THE VMC GROUP

Aeroflex International Isolators | Amber/Booth | Korfund Dynamics | Vibration Mountings & Controls

PROJECT: YASKAWA A1000 AND Z1000 VFD DRIVES

REP:

ARCHITECT:

ENGINEER:

CUSTOMER: Yaskawa of America

P.O. NUMBER: 420015865

COMMENTS:

Bolt Sizing for seismic parameters
Sds=2.00
z/h (roof installation)=1
Ip=1.5 (seismic importance factor)

S/O NO.: NJ243008

DATE: 10/25/2012

VMA NO.: VMA-47676-01A Rev1

The VMC Group
Headquarters: 113 Main Street, Bloomingdale, NJ 07403 • Tel: 973-838-1780 • Fax: 973-492-8430
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REV.	DESCRIPTION	SOURCE of CHANGE	DATE
0	Initial Submittal	ASP	04/19/11
1	Rev 1	Matrix rev	10/22/12

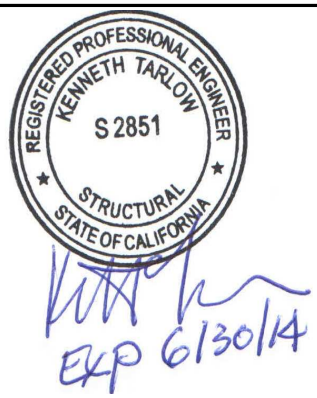
SEISMIC RESTRAINT
For
Yaskawa Z1000 and A1000 wall mounted Commercial VFDs.

CUSTOMER: YASKAWA OF AMERICA

JOB: YASKAWA A1000 AND Z1000 VFD DRIVES
P.O. No: 4200158685

The following report has been performed for compliance with the applicable building codes and job specifications.

Applicable Building Code: **IBC-2009**
Applicable Job Specification: **CBC 2010**



This report reflects information received and reviewed for seismic restraint as of date shown

Kenneth Tarlow SE
SE2851
California Structural Engineer

The VMC Group
113 Main Street
Bloomingdale NJ, 07403

THE VMC GROUP
The Power of Together ™

CAGE CODE	SIZE	DWG NO	REV
4U931		VMA-47676-01A Rev1	1

BY	DATE:	SO NO.	SHEET:
KMT	10/25/2012	NJ243008	2 of 43

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CUSTOMER	BY	DATE	CHECKED	DATE
Yaskawa of America	KMT	10/25/2012		

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ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 7/2/2012

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER		CONTACT NAME: Gregory Downs	
Frenkel & Company 350 Hudson Street, 4th Floor New York, NY 10014	(212) 488-0200	PHONE (A/C, No, Ext): 201-793-4010	FAX (A/C, No): 201-356-0052
		E-MAIL ADDRESS: Gdowns@frenkel.com	
		INSURER(S) AFFORDING COVERAGE	NAIC #
		INSURER A : Lloyd's of London	112200
INSURED The VMC Group 113 Main Street Bloomingdale, NJ 07403-		INSURER B :	
		INSURER C :	
		INSURER D :	
		INSURER E :	
		INSURER F :	

COVERAGES CERTIFICATE NUMBER: REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	GENERAL LIABILITY						EACH OCCURRENCE	$
	COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$
	CLAIMS-MADE OCCUR						MED EXP (Any one person)	$
							PERSONAL & ADV INJURY	$
							GENERAL AGGREGATE	$
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$
	POLICY PRO-JECT LOC							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	ANY AUTO						BODILY INJURY (Per person)	$
	ALL OWNED AUTOS / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	HIRED AUTOS / NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
	UMBRELLA LIAB OCCUR						EACH OCCURRENCE	$
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$
	DED RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N						WC STATU-TORY LIMITS OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N / A (Mandatory in NH)						E.L. EACH ACCIDENT	$
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$
A	Manufacturers Engineering			PVMC00112	7/1/2012	7/1/2013	Occurrence Limit	3,000,000
A	Design Errors & Omissions			PVMC00112	7/1/2012	7/1/2013	Deductible	50,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, If more space is required)

CERTIFICATE HOLDER

Evidence of Coverage
-

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

PROJECT	JOB / DWG NUMBER	REV. NO.	SHEET NO.
Yaskawa A1000 and Z1000 VFD drives	VMA-243008-01A Rev1	1	5 of 43

CUSTOMER	BY	DATE	CHECKED	DATE
Yaskawa of America	KMT	10/25/2012		

Certified Product Tables

YASKAWA AMERICA CORP.

Table 1 - A1000 Series Standard VFDs (Industrial AC Drives)

Standard Drive Model Series	Standard Drive Frame Size	Max. Cabinet Dims L x W x H [in]	Max. Cabinet Weight [lbs]	Anchor size
CIMR-AU2A	12	13.8 x 23.2 x 46.0	238	1/2" dia
CIMR-AU2A	12	13.8 x 23.2 x 46.0	240	
CIMR-AU4A			233	
CIMR-AU4A			246	
CIMR-AU4A			257	
CIMR-AU5A			233	
CIMR-AU5A			235	
CIMR-AU4A	13	14.6 x 24.1 x 48.3	292	1/2" dia
CIMR-AU4A	14	14.6 x 30.4 x 61.3	504	1/2" dia
CIMR-AU4A	14	14.6 x 30.4 x 61.3	515	

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CUSTOMER	BY	DATE	CHECKED	DATE
Yaskawa of America	KMT	10/25/2012		

Table 2 - Z1000 Series Standard VFDs (Commercial HCAC Drives)

Standard Drive Model Series	Standard Drive Frame Size	Max. Cabinet Dims L x W x H [in]	Max. Cabinet Weight [lbs]	Anchor Size
CIMR-ZU2A	1	8.7x4.9x14.1	12.3	#10
CIMR-ZU2A			13.0	
CIMR-ZU4A			4.8	
CIMR-ZU4A			7.6	
CIMR-ZU4A			11.0	
CIMR-ZU2A	2	9.3x4.9x14.1	16.3	#10
CIMR-ZU2A			17.2	
CIMR-ZU4A			16.1	
CIMR-ZU4A			16.7	
CIMR-ZU4A			18.5	
CIMR-ZU2A	3	9.4x7.9x20.1	26.0	1/4" dia
CIMR-ZU2A			29.0	
CIMR-ZU4A				
CIMR-ZU4A				
CIMR-ZU2A	4	10.5x10.0x21.3	59.0	1/4" dia
CIMR-ZU2A			62.0	
CIMR-ZU2A			64.0	
CIMR-ZU4A	4	10.5x10.0x21.3	59.0	
CIMR-ZU4A			64.0	
CIMR-ZU4A			68.0	
CIMR-ZU4A			70.0	
CIMR-ZU4A	5	11.5x10.9x27.6	101	3/8" dia
CIMR-ZU2A	6	15.9x13.4x30.5	143	3/8" dia
CIMR-ZU2A			150	
CIMR-ZU2A			154	
CIMR-ZU2A			161	
CIMR-ZU4A			161	
CIMR-ZU4A			167	
CIMR-ZU4A			174	
CIMR-ZU4A	7	19.0x17.9x41.1	286	3/8" dia
CIMR-ZU2A	8	13.8 x 23.2 x 31.5	238	3/8" dia.
CIMR-ZU2A			238	
CIMR-ZU4A			257	
CIMR-ZU4A	9	14.6 x 24.1 x 37.4	292	1/2" dia.
CIMR-ZU4A	10	14.6 x 30.4 x 44.9	504	1/2" dia.
CIMR-ZU4A				
CIMR-ZU4A	10	14.6 x 30.4 x 44.9	515	

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Table 3 - Z1000 Series Bypass VFDs (Commercial HVAC Drives)

Bypass Drive Base Model	Bypass Drive Cabinet Size	Max. Cabinet Dims L x W x H [in]	Max. Cabinet Weight [lbs]	Anchor Size
Z1B1D002	W1	41.6x6.8.0x12.9	70	3/8" dia.
Z1B1D003				
Z1B1D004				
Z1B1D007				
Z1B1D010				
Z1B1D016				
Z1B1B001				
Z1B1B002				
Z1B1B003				
Z1B1B004				
Z1B1B007				
Z1B1B011				
Z1B1D024	W2	45.1x6.8x12.9	80	3/8" dia.
Z1B1D030				
Z1B1B014				
Z1B1B021				
Z1B1B027				
Z1B1D046	W3	48.2x10.2x13.2	90	3/8" dia.
Z1B1D059				
Z1B1B034				
Z1B1B040				
Z1B1D074	W4	52.8x12.7x14.2	160	3/8" dia.
Z1B1D088	W5	42.8x25.8x16.1	280	1/2" dia
Z1B1D114	W5	42.8x25.8x16.1	280	1/2" dia
Z1B1B052	W4	52.8x12.7x14.2	160	3/8" dia.
Z1B1B065				
Z1B1B077				
Z1B1B096	W5	42.8x25.8x16.1	280	1/2" dia
Z1B1B124	W5	42.8x25.8x16.1	280	1/2" dia
Z1B1D143	W6	49.1x28.4x19.0	380	1/2" dia
Z1B1D169				
Z1B1B156	W6	49.1x28.4x19.0	380	1/2" bolt
Z1B1B180				

