



# ENGINEERED SEISMIC BRACING

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### ISAT

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 ENG PKG NO:  
 DATE: **03/27/09**  
 DSHPD:

SCALE: **N.T.S.**

REV	BY	ISSUE COMMENTS	DATE
1	MM	ISSUE FOR CONSTRUCTION	03/27/09
2	MM	UPDATE LEGENDS & DETAILS	04/01/09

SHEET TITLE:  
**COVER SHEET**

DRAWING NO. :  
**K-AB29-126-001**

**HVAC DUCT**

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**SCALE: N.T.S.**

REV.	BY	ISSUE FOR CONSTRUCTION	DATE
1	NA	ISSUE FOR CONSTRUCTION	03/27/09
2	NA	UPDATE LEGEND & DETAILS	04/01/09

**SHEET TITLE:**  
**RESTRAINT LEGENDS & TDLF**  
**DRAWING NO.:**  
**K-AB29-126-002**

### ISAT SEISMIC RESTRAINT LEGEND

Project: SVP - CLEAN UTILITIES

Item	Location	Restraint Type	Notes
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### ISAT SEISMIC RESTRAINT LEGEND

Project: SVP - CLEAN UTILITIES

Item	Location	Restraint Type	Notes
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#### SEISMIC DESIGN FORCE (SDF) CALCULATION WORKSHEET

INTERNATIONAL SEISMIC APPLICATION TECHNOLOGY  
14848 Northam St., La Mirada, CA 92653  
PHONE 877-999-4728 FAX 714-523-0845

Project Name: \_\_\_\_\_ Date: 9/16/2008  
Location: \_\_\_\_\_  
Contractor: \_\_\_\_\_  
Building Code: 1997 UBC

**PROJECT SEISMIC ENGINEERING PARAMETERS**

Seismic Zone: \_\_\_\_\_ Zone # = 3  
Component Amplification Factor: \_\_\_\_\_ Z = 0.3  
Component Response Modification Factor: \_\_\_\_\_ Rp = 3.00  
Importance Factor: \_\_\_\_\_ Ip = 1.25  
Roof Elevation With Respect to Grade: \_\_\_\_\_ Hg = 50.00  
Seismic Coefficient (if given by customer): \_\_\_\_\_ Cs = 0.33

**Ca Calculation (Zones 1, 2A, 2B, & 3 Only):**  
Soil Profile Type (if Ca is not given): \_\_\_\_\_ Ss = \_\_\_\_\_  
Seismic Coefficient (found by Soil Profile Type vs. Zone): \_\_\_\_\_ Cs = Ca from Customer

**Ca Calculation (Zone 4 Only):**  
Soil Profile Type (if Ca is not given): \_\_\_\_\_ Ss = \_\_\_\_\_  
Near Source Factor (if given by customer): \_\_\_\_\_ Nsf = \_\_\_\_\_  
Seismic Source Type (if Na is not given by customer): \_\_\_\_\_ Sst = \_\_\_\_\_  
Closed Distance To Known Seismic Source (if Na is not given by customer): \_\_\_\_\_ Dist (mi) = \_\_\_\_\_  
New Source Factor (found by Seismic Source Type vs. Dist. from Table 16-3): \_\_\_\_\_ Nsf = \_\_\_\_\_  
Ca (found by Zone vs. Soil Profile Type, from Table 16-3): \_\_\_\_\_ Ca = \_\_\_\_\_

**SEISMIC BRACING CALCULATION - TOTAL DESIGN LATERAL FORCE**  
UBC FORMULA SECTION 1632, (b)2

$$F_p = R_p \times C_a \times I_p \times W_p \quad (R_p = 3.0 \times I_p) \quad \times \quad W_p$$

Floor # / Story	Hk (ft)	Eg	Fp shall not be less than 0.7 Ca x Ip x Wp =	Fp shall not be more than 4.0 Ca x Ip x Wp =	Eg	Fp / 1.4
1st	11	0.19	1.65	0.29	0.21	0.21
INTERNAL 2nd	20	0.23	1.65	0.29	0.21	0.21
2nd	32	0.29	1.65	0.29	0.21	0.21
INTERNAL 4th	44	0.34	1.65	0.29	0.25	0.25
3rd	55	0.40	1.65	0.40	0.29	0.29
INTERNAL 6th	68	0.46	1.65	0.46	0.33	0.33
4th	88	0.55	1.65	0.55	0.39	0.39

WHERE:  
Hk = Overhead Deck Elevation From Grade (ft)  
Eg = As calculated per equation shown above.  
Fp = Resultant after comparison.  
Fp < Eg, Controls Fp to "Allowable Stress Design". Use this value in conjunction with ISAT Bracing Tables.

