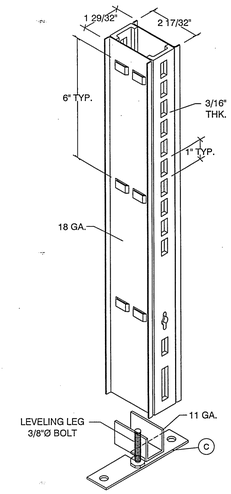
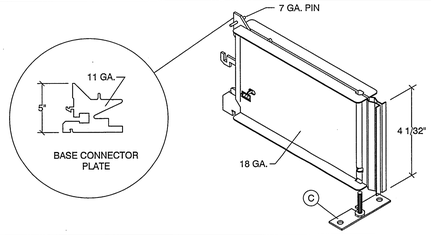
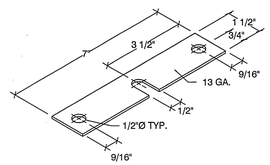


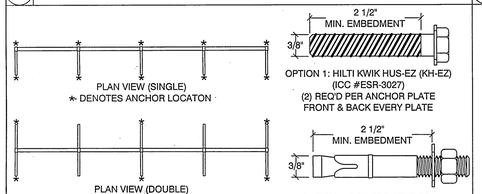
A UPRIGHT



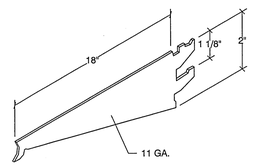
B BASE BRACKET



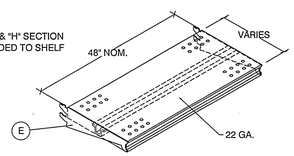
C ANCHOR PLATE



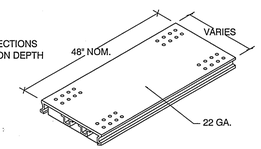
D ANCHOR



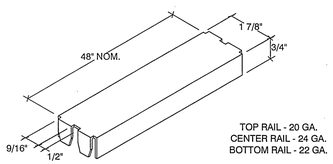
E ARM



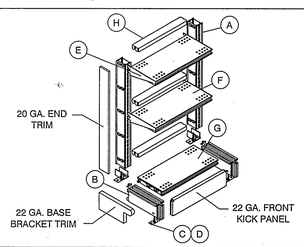
F SHELF



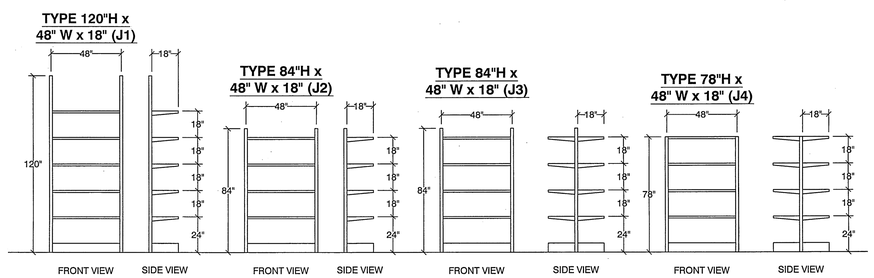
G BASE DECK



H HORIZONTAL BRACE



I GENERAL CONFIGURATION



J LIGHT DUTY STORAGE GONDOLA ELEVATIONS

1

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 2010 OSSC AND THE ASCE 7-05.

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

LATERAL FORCE:

$V = C_s * W_s$ WHERE $C_s = S_{DS}/(R/I)$
$= [(2/3) * F_a * S_s * I/R] * W_s$

SPECIFICATIONS:
- MAIN STEEL — Fy = 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 — 500 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

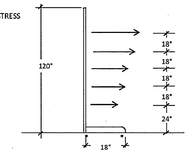
2

LOADS & DISTRIBUTION: TYPE 120"Hx48"Wx18"D **(SEE DETAIL J)**
ANALYSIS BASED ON SECTION 1613 OF THE 2010 OSSC AND THE ASCE 7-05.

SITE CLASS = D
$V = C_s * W_s$ WHERE $C_s = S_{DS}/(R/I)$
AND W_s = OPERATING WEIGHT
$S_{DS} = 2/3*F_a*S_s$ WHERE $S_s = 0.86$, $F_a = 1.16$
= 0.665
I = 1.50 <=== IN AREA OF PUBLIC ACCESS
R = 3 <=== TABLE 15.4-2

REDUCTION = 0.7 <=== WORKING STRESS

NO. OF LEVELS = 5 LVL
PRODUCT LOAD, wPL = 70 LB/LVL
DEAD LOAD, wDL = 5 LB/LVL



LONGITUDINAL & TRANSVERSE DIRECTION

V = 0.7*[0.665*1.5*(0.67*350 LB + 25 LB)/3]
= 60 LB

LATERAL FORCE DISTRIBUTION						
h	LEVEL	WEIGHT	HEIGHT	W X H	Fi	Mot
24 IN	1	75 LB	24 IN	1,800 IN-LB	5 LB	116 IN-LB
18 IN	2	75 LB	42 IN	3,150 IN-LB	8 LB	355 IN-LB
18 IN	3	75 LB	60 IN	4,500 IN-LB	12 LB	725 IN-LB
18 IN	4	75 LB	78 IN	5,850 IN-LB	16 LB	1,225 IN-LB
18 IN	5	75 LB	96 IN	7,200 IN-LB	19 LB	1,856 IN-LB
96 IN		375 LB	Σ =	22,500 IN-LB	60 LB	4,277 IN-LB