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Yaskawa of America	KMT	10/25/2012		

Table 4 - Z1000 Series Configured VFDs (Commercial HVAC Drives)

Configured Drive Base Model	Configured Drive Cabinet Size	Max. Cabinet Dims L x W x H [in]	Max. Cabinet Weight [lbs]	Anchor size
Z1C1D002	W1	41.6x6.8.0x12.9	65	3/8" dia
Z1C1D003				
Z1C1D004				
Z1C1D007				
Z1C1D010				
Z1C1D016				
Z1C1B001				
Z1C1B002				
Z1C1B003				
Z1C1B004				
Z1C1B007				
Z1C1B011				
Z1C1D024	W2	45.1x6.8x12.9	75	3/8" dia
Z1C1D030				
Z1C1B014				
Z1C1B021				
Z1C1B027				
Z1C1D046	W3	48.2x10.2x13.2	85	3/8" dia
Z1C1D059				
Z1C1B034				
Z1C1B040				
Z1C1D074	W4	52.8x12.7x14.2	160	3/8 dia
Z1C1D088				
Z1C1D114	W4	52.8x12.7x14.2	160	3/8 dia
Z1C1B052	W4	52.8x12.7x14.2	160	3/8" dia
Z1C1B065			160	
Z1C1B077	W4		160	
Z1C1B096			180	
Z1C1B124	W5	42.8x25.8x16.1	240	1/2 " dia
Z1C1D143	W6	49.1x28.4x19.0	385	1/2" dia
Z1C1D169			385	
Z1C1D211			385	
Z1C1D273			450	
Z1C1B156			385	
Z1C1B180			385	
Z1C1B240			450	

Section II. SCHEDULE

Frame no	Max weight	Attach. to Conc	Attach. to CMU	Attch. To Steel	Attach. to Timber
A1000 Models Standard Frames 12 Thru 14 & Z1000 By Pass Frames W5 and W6	515 lbs	1/2" dia Hilti Kwik Bolt TZ with 3 1/2" embed.	1/2" Dia Simpson Titen Screw Anchor with 3 1/2" embed.	1/2" Dia A307 Bolt	1/2" Dia A307 bolt
Z1000 Frames 5 thru 8 and By Pass Frames W1 thru W4	257 lbs	3/8" Dia Hilti Kwik Bolt TZ with 3" of Embed.	3/8" Dia Simpson Titen Screw Anchor with 2" embed.	3/8" dia A307 Bolt	3/8" Dia A307 Bolt
Z1000 Frames 3 and 4	70 lbs	1/4" Dia Hilti Kwik Bolt TZ with 3 1/2" embed	NA	1/4" dia TEK Screw	1/4"x3" Simpson SDS Screw
Z1000 Frames 1 and 2	18.5 lbs	NA	NA	#10 TEK Screw	#10 Wood Screw

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Yaskawa of America	KMT	10/25/2012		

III. SUMMARY OF CRITICAL ASSUMPTIONS AND DIRECTIVE STATEMENTS:

1. This analysis does not certify that the concrete housekeeping pads, building structure, isolated or restrained equipment, or any other attached equipment, such as piping or ductwork, is capable of handling the applied seismic loads. Any non-VMC Group mounting supports, brackets, or other means of attachment must be independently certified. This calculation only certifies the seismic restraint capability of attachment of said equipment.

2. Weight and dimensional data were provided by the customer. Information not provided for in the job specification must be verified by the building engineer. The values used in this analysis should be verified. If they vary, disregard these recommendations and notify The VMC Group of the changes.

3. All accessory attachments (pipe, conduit, etc.) to the equipment shall be attached in a manner that allows relative motion (flex, swing joint/elbow, etc.) to prevent failure due to differential movement between the equipment and attached accessory caused by seismic loading on the system.

4. Unless noted on the drawings, all drawings in this report are considered not to scale.

5. All housekeeping pads must be properly dowelled and reinforced by others to carry the seismic loads.

6. When several pieces of equipment are installed identically, the most critical one is analyzed.

7. When installing concrete expansion anchors, they must be torqued to manufacturer recommended settings to ensure maximum holding capacity in the concrete. Observe concrete edge distance and anchor spacing limitations as expressed by the anchor manufacturer or ICCES rating publication. For anchors installed in the underside of the slab, embedment depth must be at least one half of the slab thickness to ensure the anchor is embedded in the compression zone of the slab.

IV. PURPOSE:

This report is submitted to Yaskawa of America for the Yaskawa A1000 and Z1000 VFD drives project to verify that the seismic restraints provided and/or recommended by The VMC Group will safely accept loads resulting from seismic forces and normal operating loads.

V. SCOPE:

This report covers only seismic restraints and engineering recommendations provided by The VMC Group for use as listed in Schedule table.

This report does not cover equipment supplied by other vendors. The structural design professional must verify the adequacy of the superstructure or substructure to which the specified hardware are attached. The structure must withstand the seismic loads applied at restraint locations.

The following report has been performed for compliance with the applicable building codes and job specification PO4200158685. If there are any specifications or information that supersede the assumptions made herein, this analysis may be invalid, and The VMC Group must be notified for review of changes.

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VI. STRATEGY AND ASSUMPTIONS:

For the purposes of this analysis, it must be assumed that the building and its internal structure have been designed to perform as required by the adopted building code in response to an earthquake and remain intact and functioning after such an event. Per code the equipment must be restrained and not break away from its supports during an earthquake. The forces acting on a piece of equipment are the vertical and lateral forces resulting from the earthquake, the force of gravity, and the forces at the restraints that hold the equipment in place. The analysis assumes that the equipment does not move beyond the restraints during the earthquake. The acceleration at its center of gravity generate forces that must be balanced by reactions at the restraints. The code allows equipment to be analyzed as though it were a rigid component; however, factors (*ap, Rp*) are applied within the computation to address flexibility issues for particular equipment types or flexible mounting arrangements. Given the above, the problem can be reduced to a static analysis.

The forces acting on the restraints include both shear and tensile components. The application direction of the lateral seismic acceleration can vary and is unknown. Depending on its direction, it is likely that not all of the restraints will be affected or share the load equally. This report will determine the worst case combination of forces at all restraint points for any possible direction that the acceleration can follow to ensure that the restraints are adequate.

It is assumed that the equipment is design to be strong enough to transfer the load path from its center of gravity to the restraint connection points without failure. Under some instances (particularly those relating to life support issues in hospital settings) newer code requirements indicate that critical equipment must be seismically qualified to ensure its continued operation during and after a seismic event. Special care must be taken in these situations to ensure that the equipment has been certified to meet the maximum anticipated seismic load.

VII. ALLOWABLE LOADS:

Unless otherwise specified, allowable bolt loads are per the Manual of Steel Construction - AISC 13th Edition. All concrete is assumed to be 2500 psi.

For Concrete Anchors: Ratings are per ICC ESR reports.

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VIII. SEISMIC INPUT LOADS (LRFD)

These calculations certify that the VMC components and specified hardware, when properly installed, are capable of safely supporting a maximum seismic load based upon the LRFD load combinations from ASCE-7:

1.2D(+/-) 1.0E (Section 2.3.2 Equation 5)
0.9D(+/-) 1.0E (Section 2.3.2 Equation 7)

Where:

$E = pQ_E(+/-).2S_{ds}D$
p= Reliability factor: taken as 1.0 for mechanical and electrical components
Q_E = horizontal seismic force F_p
S_{DS}= Design spectral response
D= Dead load
($0.2S_{DS}D$ is taken in the vertical direction)

Final Seismic Loading Conditions:

1: Vertical Load (P_z) = ($1.2 + 0.2*S_{DS}$) Horizontal Load (P_h) = F_p
2: Vertical Load (P_z) = ($0.9 - 0.2*S_{DS}$) Horizontal Load (P_h) = F_p

Horizontal Seismic Force per equation 13.3-1 (ASCE 7-05):

$$F_p = \frac{0.4*a_p*S_{DS}*(1+2(z/h))}{(R_p/I_p)} *W_p$$

Where:
a_p = The attachment amplification factor from Table 13.6-1 (ASCE 7-05)
S_{DS} = Design Spectral Response Acc. at short period, Section 11.4.4 (ASCE 7-05)
S_{MS} = Max Earthquake Spectral Response Acc. for Short Period, Section 11.4.3 (ASCE 7-05)
F_a = Site Coefficient from Table 1613.5.3(1) (IBC 2006) (Use "D" if unknown)
S_s = Mapped Spectral Acc. for Short Period, Section 1613.5.1 (IBC 2006)
z = Height of the equipment attachment to structure.
h = Average Roof Height
R_p = Component Response Modification factor from Table 13.6-1 (ASCE 7-05)
I_p = Component Importance factor from Section 13.1.3 (ASCE 7-05)
W_p = The operating weight of the system

And: $S_{DS} = (2/3)*S_{MS}$ $S_{MS} = F_a*S_s$

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VIII. SEISMIC INPUT FORCES: LRFD Contd.