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OPA-0485 November 14, 2002  
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Exp. 11/14/05

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International Seismic Application Technology  
600 Ames Boulevard, Suite 104, CA 92025  
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www.isat.com

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Original Nov-99 Page B27.3

ATRC Dia.	W. Max.	H. Max.	A' Max.	A' Min.	W' Max.	W' Min.
3/8"	6"	1,115 #	6"	1,115 #	12"	12"
1/2"	6"	2,230 #	6"	1,115 #	12"	12"
5/8"	3-1/2"	2,185 #	7"	1,080 #	23"	23"
3/4"	3-1/2"	2,185 #	7-1/2"	1,080 #	23"	23"
7/8"	4-1/2"	2,185 #	8"	1,080 #	33"	33"
1"	4-1/2"	2,185 #	8-1/2"	1,080 #	33"	33"

**APPROVED Fixed Equipment Anchorage**  
Office of Seismic Health Planning and Development  
OPA-0485  
WEDNESDAY, JUNE 13, 2007  
Anthony R. Pike (916) 654-3362

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Rev. 3 06/13/07 Page B27.5

ATRC Dia.	W. Max.	H. Max.	A' Max.	A' Min.	W' Max.	W' Min.
3/8"	6"	1,115 #	6"	1,115 #	12"	12"
1/2"	6"	2,230 #	6"	1,115 #	12"	12"
5/8"	3-1/2"	2,185 #	7"	1,080 #	23"	23"
3/4"	3-1/2"	2,185 #	7-1/2"	1,080 #	23"	23"
7/8"	4-1/2"	2,185 #	8"	1,080 #	33"	33"
1"	4-1/2"	2,185 #	8-1/2"	1,080 #	33"	33"

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WEDNESDAY, JUNE 13, 2007  
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Rev. 3 06/13/07 Page B27.6

ATRC Dia.	W. Max.	H. Max.	A' Max.	A' Min.	W' Max.	W' Min.
3/8"	6"	1,115 #	6"	1,115 #	12"	12"
1/2"	6"	2,230 #	6"	1,115 #	12"	12"
5/8"	3-1/2"	2,185 #	7"	1,080 #	23"	23"
3/4"	3-1/2"	2,185 #	7-1/2"	1,080 #	23"	23"
7/8"	4-1/2"	2,185 #	8"	1,080 #	33"	33"
1"	4-1/2"	2,185 #	8-1/2"	1,080 #	33"	33"

**APPROVED Fixed Equipment Anchorage**  
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OPA-0485  
TUESDAY, JUNE 4, 2007  
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Rev. 3 06/04/07 Page B27.8

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Original Nov-02 Page B27.7

**ISAT TECHNICAL BULLETIN**  
APPROVAL FOR USE OF HIK BOLT T2 ANCHORS  
The original ISAT D1 and D2 series installation details are to be utilized with the HIK Bolt 3 or HIK Bolt T2 anchors may be installed offset from the face center-line up to a maximum of 4" as illustrated below.

**APPROVED Fixed Equipment Anchorage**  
Office of Seismic Health Planning and Development  
OPA-0485  
Thursday, March 15, 2007  
Anthony R. Pike (916) 654-3362

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Original 03/15/07 Page D-1

**Engineered Brace Anchor Connections**  
Normal Weight Concrete (2,000 psi Minimum)

POWER-STUD by Powers Fasteners, Inc.  
ICBO Report No. 8225, Table 3  
Without Special Inspection

Anchor	Page	Anchor	Anchor Diameter	Lead	Minimum Embedment	Minimum Spacing	Minimum Anchor Distance	Anchor Connection
AN1	D1.1	1	3/8"	492 #	3"	12"	4-1/2"	Shut
AN2	D1.2	2	3/8"	984 #	3"	12"	4-1/2"	PL1 or PL2
AN3	D1.3	4	3/8"	1,968 #	3"	12"	4-1/2"	PL1 or PL2
AN4	D1.1	1	1/2"	742 #	4"	16"	6"	Shut
AN5	D1.2	2	1/2"	1,484 #	4"	16"	6"	PL1 or PL2
AN6	D1.3	4	1/2"	2,968 #	4"	16"	6"	PL1 or PL2
AN7	D1.1	1	5/8"	1,216 #	6"	20"	7-1/2"	Shut
AN8	D1.2	2	5/8"	2,432 #	6"	20"	7-1/2"	PL1 or PL2
AN9	D1.3	4	5/8"	4,864 #	6"	20"	7-1/2"	PL1 or PL2

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Brace Anchorage	Anchor Qty.	Anchor Diameter	Minimum Concrete Thickness	Minimum Depth
AN1	1	3/8"	4-1/2"	6"
AN4	1	1/2"	6"	4"
AN7	1	5/8"	7-1/2"	6"

**APPROVED Fixed Equipment Anchorage**  
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ENG. PKG. NO:  
DATE: 03/27/09  
OSHPD:

SCALE: **N.T.S.**

REVISION:

REV. BY	ISSUE	COMMENTS	DATE
AS	1	ISSUE FOR CONSTRUCTION	03/27/09
AM	2	UPDATE LEGEND & DETAILS	04/01/09

SHEET TITLE:  
**SEISMIC DETAILS**

DRAWING NO.:  
**K-AB29-126-003**

When installing Anchors, Take Appropriate Precautions To Avoid Severing Rebar or Post-Tensioned Tendons Within Concrete Deck Elements

Single Anchor Connection Details AN2, AN3, ANB  
Minimum 3,000 psi Normal Weight Concrete  
Power-STUD by Powers Fasteners, Inc. (CBO Report No. 5225)  
See Page D1 for Minimum Anchor Spacing Requirements

Anchor	Anchor Dia.	Anchor Diameter	Minimum Concrete Thickness	Minimum Depth
AN2	2	3/8"	4-1/2"	3"
AN3	2	5/8"	6-1/2"	5"

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Fixed Equipment Anchorage  
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Rev. 3 Oct-02  
Page D1.2

Submit Seismic Reaction Loads and Obtain Approval From Engineer of Record Before Welding To Structural Steel

**WELDED BRACKET CONNECTION TO STRUCTURAL STEEL BEAM OR CHANNEL**

Bracket	Max. Allowable Brace Reaction @ 45 Degree Brace Angle
ABW	2,185 lbs.
ABW	1,860 lbs.
ABF12	1,865 lbs.
ABF4	2,335 lbs.

