNING ANALYSIS: TYPE 84"Hx48"Wx18"D** (SEE DETAIL D)

DEPTH (D) = 18 IN  
TOP SHELF HEIGHT = 96 IN  
# LEVELS = 5 LIV

**(A) FULLY LOADED/DOUBLE SIDED LOADED:**  
 $V_{total} = 22$  LB  
 $M_{ot} = \sum(V * h) * 0.75 = 730$  IN-LB  
 $M_{st} = \sum[(0.6 - 0.115 * C_u) * wDL + 0.75 * (0.6 - 0.145 * C_u) * wPL] * Depth / 2 = 1,047$  IN-LB  
 $P_{up/rt} = (Mot - Mst) / D = 0$  LB ← NO UPLIFT

**TOP SHELF LOADED ONLY:**  
 $V_{top} = [0.7 * 1.51 * 1.5 * (70 LB + 25 LB) / 3] = 5$  LB  
 $M_{ot} = V_{top} * h = 483$  IN-LB  
 $M_{st} = \sum[(0.6 - 0.115 * C_u) * wDL + 0.75 * (0.6 - 0.145 * C_u) * wPL] * Depth / 2 = 405$  IN-LB  
 $P_{up/rt} = (Mot - Mst) / D = 4$  LB ← UPLIFT

**ANCHOR:**  
QUANTITY = 1 PULLOUT = 750 LB SHEAR = 800 LB  
OCCURRENCE = 2  
 $P_u/P_n \leq V_u/V_n \leq 1.2$   
COMBINED STRESS(A) = (0 LB / (1 \* 750 LB)) + (14 LB / (1 \* 800 LB)) = 0.02 < 1.2 O.K.  
COMBINED STRESS(B) = (6 LB / (1 \* 750 LB)) + (6 LB / (1 \* 800 LB)) = 0.02 < 1.2 O.K.

(1) 3/8"Ø x 2-1/2" MIN. EMBED. HILTI KH-EZ SCREW ANCHOR (ICC ESR-3027) PER ANCHOR PLATE; ANCHOR PERIMETER ONLY, EVERY OTHER BAY.  
OR  
USE 3/8"Ø x 2-1/2" MIN. EMBED. POWERS POWER STUD SD2 (ICC ESR-2502) AS AN OPTION. (PULLOUT CAPACITY=750 LB, SHEAR CAPACITY=800 LB, OK BY SIMPLE REVIEW)

**OVERTURNING ANALYSIS: TYPE 84"Hx48"Wx18"D** (SEE DETAIL D)

DOUBLE SIDED DEPTH (D) = 96 IN  
TOP SHELF HEIGHT = 78 IN  
# LEVELS = 4 LIV

**(A) FULLY LOADED/DOUBLE SIDED LOADED:**  
 $V_{total} = 22$  LB  
 $M_{ot} = \sum(V * h) * 0.75 = 973$  IN-LB  
 $M_{st} = \sum[(0.6 - 0.115 * C_u) * wDL + 0.75 * (0.6 - 0.145 * C_u) * wPL] * Depth / 2 = 3,352$  IN-LB  
 $P_{up/rt} = (Mot - Mst) / D = 0$  LB ← NO UPLIFT

**(B) TOP SHELF LOADED/DOUBLE SIDED LOADED:**  
 $V_{top} = [0.7 * 1.51 * 1.5 * (70 LB + 20 LB) * 2/3] = 10$  LB  
 $M_{ot} = V_{top} * h * 0.75 = 558$  IN-LB  
 $M_{st} = \sum[(0.6 - 0.115 * C_u) * wDL + 0.75 * (0.6 - 0.145 * C_u) * wPL] * Depth / 2 = 1,514$  IN-LB  
 $P_{up/rt} = (Mot - Mst) / D = 0$  LB ← NO UPLIFT

**ANCHOR:**  
QUANTITY = 1 PULLOUT = 750 LB SHEAR = 800 LB  
OCCURRENCE = 2  
 $P_u/P_n \leq V_u/V_n \leq 1.2$   
COMBINED STRESS(A) = (0 LB / (1 \* 750 LB)) + (22 LB / (1 \* 800 LB)) = 0.03 < 1.2 O.K.  
COMBINED STRESS(B) = (0 LB / (1 \* 750 LB)) + (10 LB / (1 \* 800 LB)) = 0.01 < 1.2 O.K.

USE (1) 3/8"Ø x 2-1/2" MIN. EMBED. HILTI KH-EZ SCREW ANCHOR (ICC ESR-3027) PER ANCHOR PLATE; ANCHOR PERIMETER ONLY, EVERY OTHER BAY.  
OR  
USE 3/8"Ø x 2-1/2" MIN. EMBED. POWERS POWER STUD SD2 (ICC ESR-2502) AS AN OPTION. (PULLOUT CAPACITY=750 LB, SHEAR CAPACITY=800 LB, OK BY SIMPLE REVIEW)

**LOADS & DISTRIBUTION: TYPE 84"Hx48"Wx18"D** (SEE DETAIL J)

ANALYSIS BASED ON SECTION 1613 OF THE 2012 IBC AND THE ASCE 7-10.