The building is a Occupancy Category IV Ss = 3.00

Site class = D Therefore use Seismic Design Category D

From the appropriate tables: Fa = **1.00** Sds = **2.000**

For: ap = 2.5, Rp = 2.5, Ip = 1.5

At: z/h =	Fp =
0.0	1.20 g's
0.2	1.68 g's
0.4	2.16 g's
0.6	2.64 g's
0.8	3.12 g's
1.0	3.60 g's

Satisfying the upper and lower bounds: 0.3*Sds*Ip*Wp < Fp < 1.6*Sds*Ip*Wp

At Ip = 1.5, Fp Min = 0.90 g's At Ip = 1, Fp Min = 0.60 g's

At Ip = 1.5, Fp Max = 4.80 g's At Ip = 1, Fp Max = 3.20 g's

Table 2

Condition 1	At z/h =	Ph	Pz	Ph	Pz	Ph	Pz	Ph	Pz
	0.0	1.20 g's	1.60 g's						
	0.2	1.68 g's	1.60 g's						
	0.4	2.16 g's	1.60 g's						
	0.6	2.64 g's	1.60 g's						
	0.8	3.12 g's	1.60 g's						
	1.0	3.60 g's	1.60 g's						
Condition 2	0.0	1.20 g's	0.50 g's						
	0.2	1.68 g's	0.50 g's						
	0.4	2.16 g's	0.50 g's						
	0.6	2.64 g's	0.50 g's						
	0.8	3.12 g's	0.50 g's						
	1.0	3.60 g's	0.50 g's						

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IX. i Anchoring Analysis

Design Criteria

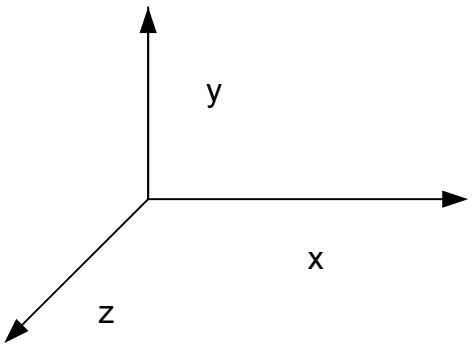
The VFD Drives are all wall mounted with a minimum of 4 bolts. There are 4 different bolt sizes, the bolts getting larger as the weights increase. We have evaluated the largest unit with each bolt size.

The RISA3d program was used to approx. the behavior of the steel box.

All loads were applied at the center of mass of the box to develops appropriate torsion

Loading Combinations

1.2D – EY + Ex	1.2D +EY + Ex	1.2D – EY – Ex	1.2D + EY - Ex
.9D+ EY+ Ex	.9D – EY + Ex	.9D + EY- Ex	.9D – EY – Ex
1.2D – EY + Ez	1.2D +EY + Ez	1.2D – EY – Ez	1.2D + EY - Ez
.9D+ EY+ Ez	.9D – EY + Ez	.9D + EY- Ez	.9D – EY - Ez



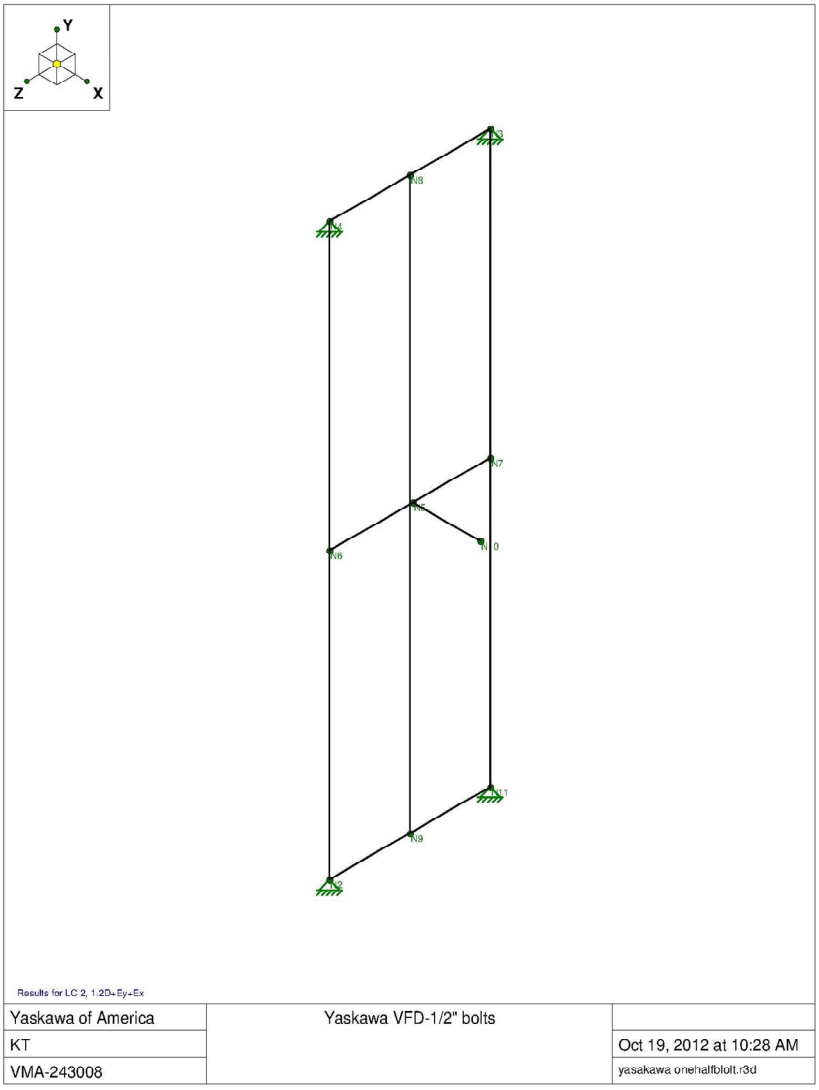
Coordinate System

Critical weights largest loads for each connector type.

Standard Drive Model Series	Frame Size	Max Cabinet Dims LxWxH	Max Cabinet weight	Anchor Size
CIMIR-ZU4A	2	9.3x4.9x14.1	18.5 lbs	#10
CIMIR-ZU4A	3	9.4x7.9x20.1	29	1/4" dia.
CIMR-ZU4A	8	13.8x23.2x31.5	257	3/8" dia
CIMR-AU4A	14	14.6 x30.4x 61.3	515 lbs	1/2" dia

PROJECT	JOB / DWG NUMBER	REV. NO.	SHEET NO.
Yaskawa A1000 and Z1000 VFD drives	VMA-243008-01A Rev1	1	15 of 43

CUSTOMER	BY	DATE	CHECKED	DATE
Yaskawa of America	KMT	10/25/2012		



The Risa3D model

PROJECT	JOB / DWG NUMBER	REV. NO.	SHEET NO.
Yaskawa A1000 and Z1000 VFD drives	VMA-243008-01A Rev1	1	16 of 43

CUSTOMER	BY	DATE	CHECKED	DATE
Yaskawa of America	KMT	10/25/2012		

½" Dia Anchors

Z1000 Series Frame size 9 thru 14
Z1000 bypass frames sizes W5 thru W6

Weight max=515 lbs

Vseis horiz=3.6w or 3.6x515=1854 lbs
Vseis vert= .2Sds=.2x2x1854=206 lbs

Results from Risa3D model see appendix A

Vy=214 Vz=23.5

V tens=530 lbs/ bolt

For Concrete Use ½" dia Hilti Kwik Bolt TZ with 3 ½" Embed See Appendix E

For Masonry (CMU) ½" dia Simpson Titen Screw Anchors with 3 ½" Embed per ESR 1056

For Timber Use ½" dia A 307 Bolt

For Steel Use ½" Dia A307 Bolt

3/8" Dia Anchors

Z1000 Series Frame size 5 thru 8
Z1000 bypass frames sizes W1 thru W4

Wt.=257 lbs
Vseis= 3.6 x 257=925lbs
V vert=.4x257= 102.8 lbs

Results From Risa3d model Appendix B

Results
Vens=275 lbs Vz=29.1 Vy=102

For Concrete Hilti Kwik Bolt TZ 3/8" dia with 3 " embed see Appendix F

For Masonry 3/8" dia Simpson Titen HD screw anchor with 3" embed @ ESR 1056

For Timber 3/8" lag bolt with 4" Embed.

For Steel 3/8 Dia A307 Bolt.