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Rev. 1 Jun-00  
Page D4.1

**SAT #40-4 BEAM CLAMP ASSEMBLY**  
SEISMIC RESTRAINT CONNECTION TO STRUCTURAL STEEL

**APPROVED**  
Fixed Equipment Anchorage  
OPA-0485  
Rev. 1 Jun-00  
Page D4.3

**SAT #40-4 BEAM CLAMP ASSEMBLY WITH INTERCONNECTING STRUT**  
SEISMIC RESTRAINT CONNECTION TO STRUCTURAL STEEL

**APPROVED**  
Fixed Equipment Anchorage  
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Rev. 1 Jun-00  
Page D4.3

**BRACE ARM ANCHORAGE**  
EMBEDDED IN CONCRETE. CONCRETE MUST BE MINIMUM 3,000 PSI

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Rev. 1 Oct-01  
Page D7.1

**SEISMIC RESTRAINT CONNECTION TO METAL STUD GWS ASSEMBLY**  
Prior Approval From Engineer of Record Required

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Page D8.1

**SAT #40-4 BEAM CLAMP ASSEMBLY**  
VERTICAL SUPPORT CONNECTIONS TO STRUCTURAL STEEL

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Fixed Equipment Anchorage  
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Rev. 1 Oct-01  
Page G1.12

**VERTICAL SUPPORT ANCHORAGE**

Anchor Diameter	Minimum Rod Diameter	Anchor Diameter	Minimum Embedment	Minimum Tension Design Value	Minimum Edge Distance	Minimum Concrete Thickness	Anchor Embedment Tension
3/8"	3/8"	3"	6"	895 lbs.	5-3/4"	4-1/2"	89 lbs.
1/2"	1/2"	4"	8"	1,143 lbs.	7-3/8"	5-1/8"	109 lbs.
3/4"	3/4"	6"	10"	1,507 lbs.	8-1/8"	7"	143 lbs.

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Rev. 1 4/17/06  
Page G7.11H

**DUAL ANCHOR VERTICAL SUPPORT CONNECTION**

Min. Anchor Diameter	Min. Concrete Thickness, Tc	Min. Embedment Depth, De	Min. Edge Distance, E	Min. Spacing, S
3/8"	4-1/2"	6"	5-3/4"	6"
1/2"	5-1/2"	8"	7-3/8"	8"
3/4"	6-1/2"	10"	8-1/8"	10"

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**BEAM CLAMP OR WELDED LUG ATTACHMENT TO WIDE FLANGED BEAM**

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OPA-0485 November 14, 2002  
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**Directory - ISAT Right Brace Assemblies**

SAT Brace Assembly	Lower Bracket	Upper Bracket	Brace Arm	Maximum Reaction - Tension	Maximum Reaction - Compression
R1	RCW28	ABW	Single Strut	97	950
R2	RCW28	ABW	Double Strut	100	950
R3	RCW28	ABW	Single Strut	100	1,115
R4	RCW28	ABW	Double Strut	100	1,115
R5	RCW28	ABW	Single Strut	100	1,115
R6	RCW28	ABW	Double Strut	100	1,115
R7	RCW28	ABW	Single Strut	100	1,115
R8	RCW28	ABW	Double Strut	100	1,115
R9	RCW28	ABW	Single Strut	100	1,115
R10	RCW28	ABW	Double Strut	100	1,115
R11	RCW28	ABW	Single Strut	100	1,115
R12	RCW28	ABW	Double Strut	100	1,115
R13	RCW28	ABW	Single Strut	100	1,115
R14	RCW28	ABW	Double Strut	100	1,115
R15	RCW28	ABW	Single Strut	100	1,115
R16	RCW28	ABW	Double Strut	100	1,115
R17	RCW28	ABW	Single Strut	100	1,115
R18	RCW28	ABW	Double Strut	100	1,115
R19	RCW28	ABW	Single Strut	100	1,115
R20	RCW28	ABW	Double Strut	100	1,115
R21	RCW28	ABW	Single Strut	100	1,115
R22	RCW28	ABW	Double Strut	100	1,115
R23	RCW28	ABW	Single Strut	100	1,115
R24	RCW28	ABW	Double Strut	100	1,115
R25	RCW28	ABW	Single Strut	100	1,115
R26	RCW28	ABW	Double Strut	100	1,115
R27	RCW28	ABW	Single Strut	100	1,115
R28	RCW28	ABW	Double Strut	100	1,115
R29	RCW28	ABW	Single Strut	100	1,115
R30	RCW28	ABW	Double Strut	100	1,115