SITE CLASS = D  
 $V = C_s * W_s$  WHERE  $C_s = S_{DS}(R/I)$   
 $S_{DS} = 2/3 * F_a * S_s$  WHERE  $S_s = 0.14Z$ ,  $F_a = 1.6$   
 $= 0.151$   
 $I = 1.50$  ← IN AREA OF PUBLIC ACCESS ← TABLE 15.4-2  
 $R = 3$  ← WORKING STRESS

REDUCTION = 0.7  
NO. OF LEVELS = 4 LIV  
PRODUCT LOAD, wPL = 70 LB/LEVEL  
DEAD LOAD, wDL = 5 LB/LEVEL

**LONGITUDINAL & TRANSVERSE DIRECTION**  
 $V = [0.7 * 1.51 * 1.5 * (0.67 * 280 LB + 20 LB) * 2/3] = 22$  LB

LEVEL	WEIGHT	HEIGHT	W X H	FI	Mot	
24 IN	1	150 LB	24 IN	3,600 IN-LB	3 LB	62 IN-LB
18 IN	2	150 LB	42 IN	6,300 IN-LB	5 LB	190 IN-LB
18 IN	3	150 LB	60 IN	9,000 IN-LB	6 LB	368 IN-LB
18 IN	4	150 LB	78 IN	11,700 IN-LB	8 LB	656 IN-LB
78 IN		600 LB	Σ = 30,600 IN-LB	22 LB		1,297 IN-LB

**LOADS & DISTRIBUTION: TYPE 84"Hx48"Wx18"D** (SEE DETAIL J)

ANALYSIS BASED ON SECTION 1613 OF THE 2012 IBC AND THE ASCE 7-10.

SITE CLASS = D  
 $V = C_s * W_s$  WHERE  $C_s = S_{DS}(R/I)$   
 $S_{DS} = 2/3 * F_a * S_s$  WHERE  $S_s = 0.14Z$ ,  $F_a = 1.6$   
 $= 0.151$   
 $I = 1.50$  ← IN AREA OF PUBLIC ACCESS ← TABLE 15.4-2  
 $R = 3$  ← WORKING STRESS

REDUCTION = 0.7  
NO. OF LEVELS = 4 LIV  
PRODUCT LOAD, wPL = 70 LB/LEVEL  
DEAD LOAD, wDL = 5 LB/LEVEL

**LONGITUDINAL & TRANSVERSE DIRECTION**  
 $V = [0.7 * 1.51 * 1.5 * (0.67 * 280 LB + 20 LB) * 2/3] = 22$  LB

LEVEL	WEIGHT	HEIGHT	W X H	FI	Mot	
24 IN	1	150 LB	24 IN	3,600 IN-LB	3 LB	62 IN-LB
18 IN	2	150 LB	42 IN	6,300 IN-LB	5 LB	190 IN-LB
18 IN	3	150 LB	60 IN	9,000 IN-LB	6 LB	368 IN-LB
18 IN	4	150 LB	78 IN	11,700 IN-LB	8 LB	656 IN-LB
78 IN		600 LB	Σ = 30,600 IN-LB	22 LB		1,297 IN-LB

**TYPE 120"H x 48" W x 18" (J1)**

**TYPE 84"H x 48" W x 18" (J2)**

**TYPE 78"H x 48" W x 18" (J3)**

FRONT VIEW SIDE VIEW FRONT VIEW SIDE VIEW FRONT VIEW SIDE VIEW

**O'REILLY AUTO**  
242 DEACON ROAD  
FREDERICKSBURG, VA 22405

ADDRESS: \_\_\_\_\_

DESCRIPTION: \_\_\_\_\_

BY: \_\_\_\_\_

DATE: \_\_\_\_\_

REV. DATE: \_\_\_\_\_

**SEIZMIC**  
EST. 1985  
SEIZMIC  
ENGINEERING, INC.  
1130 E. Cypress St.  
Covina, California  
91724  
Tel. (909)868-0889

DRAWN BY: A.N./B.G.  
DATE: 10/18/18  
LAST REV. BY: \_\_\_\_\_  
REV. DATE: \_\_\_\_\_  
TYPE: LOZ  
SCALE: N.T.S.  
APPROV BY: SALE FATEEN

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

DESCRIPTION:  
LIGHT DUTY  
STORAGE  
GONDOLA  
(FIXTURE #2A)

DRAWING NUMBER:  
18-2387-B