PROJECT	JOB / DWG NUMBER	REV. NO.	SHEET NO.
Yaskawa A1000 and Z1000 VFD drives	VMA-243008-01A Rev1	1	17 of 43

CUSTOMER	BY	DATE	CHECKED	DATE
Yaskawa of America	KMT	10/25/2012		

1/4" dia anchors

Z1000 Series Frame size 3 and 4

Weight max=70 lbs

Vseis horiz=3.6w or 3.6x515=252 lbs
Vseis vert= .2Sds=.2x2x1854=28 lbs

Results from Risa3D model see Appendix C

Vy=28 lbs Vz=4 lbs

V tens=76.17 lbs

For Concrete Use 1/4" dia Hilti Kwick Bolt TZ with 3 ½" Embed See Appendix G

For Masonry (CMU) NA

For Timber Use ¼" dia Simpson SDS screw @ ESR#2236

For Steel Use ¼" Self tapping Tek Screw

10 Ga. Dia Anchors

Z1000 Series Frame size 1 and 2

Wt.=10 lbs
Vseis= 3.6 x 10=36lbs
V vert=.4x257= 4 lbs

Results From Risa3d model Appendix D

Results
Vens= 10 lbs Vz=29.1 Vy=102

For Concrete NA

For Masonry NA

For Timber #10 Wood Screw

For Steel #12 Tek screw

Appendix A

Risa3d model, output for Frame type 14

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area (Me...	Surface (...
1	dead	DL				1				
2	seis x	ELX				1				
3	seis z	ELZ				1				
4	.4Sds	ELY				1				

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]	Footing
1	N4	Reaction	Reaction	Reaction				
2	N3	Reaction	Reaction	Reaction				
3	N2	Reaction	Reaction	Reaction				
4	N1	Reaction	Reaction	Reaction				

Joint Coordinates and Temperatures

	Label	X [in]	Y [in]	Z [in]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	0	0	17.3	0	
3	N3	0	61.4	0	0	
4	N4	0	61.4	17.3	0	
5	N5	0	30.7	8.33	0	
6	N6	0	30.7	17.3	0	
7	N7	0	30.7	0	0	
8	N8	0	61.4	8.65	0	
9	N9	0	0	8.65	0	
10	N10	7.25	30.7	8.33	0	
11	N11	0	0	0	0	

Load Combinations

	Description	Solve	PD...	SRSS	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	1.2D-Ey+Ex	Yes			DL	1.2	ELY	-1	ELX	1										
2	1.2D+Ey+Ex	Yes			DL	1.2	ELY	1	ELX	1										
3	1.2D-Ey-Ex	Yes			DL	1.2	ELY	-1	ELX	-1										
4	1.2D+Ey-Ex	Yes			DL	1.2	ELY	1	ELX	-1										
5	.9D-Ey+Ex	Yes			DL	.9	ELY	-1	ELX	1										
6	.9D+Ey+Ex	Yes			DL	.9	ELY	1	ELX	1										
7	.9D-Ey-Ex	Yes			DL	.9	ELY	-1	ELX	-1										
8	.9D+Ey-Ex	Yes			DL	.9	ELY	1	ELX	-1										
9	1.2D-Ey+Ez	Yes			DL	1.2	ELY	-1	ELZ	1										
10	1.2D+Ey+Ez	Yes			DL	1.2	ELY	1	ELZ	1										
11	1.2D-Ey-Ez	Yes			DL	1.2	ELY	-1	ELZ	-1										
12	1.2D+Ey-Ez	Yes			DL	1.2	ELY	1	ELZ	-1										
13	.9D-Ey+Ez	Yes			DL	.9	ELY	-1	ELZ	1										
14	.9D+Ey+Ez	Yes			DL	.9	ELY	1	ELZ	1										
15	.9D-Ey-Ez	Yes			DL	.9	ELY	-1	ELZ	-1										
16	.9D+Ey-Ez	Yes			DL	.9	ELY	1	ELZ	-1										
17	deqad				DL	1														

Joint Loads and Enforced Displacements (BLC 1 : dead)

	Joint Label	L,D,M	Direction	Magnitude[lb,k-ft in,rad lb*s^2/in]
1	N10	L	Y	-515

Joint Loads and Enforced Displacements (BLC 2 : seis x)

	Joint Label	L,D,M	Direction	Magnitude[lb,k-ft in,rad lb*s^2/in]
1	N10	L	X	1854

Joint Loads and Enforced Displacements (BLC 3 : seis z)

	Joint Label	L,D,M	Direction	Magnitude[lb,k-ft in,rad lb*s^2/in]
1	N10	L	Z	1850

Joint Loads and Enforced Displacements (BLC 4 : .4Sds)

	Joint Label	L,D,M	Direction	Magnitude[lb,k-ft in,rad lb*s^2/in]
1	N10	L	Y	-206

Joint Reactions (By Combination)

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N4	-469.885	98.672	11.495	0	0	0
2	1	N3	-505.763	107.328	-11.786	0	0	0
3	1	N2	-422.821	98.672	-11.495	0	0	0
4	1	N1	-455.53	107.328	11.786	0	0	0
5	1	Totals:	-1854	412	0			
6	1	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
7	2	N4	-493.417	197.344	22.989	0	0	0
8	2	N3	-530.88	214.656	-23.573	0	0	0
9	2	N2	-399.29	197.344	-22.989	0	0	0
10	2	N1	-430.414	214.656	23.573	0	0	0
11	2	Totals:	-1854	824	0			
12	2	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
13	3	N4	422.821	98.672	11.495	0	0	0
14	3	N3	455.53	107.328	-11.786	0	0	0
15	3	N2	469.885	98.672	-11.495	0	0	0
16	3	N1	505.763	107.328	11.786	0	0	0
17	3	Totals:	1854	412	0			
18	3	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
19	4	N4	399.29	197.344	22.989	0	0	0
20	4	N3	430.414	214.656	-23.573	0	0	0
21	4	N2	493.417	197.344	-22.989	0	0	0
22	4	N1	530.88	214.656	23.573	0	0	0
23	4	Totals:	1854	824	0			
24	4	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
25	5	N4	-461.06	61.67	7.184	0	0	0
26	5	N3	-496.345	67.08	-7.367	0	0	0
27	5	N2	-431.646	61.67	-7.184	0	0	0
28	5	N1	-464.949	67.08	7.367	0	0	0
29	5	Totals:	-1854	257.5	0			
30	5	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
31	6	N4	-484.592	160.342	18.679	0	0	0
32	6	N3	-521.461	174.408	-19.153	0	0	0
33	6	N2	-408.114	160.342	-18.679	0	0	0
34	6	N1	-439.832	174.408	19.153	0	0	0
35	6	Totals:	-1854	669.5	0			
36	6	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
37	7	N4	431.646	61.67	7.184	0	0	0
38	7	N3	464.949	67.08	-7.367	0	0	0
39	7	N2	461.06	61.67	-7.184	0	0	0
40	7	N1	496.345	67.08	7.367	0	0	0
41	7	Totals:	1854	257.5	0			
42	7	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
43	8	N4	408.114	160.342	18.679	0	0	0

Joint Reactions (By Combination) (Continued)

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
44	8	N3	439.832	174.408	-19.153	0	0	0
45	8	N2	484.592	160.342	-18.679	0	0	0
46	8	N1	521.461	174.408	19.153	0	0	0
47	8	Totals:	1854	669.5	0			
48	8	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
49	9	N4	364.113	-620.323	-450.834	0	0	0
50	9	N3	-412.761	826.681	-474.458	0	0	0
51	9	N2	411.176	817.667	-473.823	0	0	0
52	9	N1	-362.528	-612.024	-450.885	0	0	0
53	9	Totals:	0	412	-1850			
54	9	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
55	10	N4	340.581	-521.651	-439.339	0	0	0
56	10	N3	-437.878	934.009	-486.244	0	0	0
57	10	N2	434.708	916.338	-485.318	0	0	0
58	10	N1	-337.411	-504.696	-439.098	0	0	0
59	10	Totals:	0	824	-1850			
60	10	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
61	11	N4	-411.176	817.667	473.823	0	0	0
62	11	N3	362.528	-612.024	450.885	0	0	0
63	11	N2	-364.113	-620.323	450.834	0	0	0
64	11	N1	412.761	826.681	474.458	0	0	0
65	11	Totals:	0	412	1850			
66	11	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
67	12	N4	-434.708	916.338	485.318	0	0	0
68	12	N3	337.411	-504.696	439.098	0	0	0
69	12	N2	-340.581	-521.651	439.339	0	0	0
70	12	N1	437.878	934.009	486.244	0	0	0
71	12	Totals:	0	824	1850			
72	12	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
73	13	N4	372.937	-657.325	-455.145	0	0	0
74	13	N3	-403.342	786.432	-470.038	0	0	0
75	13	N2	402.352	780.665	-469.513	0	0	0
76	13	N1	-371.947	-652.272	-455.305	0	0	0
77	13	Totals:	0	257.5	-1850			
78	13	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
79	14	N4	349.406	-558.653	-443.65	0	0	0
80	14	N3	-428.459	893.761	-481.824	0	0	0
81	14	N2	425.883	879.336	-481.008	0	0	0
82	14	N1	-346.83	-544.944	-443.518	0	0	0
83	14	Totals:	0	669.5	-1850			
84	14	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
85	15	N4	-402.352	780.665	469.513	0	0	0
86	15	N3	371.947	-652.272	455.305	0	0	0
87	15	N2	-372.937	-657.325	455.145	0	0	0
88	15	N1	403.342	786.432	470.038	0	0	0
89	15	Totals:	0	257.5	1850			
90	15	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			
91	16	N4	-425.883	879.336	481.008	0	0	0
92	16	N3	346.83	-544.944	443.518	0	0	0
93	16	N2	-349.406	-558.653	443.65	0	0	0
94	16	N1	428.459	893.761	481.824	0	0	0
95	16	Totals:	0	669.5	1850			
96	16	COG (in):	X: 7.25	Y: 30.7	Z: 8.33			