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**TYPICAL ROD BRACING BRACKET ASSEMBLY**  
SINGLE OR DOUBLE CHANNEL

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HVAC DUCT

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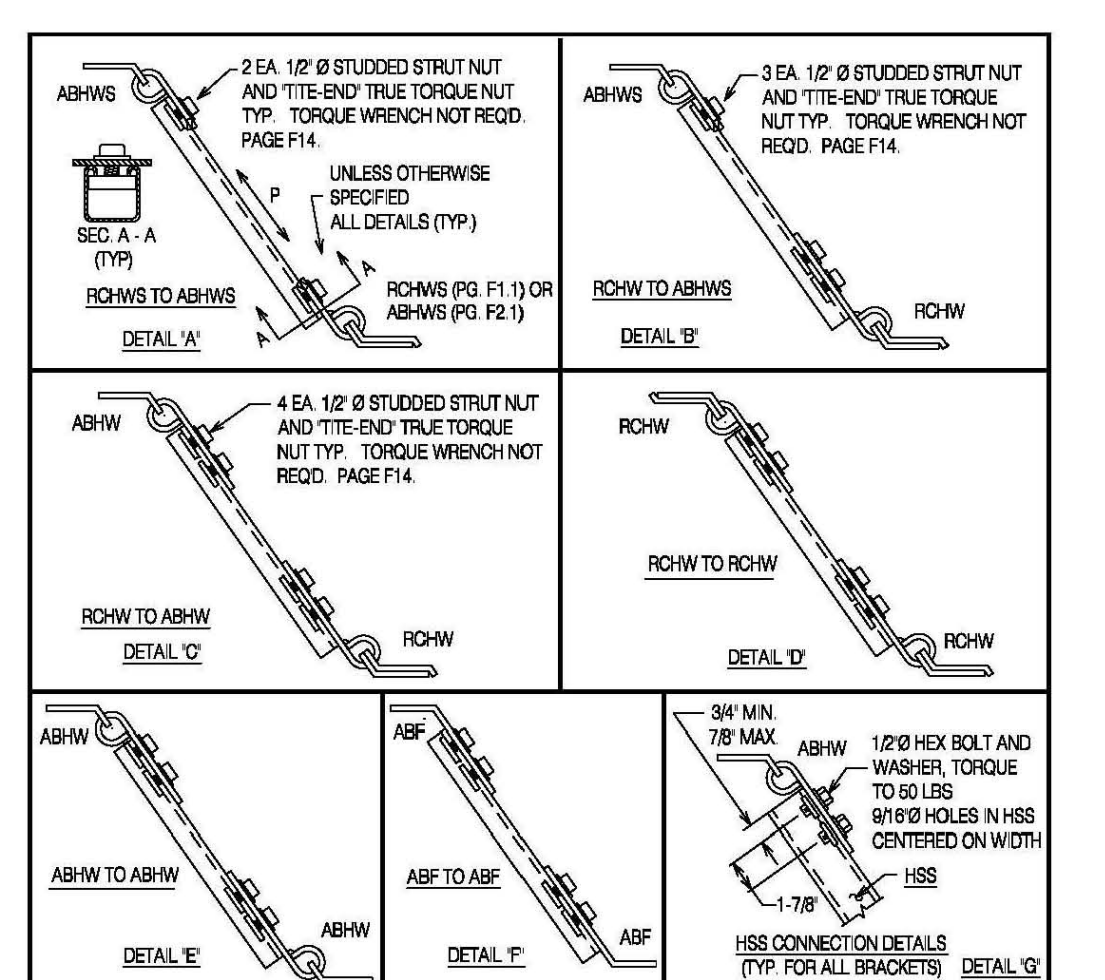
REVISION:  
REV. BY: ISSUE COMMENTS DATE  
1. AM UPDATE LEGEND & DETAILS 04/01/09