Mcol(seismic)= Σ(V * H)
= 4,277 IN-LB

Mcol(static) = (wPL+wDL) x Depth x # of levels /2
= 75 LB x 18 IN x 5 / 2
= 3,375 IN-LB

Mcol(total) = Mcol(static) + 0.75*Mcol(seismic)
= 6,582 IN-LB

3

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

(A) CHECK TENSION CAPACITY:
ARM SPAN = 18.0 IN
LOAD = 75 LB/LEVEL

ARM
A = 0.090 IN^2
Fy = 36,000.0 PSI
d = 1.125 IN

M = LOAD x (ARM SPAN/2)
= 75 LB/LEVEL x 18 IN/2
= 675 IN-LB

ASSUME ONLY THE TOP CLIP IN TENSION

TENSION CAPACITY = T= 0.6Fy x A
= 0.6 x 36000 PSI x 0.09 IN^2
= 1,944 LB

MOMENT CAPACITY = T x d
= 1944 LB x 1.125 IN
= **2,187 IN-LB** **> 675 IN-LB OK**

(B) CHECK FOR SHEAR CAPACITY:

Varm = LOAD/2
= (70 LB + 5 LB)/ 2
= 38 LB/LEVEL

SHEAR CAPACITY = 0.4Fy * A
= 0.4 x 36000 PSI x 0.09 IN^2
= **1,296 LB** **> 38 LB OK**

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

Mcol(MAX) = 6,582 IN-LB

BASE BRACKET
Fy = 36,000PSI
Sx = 1.18 IN^3

fb = Mcol(total)/Sx
= 6582 IN-LB / 1.18 IN^3
= 5,578PSI

Fb = 0.6 x 36000 PSI
= 21,600PSI

fb/Fb = 5578 PSI / 21600 PSI
= **0.26** **< 1.0 OK**

4

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

Pmax = (1+0.11S_{DS}) Pcol
= 402 LB

Mmax = Mcol
= 6,582 IN-LB

Kxlx/rx = 2.1*96 IN/1.057 IN
= 190.7

Kylylry = 1*24 IN/0.484 IN
= 49.6 → 190.7 (GOVERNS)

Cc = (2π^2E/Fy)^.5
= 126.1

SINCE Kl/r > Cc USE Fa = [12π^2E]/[23(Kl/r)^2]

Fa = [12π^2E]/[23(Kl/r)^2]
= 4,105 PSI

fa = Pcol / Area
= 523 PSI

fb = M/Sx
= 6582 IN-LB/0.676 IN^3
= 9,737 PSI

fa/Fa = 0.13 < 0.15 USE fa/Fa + fb/Fb

Fb = .6*Fy
= 21,600 PSI

Fe = 12π^2E/23(Kl/r)^2
= N/A

fb/Fb = 0.45

COMBINED STRESS = **0.58** **< 1.0 O.K.**

COLUMN SECTION PROPERTIES
t = 18 GA.
Fy= 36,000 PSI
AREA = 0.77 IN^2
Ix = .867 IN^4
Sx = .676 IN^3
rx = 1.057 IN
Iy = 0.1820 IN^4
Sy = 0.2700 IN^3
ry = 0.4840 IN
Lx = 96 IN
Ly = 24 IN

5

OVERTURNING ANALYSIS: TYPE 120"Hx48"Wx18"D **(SEE DETAIL D)**
DEPTH (D) = 18 IN
TOP SHELF HEIGHT = 96 IN
LEVELS= 5 LVL

(A) FULLY LOADED:
Vtotal = 60 LB

Mot = Σ(Fp*h)*0.75
= 3,207 IN-LB

Mst = Σ[(0.6-0.11S_{DS})wDL +0.75*(0.6-0.14S_{DS})*0.67wPL) x Depth / 2
= 921 IN-LB

Puplift = (Mot - Mst)/D
= 127 LB <= UPLIFT

(B) TOP SHELF LOADED ONLY:
Vtop = (0.7*0.665*1.5*(70 LB + 25 LB)/3]
= 22 LB

Mot = Vtop * h
= 2,123 IN-LB

Mst = Σ[(0.6-0.11S_{DS})wDL + 0.75*(0.6-0.14S_{DS})wPL] x Depth / 2
= 358 IN-LB

Puplift = (Mot - Mst)/D
= 98 LB <= UPLIFT

ANCHOR:
QUANTITY= 2 PULLOUT = 750 LB SHEAR = 800 LB
OCCURRENCE = 1

Ps/Pt + Vs/Vt ≤ 1.2
COMBINED STRESS(A) = (127 LB/(2*750 LB)) + (30 LB/(2*800 LB))
= **0.10** **< 1.2 OK**

COMBINED STRESS(B) = (98 LB/(2*750 LB)) + (11 LB/(2*800 LB))
= **0.07** **< 1.2 OK**

(2) 3/8"Ø x 2-1/2" MIN. EMBED. HILTI KH-EZ SCREW ANCHOR (ICC ESR-3027)
PER ANCHOR PLATE; FRONT AND BACK, EVERY 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=900 LB, OK BY SIMPLE REVIEW)