Appendix B

Risa3D Model and out put for Frame Size 8

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area (Me...	Surface (...
1	dead	DL				1				
2	seis x	ELX				1				
3	seis z	ELZ				1				
4	.4Sds	ELY				1				

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]	Footing
1	N4	Reaction	Reaction	Reaction				
2	N3	Reaction	Reaction	Reaction				
3	N2	Reaction	Reaction	Reaction				
4	N1	Reaction	Reaction	Reaction				

Joint Coordinates and Temperatures

	Label	X [in]	Y [in]	Z [in]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	0	0	23.2	0	
3	N3	0	31.5	0	0	
4	N4	0	31.5	23.2	0	
5	N5	0	15.7	11.6	0	
6	N6	0	15.7	23.2	0	
7	N7	0	15.7	0	0	
8	N8	0	31.5	11.6	0	
9	N9	0	0	11.6	0	
10	N10	6.9	15.7	11.6	0	
11	N11	0	0	0	0	

Load Combination Design

	Description	ASIF	CD	ABIF	Service	Hot Rolled	Cold Formed	Wood	Concrete	Footings
1	1.2D-Ey+Ex					Yes	Yes	Yes	Yes	Yes
2	1.2D+Ey+Ex					Yes	Yes	Yes	Yes	Yes
3	1.2D-Ey-Ex					Yes	Yes	Yes	Yes	Yes
4	1.2D+Ey-Ex					Yes	Yes	Yes	Yes	Yes
5	.9D-Ey+Ex					Yes	Yes	Yes	Yes	Yes
6	.9D+Ey+Ex					Yes	Yes	Yes	Yes	Yes
7	.9D-Ey-Ex					Yes	Yes	Yes	Yes	Yes
8	.9D+Ey-Ex					Yes	Yes	Yes	Yes	Yes
9	1.2D-Ey+Ez					Yes	Yes	Yes	Yes	Yes
10	1.2D+Ey+Ez					Yes	Yes	Yes	Yes	Yes
11	1.2D-Ey-Ez					Yes	Yes	Yes	Yes	Yes
12	1.2D+Ey-Ez					Yes	Yes	Yes	Yes	Yes
13	.9D-Ey+Ez					Yes	Yes	Yes	Yes	Yes
14	.9D+Ey+Ez					Yes	Yes	Yes	Yes	Yes
15	.9D-Ey-Ez					Yes	Yes	Yes	Yes	Yes
16	.9D+Ey-Ez					Yes	Yes	Yes	Yes	Yes
17	deqad					Yes	Yes	Yes	Yes	Yes

Joint Loads and Enforced Displacements (BLC 1 : dead)

	Joint Label	L,D,M	Direction	Magnitude[lb,lb-in in,rad lb*s^2/in]
1	N10	L	Y	-257

Joint Loads and Enforced Displacements (BLC 2 : seis x)

	Joint Label	L,D,M	Direction	Magnitude[lb,lb-in in,rad lb*s^2/in]
1	N10	L	X	925

Joint Loads and Enforced Displacements (BLC 3 : seis z)

	Joint Label	L,D,M	Direction	Magnitude[lb,lb-in in,rad lb*s^2/in]
1	N10	L	Z	925

Joint Loads and Enforced Displacements (BLC 4 : .4Sds)

	Joint Label	L,D,M	Direction	Magnitude[lb,lb-in in,rad lb*s^2/in]
1	N10	L	Y	-102

Joint Reactions (By Combination)

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [lb-in]	MY [lb-in]	MZ [lb-in]
1	1	N4	-253.122	51.516	14.651	0	0	0
2	1	N3	-253.122	51.516	-14.651	0	0	0
3	1	N2	-209.378	51.684	-14.759	0	0	0
4	1	N1	-209.378	51.684	14.759	0	0	0
5	1	Totals:	-925	206.4	0			
6	1	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
7	2	N4	-275.464	102.433	29.132	0	0	0
8	2	N3	-275.464	102.433	-29.132	0	0	0
9	2	N2	-187.036	102.767	-29.346	0	0	0
10	2	N1	-187.036	102.767	29.346	0	0	0
11	2	Totals:	-925	410.4	0			
12	2	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
13	3	N4	207.91	51.516	14.651	0	0	0
14	3	N3	207.91	51.516	-14.651	0	0	0
15	3	N2	254.59	51.684	-14.759	0	0	0
16	3	N1	254.59	51.684	14.759	0	0	0
17	3	Totals:	925	206.4	0			
18	3	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
19	4	N4	185.567	102.433	29.132	0	0	0
20	4	N3	185.567	102.433	-29.132	0	0	0
21	4	N2	276.933	102.767	-29.346	0	0	0
22	4	N1	276.933	102.767	29.346	0	0	0
23	4	Totals:	925	410.4	0			
24	4	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
25	5	N4	-244.677	32.272	9.178	0	0	0
26	5	N3	-244.677	32.272	-9.178	0	0	0
27	5	N2	-217.823	32.378	-9.246	0	0	0
28	5	N1	-217.823	32.378	9.246	0	0	0
29	5	Totals:	-925	129.3	0			
30	5	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
31	6	N4	-267.02	83.189	23.659	0	0	0
32	6	N3	-267.02	83.189	-23.659	0	0	0
33	6	N2	-195.48	83.461	-23.833	0	0	0
34	6	N1	-195.48	83.461	23.833	0	0	0
35	6	Totals:	-925	333.3	0			
36	6	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
37	7	N4	216.354	32.272	9.178	0	0	0
38	7	N3	216.354	32.272	-9.178	0	0	0
39	7	N2	246.146	32.378	-9.246	0	0	0
40	7	N1	246.146	32.378	9.246	0	0	0
41	7	Totals:	925	129.3	0			
42	7	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
43	8	N4	194.012	83.189	23.659	0	0	0

Joint Reactions (By Combination) (Continued)

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [lb-in]	MY [lb-in]	MZ [lb-in]
44	8	N3	194.012	83.189	-23.659	0	0	0
45	8	N2	268.488	83.461	-23.833	0	0	0
46	8	N1	268.488	83.461	23.833	0	0	0
47	8	Totals:	925	333.3	0			
48	8	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
49	9	N4	114.442	-77.414	-215.348	0	0	0
50	9	N3	-159.654	180.446	-244.65	0	0	0
51	9	N2	160.665	182.017	-247.259	0	0	0
52	9	N1	-115.454	-78.648	-217.742	0	0	0
53	9	Totals:	0	206.4	-925			
54	9	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
55	10	N4	92.1	-26.498	-200.867	0	0	0
56	10	N3	-181.997	231.363	-259.131	0	0	0
57	10	N2	183.008	233.1	-261.847	0	0	0
58	10	N1	-93.111	-27.565	-203.155	0	0	0
59	10	Totals:	0	410.4	-925			
60	10	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
61	11	N4	-159.654	180.446	244.65	0	0	0
62	11	N3	114.442	-77.414	215.348	0	0	0
63	11	N2	-115.454	-78.648	217.742	0	0	0
64	11	N1	160.665	182.017	247.259	0	0	0
65	11	Totals:	0	206.4	925			
66	11	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
67	12	N4	-181.997	231.363	259.131	0	0	0
68	12	N3	92.1	-26.498	200.867	0	0	0
69	12	N2	-93.111	-27.565	203.155	0	0	0
70	12	N1	183.008	233.1	261.847	0	0	0
71	12	Totals:	0	410.4	925			
72	12	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
73	13	N4	122.887	-96.658	-220.821	0	0	0
74	13	N3	-151.21	161.202	-239.178	0	0	0
75	13	N2	152.221	162.71	-241.746	0	0	0
76	13	N1	-123.898	-97.955	-223.255	0	0	0
77	13	Totals:	0	129.3	-925			
78	13	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
79	14	N4	100.544	-45.741	-206.34	0	0	0
80	14	N3	-173.552	212.119	-253.658	0	0	0
81	14	N2	174.564	213.794	-256.334	0	0	0
82	14	N1	-101.555	-46.872	-208.668	0	0	0
83	14	Totals:	0	333.3	-925			
84	14	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
85	15	N4	-151.21	161.202	239.178	0	0	0
86	15	N3	122.887	-96.658	220.821	0	0	0
87	15	N2	-123.898	-97.955	223.255	0	0	0
88	15	N1	152.221	162.71	241.746	0	0	0
89	15	Totals:	0	129.3	925			
90	15	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			
91	16	N4	-173.552	212.119	253.658	0	0	0
92	16	N3	100.544	-45.741	206.34	0	0	0
93	16	N2	-101.555	-46.872	208.668	0	0	0
94	16	N1	174.564	213.794	256.334	0	0	0
95	16	Totals:	0	333.3	925			
96	16	COG (in):	X: 6.9	Y: 15.7	Z: 11.6			