SHEET TITLE:  
**SEISMIC DETAILS**

DRAWING NO.:  
**K-AB29-126-004**



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'TITE-END' TRUE TORQUE NUT RIGID BRACE ASSEMBLY DETAILS

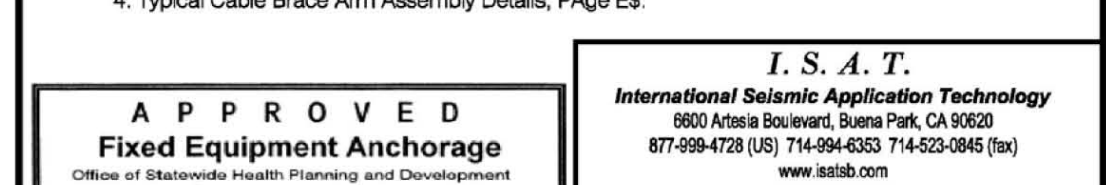


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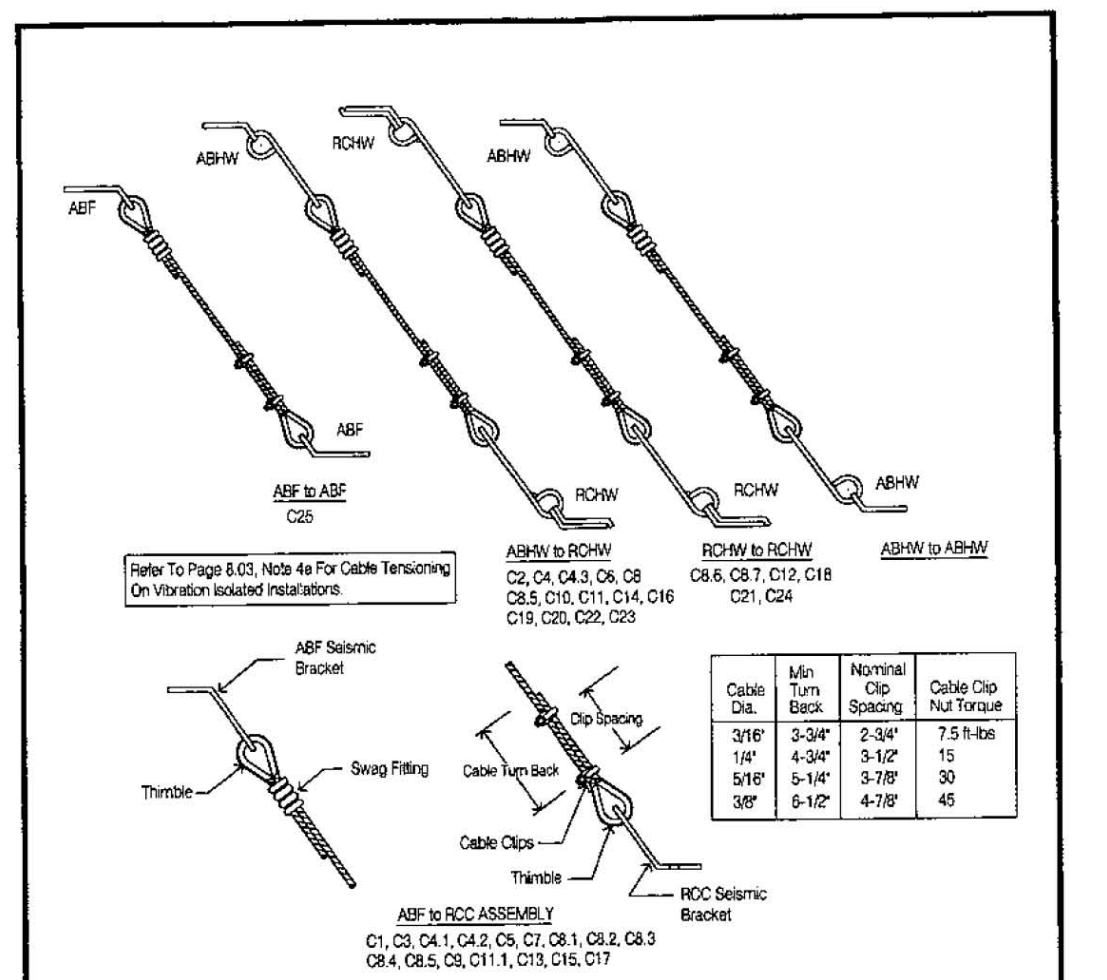
ISAT Cable Assembly	ISAT Seismic Bracket	ISAT Cable	Cable Brace Assembly
ASSEMBLY	BRACKET	BRACKET	ASSEMBLY
ASSEMBLY	BRACKET	BRACKET	ASSEMBLY
C1	RCC38	ABF12	3/16 DIA. 840
C2	RCHW38	ABW12	3/16 DIA. 840
C3	RCC38	ABF12	1/4 DIA. 980
C4	RCHW38	ABW12	1/4 DIA. 980
C4.1	RCC38X	ABF12	5/16 DIA. 1,115
C4.2	RCC38X	ABW12	1/4 DIA. 1,400
C4.3	RCHW38X	ABW12	1/4 DIA. 1,115
C5	RCC12	ABF12	3/16 DIA. 840
C6	RCC12	ABF12	1/4 DIA. 980
C7	RCC12	ABF12	1/4 DIA. 980
C8	RCHW12	ABW12	1/4 DIA. 980
CB.1	RCC12X	ABF34	5/16 DIA. 1,950
CB.2	RCC12X	ABF34	3/8 DIA. 1,950
CB.3	RCC12X	ABF12	1/4 DIA. 1,400
CB.4	RCC12X	ABF12	5/16 DIA. 1,855
CB.5	RCHW12X	ABW12	1/4 DIA. 1,400
CB.6	RCHW12X	ABW12	5/16 DIA. 1,950
CB.7	RCHW12X	ABW12	3/8 DIA. 2,050
C9	RCC38	ABF34	1/4 DIA. 1,400
C10	RCC38	ABF34	1/4 DIA. 1,400
C11	RCHW38	ABW12	5/16 DIA. 1,855
C12	RCHW38	ABW12	3/8 DIA. 1,950
C13	RCC34	ABF34	1/4 DIA. 1,400
C14	RCC34	ABF34	5/16 DIA. 1,950
C15	RCC34	ABF34	3/8 DIA. 1,950
C16	RCHW34	ABW12	5/16 DIA. 1,855
C17	RCC34	ABF34	3/8 DIA. 1,950
C18	RCHW34	RCHW38	3/8 DIA. 2,185
C19	RCHW34	RCHW38	3/8 DIA. 2,185
C20	RCHW34	RCHW38	5/16 DIA. 1,855
C21	RCHW34	RCHW38	3/8 DIA. 2,185
C22	1"	RCHW100	ABW12
C23	1"	RCHW100	ABW12
C24	1"	RCHW100	RCHW38
C25	1"	ABF34	ABF34

1. 3/8" thru 3/4" Seismic Bracket Per USDO Report # PFC 6556 (except RCC38X, RCC12X)  
2. RCC38X, RCC12X Values per USDO Test Report #H4685 and Structural Engineering Review  
3. Engineered 7/8" and 1" Bracket Design Values Based On 3/4" Bracket Testing  
4. Typical Cable Brace Arm Assembly Details, Page E3.