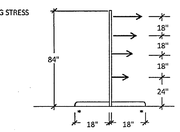
6

LOADS & DISTRIBUTION: TYPE 84"Hx48"Wx18"D **(SEE DETAIL J)**
ANALYSIS BASED ON SECTION 1613 OF THE 2010 OSSC AND THE ASCE 7-05.

SITE CLASS = D
$V = C_s * W_s$ WHERE $C_s = S_{DS}/(R/I)$
AND W_s = OPERATING WEIGHT
$S_{DS} = 2/3*F_a*S_s$ WHERE $S_s = 0.86$, $F_a = 1.16$
= 0.665
I = 1.50 <=== IN AREA OF PUBLIC ACCESS
R = 3 <=== TABLE 15.4-2

REDUCTION = 0.7 <=== WORKING STRESS

NO. OF LEVELS = 4 LVL
PRODUCT LOAD, wPL = 70 LB/LVL
DEAD LOAD, wDL = 5 LB/LVL



LONGITUDINAL & TRANSVERSE DIRECTION

V = [0.7*0.665*1.5*(0.67*280 LB+20 LB)*2/3]
= 97 LB

LATERAL FORCE DISTRIBUTION						
h	LEVEL	WEIGHT	HEIGHT	W X H	Fi	Mot
24 IN	1	150 LB	24 IN	3,600 IN-LB	11 LB	273 IN-LB
18 IN	2	150 LB	42 IN	6,300 IN-LB	20 LB	836 IN-LB
18 IN	3	150 LB	60 IN	9,000 IN-LB	28 LB	1,706 IN-LB
18 IN	4	150 LB	78 IN	11,700 IN-LB	37 LB	2,882 IN-LB
78 IN		600 LB	Σ =	30,600 IN-LB	97 LB	5,697 IN-LB

7

OVERTURNING ANALYSIS: TYPE 84"Hx49"Wx18"D **(SEE DETAIL D)**
DOUBLE SIDED DEPTH (D) = 36 IN
TOP SHELF HEIGHT = 78 IN
LEVELS= 4 LVL

(A) FULLY LOADED/DOUBLE SIDED LOADED:
Vtotal = 97 LB

Mot = Σ(Fp*h)*0.75
= 4,272 IN-LB

Mst = Σ[(0.6-0.11S_{DS})wDL +0.75*(0.6-0.14S_{DS})*0.67wPL] x Depth / 2
= 2,947 IN-LB

Puplift = (Mot - Mst)/D
= 37 LB <= UPLIFT

(B) TOP SHELF LOADED/DOUBLE SIDED LOADED:
Vtop = (0.7*0.665*1.5*(70 LB + 20 LB) *2/3]
= 42 LB

Mot = Vtop*h*0.75
= 2,451 IN-LB

Mst = Σ[(0.6-0.11S_{DS})wDL +0.75*(0.6-0.14S_{DS})wPL] x Depth / 2
= 1,337 IN-LB

Puplift = (Mot - Mst)/D
= 31 LB <= UPLIFT

ANCHOR:
QUANTITY= 2 PULLOUT = 750 LB SHEAR = 800 LB
OCCURRENCE = 2

Ps/Pt + Vs/Vt ≤ 1.2
COMBINED STRESS(A) = (74 LB/(2*750 LB)) + (96 LB/(2*800 LB))
= **0.11** **< 1.2 OK**

COMBINED STRESS(B) = (62 LB/(2*750 LB)) + (42 LB/(2*800 LB))
= **0.07** **< 1.2 OK**

USE (2) 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=900 LB, OK BY SIMPLE REVIEW)

8

ADDRESS:
O'REILLY AUTO
489 WEST 5TH AVENUE
JUNCTION CITY, OR

REV.	DATE	BY	DESCRIPTION
◁			
◁			
◁			
◁			
◁			

SEIZMIC
EST. 1985
SEIZMIC ENGINEERING, INC.
161 Atlantic Street
Pomona, California 91768
Tel.(909)869-0989
Fax (909)869-0981

DRAWN BY:	A.N./T.C.
DATE:	08/27/13
LAST REV. BY:	
REV. DATE:	
TYPE:	LOZ
SCALE:	N.T.S.
APRVD BY:	SAL E. FATEEN

REGISTERED PROFESSIONAL ENGINEER 12303 OREGON JULY 15, 1983 MICHAEL M. OBI

EXPIRATION DATE: DEC 31 2014

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

DRAWING NUMBER:
13-1274-B