Appendix C

Risa3D model for frame size 4

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area (Me...	Surface (...
1	dead	DL				1				
2	seis x	ELX				1				
3	seis z	ELZ				1				
4	.4Sds	ELY				1				

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]	Footing
1	N4	Reaction	Reaction	Reaction				
2	N3	Reaction	Reaction	Reaction				
3	N2	Reaction	Reaction	Reaction				
4	N1	Reaction	Reaction	Reaction				

Joint Coordinates and Temperatures

	Label	X [in]	Y [in]	Z [in]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	0	0	10	0	
3	N3	0	21.3	0	0	
4	N4	0	21.3	10	0	
5	N5	0	10.65	5	0	
6	N6	0	10.65	10	0	
7	N7	0	10.65	0	0	
8	N8	0	21.3	5	0	
9	N9	0	0	5	0	
10	N10	5	10.65	5	0	

Load Combination Design

	Description	ASIF	CD	ABIF	Service	Hot Rolled	Cold Formed	Wood	Concrete	Footings
1	1.2D-Ey+Ex					Yes	Yes	Yes	Yes	Yes
2	1.2D+Ey+Ex					Yes	Yes	Yes	Yes	Yes
3	1.2D-Ey-Ex					Yes	Yes	Yes	Yes	Yes
4	1.2D+Ey-Ex					Yes	Yes	Yes	Yes	Yes
5	.9D-Ey+Ex					Yes	Yes	Yes	Yes	Yes
6	.9D+Ey+Ex					Yes	Yes	Yes	Yes	Yes
7	.9D-Ey-Ex					Yes	Yes	Yes	Yes	Yes
8	.9D+Ey-Ex					Yes	Yes	Yes	Yes	Yes
9	1.2D-Ey+Ez					Yes	Yes	Yes	Yes	Yes
10	1.2D+Ey+Ez					Yes	Yes	Yes	Yes	Yes
11	1.2D-Ey-Ez					Yes	Yes	Yes	Yes	Yes
12	1.2D+Ey-Ez					Yes	Yes	Yes	Yes	Yes
13	.9D-Ey+Ez					Yes	Yes	Yes	Yes	Yes
14	.9D+Ey+Ez					Yes	Yes	Yes	Yes	Yes
15	.9D-Ey-Ez					Yes	Yes	Yes	Yes	Yes
16	.9D+Ey-Ez					Yes	Yes	Yes	Yes	Yes
17	deqad					Yes	Yes	Yes	Yes	Yes

Joint Loads and Enforced Displacements (BLC 1 : dead)

	Joint Label	L,D,M	Direction	Magnitude[lb,lb-ft in,rad lb*s^2/in]
1	N10	L	Y	-70

Joint Loads and Enforced Displacements (BLC 2 : seis x)

Joint Label	L,D,M	Direction	Magnitude[lb,lb-ft in,rad lb*s^2/in]

Joint Loads and Enforced Displacements (BLC 2 : seis x) (Continued)

	Joint Label	L,D,M	Direction	Magnitude[lb,lb-ft in,rad lb*s^2/in]
1	N10	L	X	252

Joint Loads and Enforced Displacements (BLC 3 : seis z)

	Joint Label	L,D,M	Direction	Magnitude[lb,lb-ft in,rad lb*s^2/in]
1	N10	L	Z	252

Joint Loads and Enforced Displacements (BLC 4 : .4Sds)

	Joint Label	L,D,M	Direction	Magnitude[lb,lb-ft in,rad lb*s^2/in]
1	N10	L	Y	-28

Joint Reactions (By Combination)

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [lb-ft]	MY [lb-ft]	MZ [lb-ft]
1	1	N4	-69.573	14	2.019	0	0	0
2	1	N3	-69.573	14	-2.019	0	0	0
3	1	N2	-56.427	14	-2.019	0	0	0
4	1	N1	-56.427	14	2.019	0	0	0
5	1	Totals:	-252	56	0			
6	1	COG (in):	X: 5	Y: 10.65	Z: 5			
7	2	N4	-76.146	28	4.038	0	0	0
8	2	N3	-76.146	28	-4.038	0	0	0
9	2	N2	-49.854	28	-4.038	0	0	0
10	2	N1	-49.854	28	4.038	0	0	0
11	2	Totals:	-252	112	0			
12	2	COG (in):	X: 5	Y: 10.65	Z: 5			
13	3	N4	56.427	14	2.019	0	0	0
14	3	N3	56.427	14	-2.019	0	0	0
15	3	N2	69.573	14	-2.019	0	0	0
16	3	N1	69.573	14	2.019	0	0	0
17	3	Totals:	252	56	0			
18	3	COG (in):	X: 5	Y: 10.65	Z: 5			
19	4	N4	49.854	28	4.038	0	0	0
20	4	N3	49.854	28	-4.038	0	0	0
21	4	N2	76.146	28	-4.038	0	0	0
22	4	N1	76.146	28	4.038	0	0	0
23	4	Totals:	252	112	0			
24	4	COG (in):	X: 5	Y: 10.65	Z: 5			
25	5	N4	-67.108	8.75	1.262	0	0	0
26	5	N3	-67.108	8.75	-1.262	0	0	0
27	5	N2	-58.892	8.75	-1.262	0	0	0
28	5	N1	-58.892	8.75	1.262	0	0	0
29	5	Totals:	-252	35	0			
30	5	COG (in):	X: 5	Y: 10.65	Z: 5			
31	6	N4	-73.681	22.75	3.281	0	0	0
32	6	N3	-73.681	22.75	-3.281	0	0	0
33	6	N2	-52.319	22.75	-3.281	0	0	0
34	6	N1	-52.319	22.75	3.281	0	0	0
35	6	Totals:	-252	91	0			
36	6	COG (in):	X: 5	Y: 10.65	Z: 5			
37	7	N4	58.892	8.75	1.262	0	0	0
38	7	N3	58.892	8.75	-1.262	0	0	0
39	7	N2	67.108	8.75	-1.262	0	0	0
40	7	N1	67.108	8.75	1.262	0	0	0
41	7	Totals:	252	35	0			
42	7	COG (in):	X: 5	Y: 10.65	Z: 5			
43	8	N4	52.319	22.75	3.281	0	0	0

Joint Reactions (By Combination) (Continued)