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Page E3

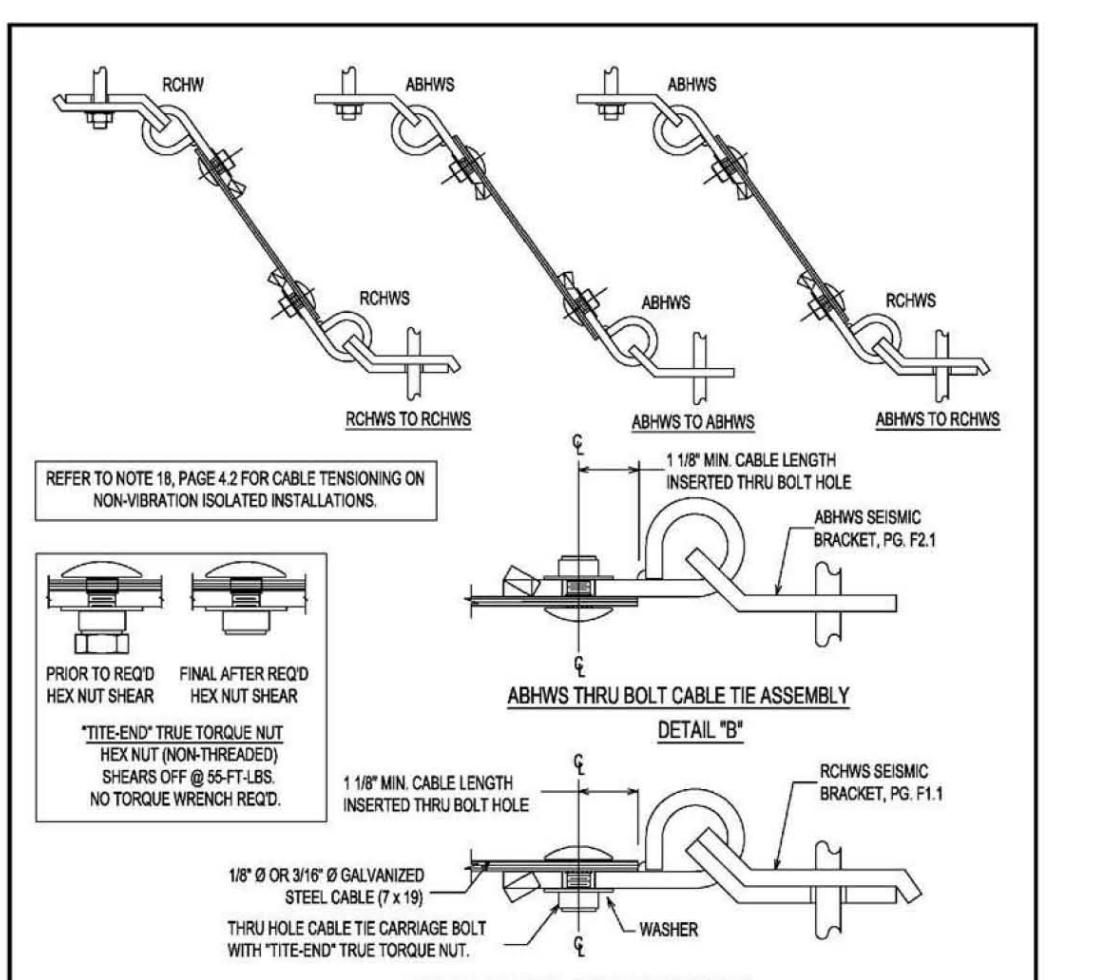


THRU BOLT CABLE ASSEMBLY  
CABLE BRACING TO BE INSTALLED IN A SYMMETRICAL PATTERN PER SEISMIC INSTALLATION DETAILS.