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [lb-ft]	MY [lb-ft]	MZ [lb-ft]
44	8	N3	52.319	22.75	-3.281	0	0	0
45	8	N2	73.681	22.75	-3.281	0	0	0
46	8	N1	73.681	22.75	3.281	0	0	0
47	8	Totals:	252	91	0			
48	8	COG (in):	X: 5	Y: 10.65	Z: 5			
49	9	N4	56.427	-33.11	-60.981	0	0	0
50	9	N3	-69.573	61.11	-65.019	0	0	0
51	9	N2	69.573	61.11	-65.019	0	0	0
52	9	N1	-56.427	-33.11	-60.981	0	0	0
53	9	Totals:	0	56	-252			
54	9	COG (in):	X: 5	Y: 10.65	Z: 5			
55	10	N4	49.854	-19.11	-58.962	0	0	0
56	10	N3	-76.146	75.11	-67.038	0	0	0
57	10	N2	76.146	75.11	-67.038	0	0	0
58	10	N1	-49.854	-19.11	-58.962	0	0	0
59	10	Totals:	0	112	-252			
60	10	COG (in):	X: 5	Y: 10.65	Z: 5			
61	11	N4	-69.573	61.11	65.019	0	0	0
62	11	N3	56.427	-33.11	60.981	0	0	0
63	11	N2	-56.427	-33.11	60.981	0	0	0
64	11	N1	69.573	61.11	65.019	0	0	0
65	11	Totals:	0	56	252			
66	11	COG (in):	X: 5	Y: 10.65	Z: 5			
67	12	N4	-76.146	75.11	67.038	0	0	0
68	12	N3	49.854	-19.11	58.962	0	0	0
69	12	N2	-49.854	-19.11	58.962	0	0	0
70	12	N1	76.146	75.11	67.038	0	0	0
71	12	Totals:	0	112	252			
72	12	COG (in):	X: 5	Y: 10.65	Z: 5			
73	13	N4	58.892	-38.36	-61.738	0	0	0
74	13	N3	-67.108	55.86	-64.262	0	0	0
75	13	N2	67.108	55.86	-64.262	0	0	0
76	13	N1	-58.892	-38.36	-61.738	0	0	0
77	13	Totals:	0	35	-252			
78	13	COG (in):	X: 5	Y: 10.65	Z: 5			
79	14	N4	52.319	-24.36	-59.719	0	0	0
80	14	N3	-73.681	69.86	-66.281	0	0	0
81	14	N2	73.681	69.86	-66.281	0	0	0
82	14	N1	-52.319	-24.36	-59.719	0	0	0
83	14	Totals:	0	91	-252			
84	14	COG (in):	X: 5	Y: 10.65	Z: 5			
85	15	N4	-67.108	55.86	64.262	0	0	0
86	15	N3	58.892	-38.36	61.738	0	0	0
87	15	N2	-58.892	-38.36	61.738	0	0	0
88	15	N1	67.108	55.86	64.262	0	0	0
89	15	Totals:	0	35	252			
90	15	COG (in):	X: 5	Y: 10.65	Z: 5			
91	16	N4	-73.681	69.86	66.281	0	0	0
92	16	N3	52.319	-24.36	59.719	0	0	0
93	16	N2	-52.319	-24.36	59.719	0	0	0
94	16	N1	73.681	69.86	66.281	0	0	0
95	16	Totals:	0	91	252			
96	16	COG (in):	X: 5	Y: 10.65	Z: 5			

Appendix D

Risa 3D Analysis for Frame Size 2

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area (Me...	Surface (...
1	dead	DL				1				
2	seis x	ELX				1				
3	seis z	ELZ				1				
4	.4Sds	ELY				1				

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]	Footing
1	N4	Reaction	Reaction	Reaction				
2	N3	Reaction	Reaction	Reaction				
3	N2	Reaction	Reaction	Reaction				
4	N1	Reaction	Reaction	Reaction				

Joint Coordinates and Temperatures

	Label	X [in]	Y [in]	Z [in]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	0	0	10	0	
3	N3	0	20.1	0	0	
4	N4	0	20.1	10	0	
5	N5	0	10.05	5	0	
6	N6	0	10.05	10	0	
7	N7	0	10.05	0	0	
8	N8	0	20.1	5	0	
9	N9	0	0	5	0	
10	N10	7.25	10.65	5	0	

Load Combination Design

	Description	ASIF	CD	ABIF	Service	Hot Rolled	Cold Formed	Wood	Concrete	Footings
1	1.2D-Ey+Ex					Yes	Yes	Yes	Yes	Yes
2	1.2D+Ey+Ex					Yes	Yes	Yes	Yes	Yes
3	1.2D-Ey-Ex					Yes	Yes	Yes	Yes	Yes
4	1.2D+Ey-Ex					Yes	Yes	Yes	Yes	Yes
5	.9D-Ey+Ex					Yes	Yes	Yes	Yes	Yes
6	.9D+Ey+Ex					Yes	Yes	Yes	Yes	Yes
7	.9D-Ey-Ex					Yes	Yes	Yes	Yes	Yes
8	.9D+Ey-Ex					Yes	Yes	Yes	Yes	Yes
9	1.2D-Ey+Ez					Yes	Yes	Yes	Yes	Yes
10	1.2D+Ey+Ez					Yes	Yes	Yes	Yes	Yes
11	1.2D-Ey-Ez					Yes	Yes	Yes	Yes	Yes
12	1.2D+Ey-Ez					Yes	Yes	Yes	Yes	Yes
13	.9D-Ey+Ez					Yes	Yes	Yes	Yes	Yes
14	.9D+Ey+Ez					Yes	Yes	Yes	Yes	Yes
15	.9D-Ey-Ez					Yes	Yes	Yes	Yes	Yes
16	.9D+Ey-Ez					Yes	Yes	Yes	Yes	Yes
17	deqad					Yes	Yes	Yes	Yes	Yes

Joint Loads and Enforced Displacements (BLC 1 : dead)

	Joint Label	L,D,M	Direction	Magnitude[lb,lb-ft in,rad lb*s^2/in]
1	N10	L	Y	0

Joint Loads and Enforced Displacements (BLC 2 : seis x)

Joint Label	L,D,M	Direction	Magnitude[lb,lb-ft in,rad lb*s^2/in]

Joint Loads and Enforced Displacements (BLC 2 : seis x) (Continued)

	Joint Label	L,D,M	Direction	Magnitude[lb,lb-ft in,rad lb*s^2/in]
1	N10	L	X	66.6

Joint Loads and Enforced Displacements (BLC 3 : seis z)

	Joint Label	L,D,M	Direction	Magnitude[lb,lb-ft in,rad lb*s^2/in]
1	N10	L	Z	66.6

Joint Loads and Enforced Displacements (BLC 4 : .4Sds)

	Joint Label	L,D,M	Direction	Magnitude[lb,lb-ft in,rad lb*s^2/in]
1	N10	L	Y	7.4

Joint Reactions (By Combination)

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [lb-ft]	MY [lb-ft]	MZ [lb-ft]
1	1	N4	-18.979	1.85	.281	0	0	0
2	1	N3	-18.979	1.85	-.281	0	0	0
3	1	N2	-14.321	1.85	-.281	0	0	0
4	1	N1	-14.321	1.85	.281	0	0	0
5	1	Totals:	-66.6	7.4	0			
6	1	COG (in):	X: 7.25	Y: 10.65	Z: 5			
7	2	N4	-16.309	-1.85	-.281	0	0	0
8	2	N3	-16.309	-1.85	.281	0	0	0
9	2	N2	-16.991	-1.85	.281	0	0	0
10	2	N1	-16.991	-1.85	-.281	0	0	0
11	2	Totals:	-66.6	-7.4	0			
12	2	COG (in):	X: 7.25	Y: 10.65	Z: 5			
13	3	N4	16.309	1.85	.281	0	0	0
14	3	N3	16.309	1.85	-.281	0	0	0
15	3	N2	16.991	1.85	-.281	0	0	0
16	3	N1	16.991	1.85	.281	0	0	0
17	3	Totals:	66.6	7.4	0			
18	3	COG (in):	X: 7.25	Y: 10.65	Z: 5			
19	4	N4	18.979	-1.85	-.281	0	0	0
20	4	N3	18.979	-1.85	.281	0	0	0
21	4	N2	14.321	-1.85	.281	0	0	0
22	4	N1	14.321	-1.85	-.281	0	0	0
23	4	Totals:	66.6	-7.4	0			
24	4	COG (in):	X: 7.25	Y: 10.65	Z: 5			
25	5	N4	-18.979	1.85	.281	0	0	0
26	5	N3	-18.979	1.85	-.281	0	0	0
27	5	N2	-14.321	1.85	-.281	0	0	0
28	5	N1	-14.321	1.85	.281	0	0	0
29	5	Totals:	-66.6	7.4	0			
30	5	COG (in):	X: 7.25	Y: 10.65	Z: 5			
31	6	N4	-16.309	-1.85	-.281	0	0	0
32	6	N3	-16.309	-1.85	.281	0	0	0
33	6	N2	-16.991	-1.85	.281	0	0	0
34	6	N1	-16.991	-1.85	-.281	0	0	0
35	6	Totals:	-66.6	-7.4	0			
36	6	COG (in):	X: 7.25	Y: 10.65	Z: 5			
37	7	N4	16.309	1.85	.281	0	0	0
38	7	N3	16.309	1.85	-.281	0	0	0
39	7	N2	16.991	1.85	-.281	0	0	0
40	7	N1	16.991	1.85	.281	0	0	0
41	7	Totals:	66.6	7.4	0			
42	7	COG (in):	X: 7.25	Y: 10.65	Z: 5			
43	8	N4	18.979	-1.85	-.281	0	0	0

Joint Reactions (By Combination) (Continued)