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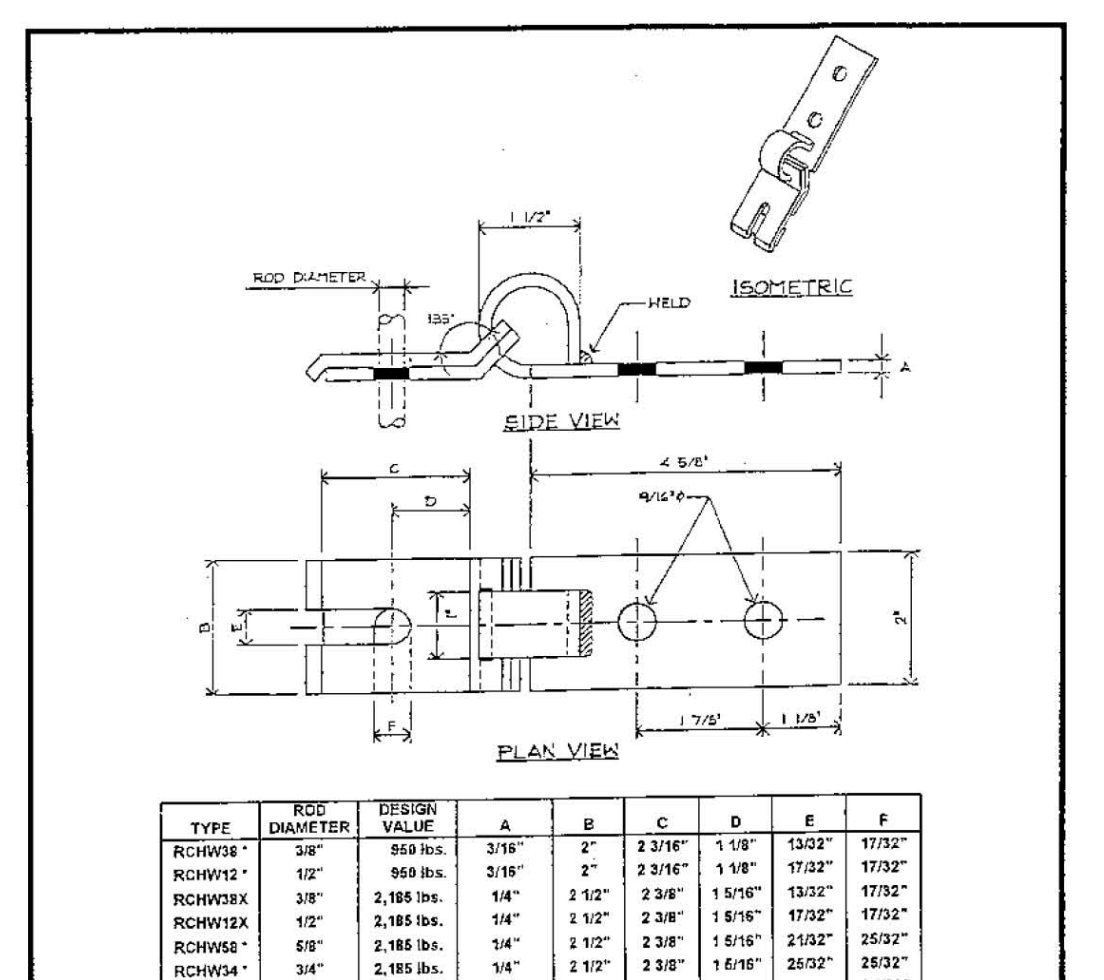


THRU ROD CABLE ASSEMBLY  
CABLE BRACING TO BE INSTALLED IN A SYMMETRICAL PATTERN PER SEISMIC INSTALLATION DETAILS.

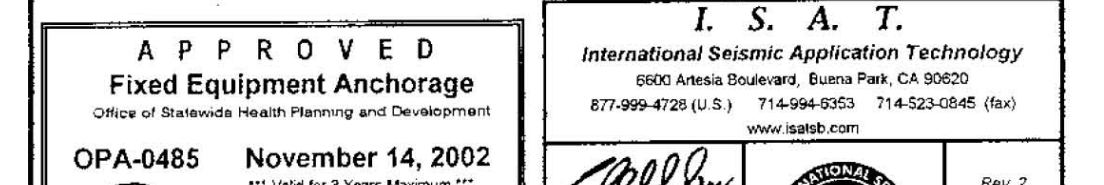


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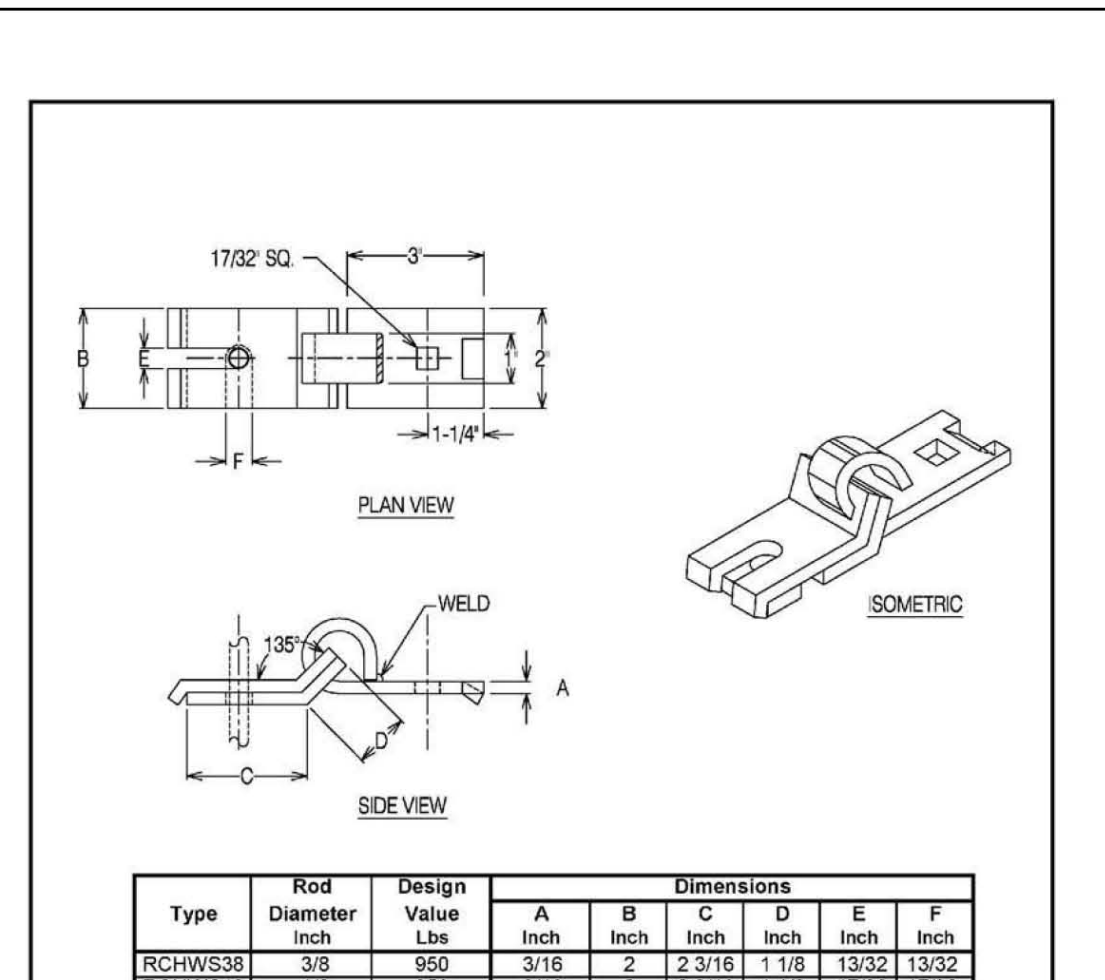