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [lb-ft]	MY [lb-ft]	MZ [lb-ft]
44	8	N3	18.979	-1.85	.281	0	0	0
45	8	N2	14.321	-1.85	.281	0	0	0
46	8	N1	14.321	-1.85	-.281	0	0	0
47	8	Totals:	66.6	-7.4	0			
48	8	COG (in):	X: 7.25	Y: 10.65	Z: 5			
49	9	N4	22.808	-9.009	-17.021	0	0	0
50	9	N3	-25.477	12.709	-17.583	0	0	0
51	9	N2	25.477	14.084	-16.279	0	0	0
52	9	N1	-22.808	-10.384	-15.717	0	0	0
53	9	Totals:	0	7.4	-66.6			
54	9	COG (in):	X: 7.25	Y: 10.65	Z: 5			
55	10	N4	25.477	-12.709	-17.583	0	0	0
56	10	N3	-22.808	9.009	-17.021	0	0	0
57	10	N2	22.808	10.384	-15.717	0	0	0
58	10	N1	-25.477	-14.084	-16.279	0	0	0
59	10	Totals:	0	-7.4	-66.6			
60	10	COG (in):	X: 7.25	Y: 10.65	Z: 5			
61	11	N4	-25.477	12.709	17.583	0	0	0
62	11	N3	22.808	-9.009	17.021	0	0	0
63	11	N2	-22.808	-10.384	15.717	0	0	0
64	11	N1	25.477	14.084	16.279	0	0	0
65	11	Totals:	0	7.4	66.6			
66	11	COG (in):	X: 7.25	Y: 10.65	Z: 5			
67	12	N4	-22.808	9.009	17.021	0	0	0
68	12	N3	25.477	-12.709	17.583	0	0	0
69	12	N2	-25.477	-14.084	16.279	0	0	0
70	12	N1	22.808	10.384	15.717	0	0	0
71	12	Totals:	0	-7.4	66.6			
72	12	COG (in):	X: 7.25	Y: 10.65	Z: 5			
73	13	N4	22.808	-9.009	-17.021	0	0	0
74	13	N3	-25.477	12.709	-17.583	0	0	0
75	13	N2	25.477	14.084	-16.279	0	0	0
76	13	N1	-22.808	-10.384	-15.717	0	0	0
77	13	Totals:	0	7.4	-66.6			
78	13	COG (in):	X: 7.25	Y: 10.65	Z: 5			
79	14	N4	25.477	-12.709	-17.583	0	0	0
80	14	N3	-22.808	9.009	-17.021	0	0	0
81	14	N2	22.808	10.384	-15.717	0	0	0
82	14	N1	-25.477	-14.084	-16.279	0	0	0
83	14	Totals:	0	-7.4	-66.6			
84	14	COG (in):	X: 7.25	Y: 10.65	Z: 5			
85	15	N4	-25.477	12.709	17.583	0	0	0
86	15	N3	22.808	-9.009	17.021	0	0	0
87	15	N2	-22.808	-10.384	15.717	0	0	0
88	15	N1	25.477	14.084	16.279	0	0	0
89	15	Totals:	0	7.4	66.6			
90	15	COG (in):	X: 7.25	Y: 10.65	Z: 5			
91	16	N4	-22.808	9.009	17.021	0	0	0
92	16	N3	25.477	-12.709	17.583	0	0	0
93	16	N2	-25.477	-14.084	16.279	0	0	0
94	16	N1	22.808	10.384	15.717	0	0	0
95	16	Totals:	0	-7.4	66.6			
96	16	COG (in):	X: 7.25	Y: 10.65	Z: 5			

Appendix E

Calculations for ½” Dia Hilti Kwik Bolt inserts

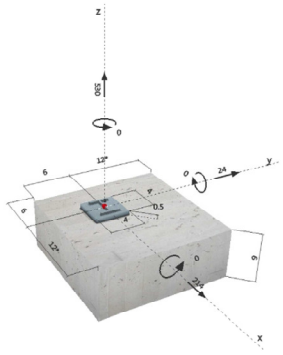
Company:	The VMC Froup	Page:	1
Specifier:		Project:	Yaskawa
Address:		Sub-Project I Pos. No.:	
Phone I Fax:	|	Date:	10/19/2012
E-Mail:			

Specifier's comments:

1 Input data

Anchor type and diameter:	**Kwik Bolt TZ - CS 1/2 (3 1/4)**
Effective embedment depth:	h_{ef} = 3.250 in., h_{nom} = 3.625 in.
Material:	Carbon Steel
Evaluation Service Report::	ESR 1917
Issued I Valid:	4/1/2012 | 5/1/2013
Proof:	design method ACI 318 / AC193
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate:	l_x x l_y x t = 4.000 in. x 4.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	S shape (AISC); (L x W x T x FT) = 3.000 in. x 2.330 in. x 0.170 in. x 0.260 in.
Base material:	cracked concrete, 2500, f_c' = 2500 psi; h = 6.000 in.
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	yes (D.3.3.6)

Geometry [in.] & Loading [lb, in.lb]



2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	Pullout Strength	530	958	56 / -	OK
Shear	Concrete edge failure in direction x+	215	771	- / 28	OK

Loading	**β_N**	**β_V**	**ζ**	**Utilization $\beta_{N,V}$ [%]**	**Status**
Combined tension and shear loads	0.553	0.279	5/3	50	OK

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Company:	The VMC Froup	Page:	2
Specifier:		Project:	Yaskawa
Address:		Sub-Project I Pos. No.:	
Phone I Fax:	|	Date:	10/19/2012
E-Mail:			

Fastening meets the design criteria!

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Appendix F

3/8" dia Hilti Kwik bolt Calculation

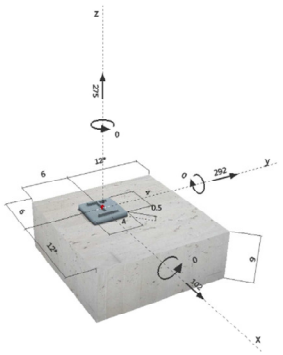
Company:	The VMC Froup	Page:	1
Specifier:		Project:	Yaskawa
Address:		Sub-Project I Pos. No.:	3/8 inch anchor
Phone I Fax:	|	Date:	10/19/2012
E-Mail:			

Specifier's comments:

1 Input data

Anchor type and diameter:	**Kwik Bolt TZ - CS 3/8 (2)**
Effective embedment depth:	h_{ef} = 2.000 in., h_{nom} = 2.313 in.
Material:	Carbon Steel
Evaluation Service Report::	ESR 1917
Issued I Valid:	4/1/2012 | 5/1/2013
Proof:	design method ACI 318 / AC193
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate:	l_x x l_y x t = 4.000 in. x 4.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	S shape (AISC); (L x W x T x FT) = 3.000 in. x 2.330 in. x 0.170 in. x 0.260 in.
Base material:	cracked concrete, 2500, f_c' = 2500 psi; h = 6.000 in.
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	yes (D.3.3.6)

Geometry [in.] & Loading [lb, in.lb]



2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	Pullout Strength	275	443	63 / -	OK
Shear	Pryout Strength	309	505	- / 62	OK

Loading	**β_N**	**β_V**	**ζ**	**Utilization $\beta_{N,V}$ [%]**	**Status**
Combined tension and shear loads	0.621	0.613	5/3	90	OK

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Company:	The VMC Froup	Page:	2
Specifier:		Project:	Yaskawa
Address:		Sub-Project I Pos. No.:	3/8 inch anchor
Phone I Fax:	|	Date:	10/19/2012
E-Mail:			

Fastening meets the design criteria!

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Appendix G

Calculation for ¼” dia Hilt Kwik Bolts

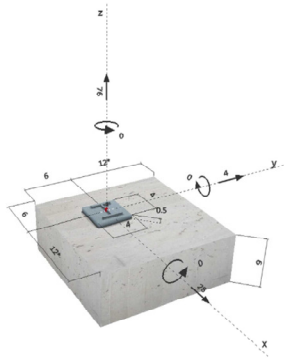
Company:	The VMC Froup	Page:	1
Specifier:		Project:	Yaskawa
Address:		Sub-Project I Pos. No.:	1/4 inch anchor
Phone I Fax:	|	Date:	10/19/2012
E-Mail:			

Specifier's comments:

1 Input data

Anchor type and diameter:	**KWIK HUS-EZ (KH-EZ) 1/4 (2 1/2)**
Effective embedment depth:	h_{ef} = 1.920 in., h_{nom} = 2.500 in.
Material:	Carbon Steel
Evaluation Service Report::	ESR 3027
Issued I Valid:	6/1/2012 | 12/1/2012
Proof:	design method ACI 318 / AC193
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate:	l_x x l_y x t = 4.000 in. x 4.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	S shape (AISC); (L x W x T x FT) = 3.000 in. x 2.330 in. x 0.170 in. x 0.260 in.
Base material:	cracked concrete, 2500, f_c' = 2500 psi; h = 6.000 in.
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	yes (D.3.3.6)

Geometry [in.] & Loading [lb, in.lb]



2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	Pullout Strength	76	227	34 / -	OK
Shear	Steel Strength	28	334	- / 9	OK

Loading	**β_N**	**β_V**	**ζ**	**Utilization $\beta_{N,V}$ [%]**	**Status**
Combined tension and shear loads	0.334	0.085	5/3	18	OK

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Company:	The VMC Froup	Page:	2
Specifier:		Project:	Yaskawa
Address:		Sub-Project I Pos. No.:	1/4 inch anchor
Phone I Fax:	|	Date:	10/19/2012
E-Mail:			

Fastening meets the design criteria!

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