STYLE 'RCHW' ROD CAPTURE, HINGED BRACKET  
I.C. & O. # PFC5586 Patent No. 6,952,255



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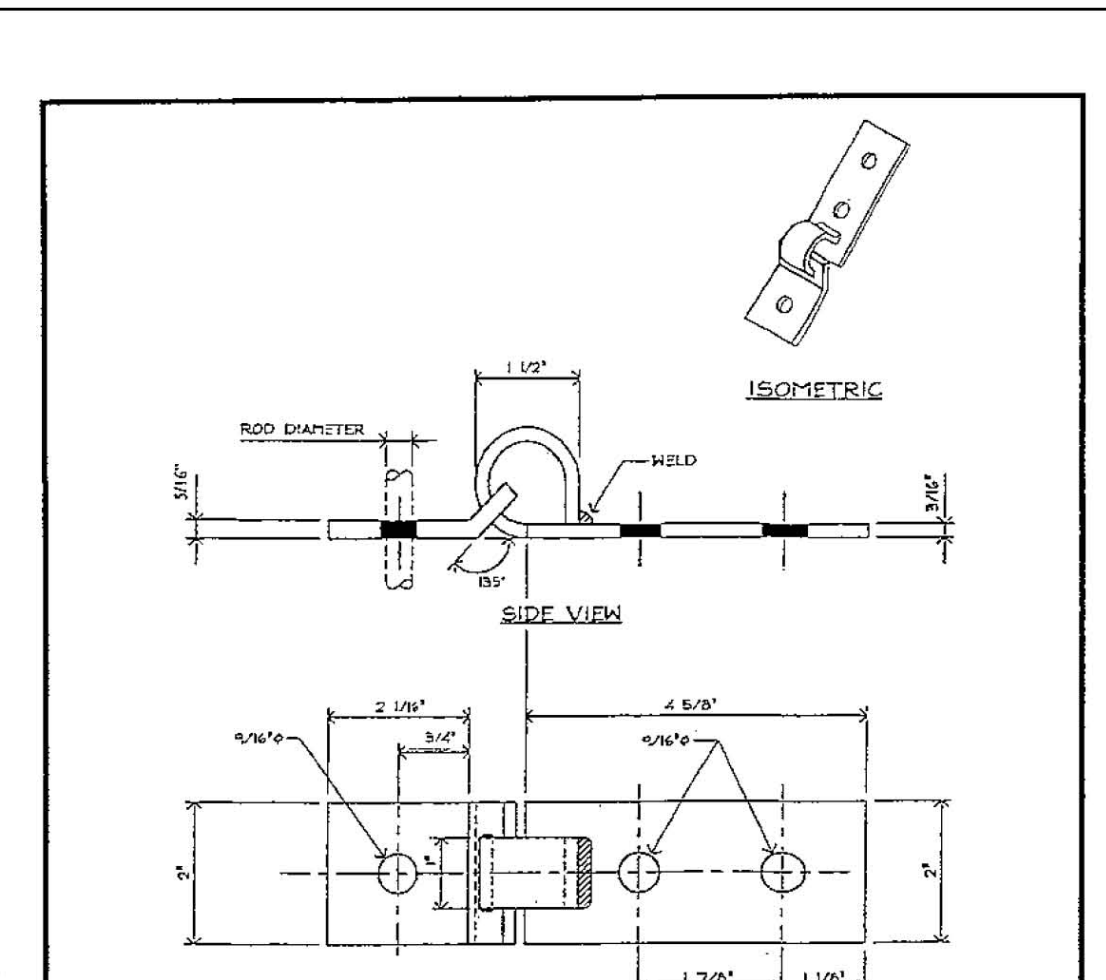


STYLE 'RCHWS' ROD CAPTURE, HINGED, SHORT BRACKET  
I.C. & O. # PFC5586



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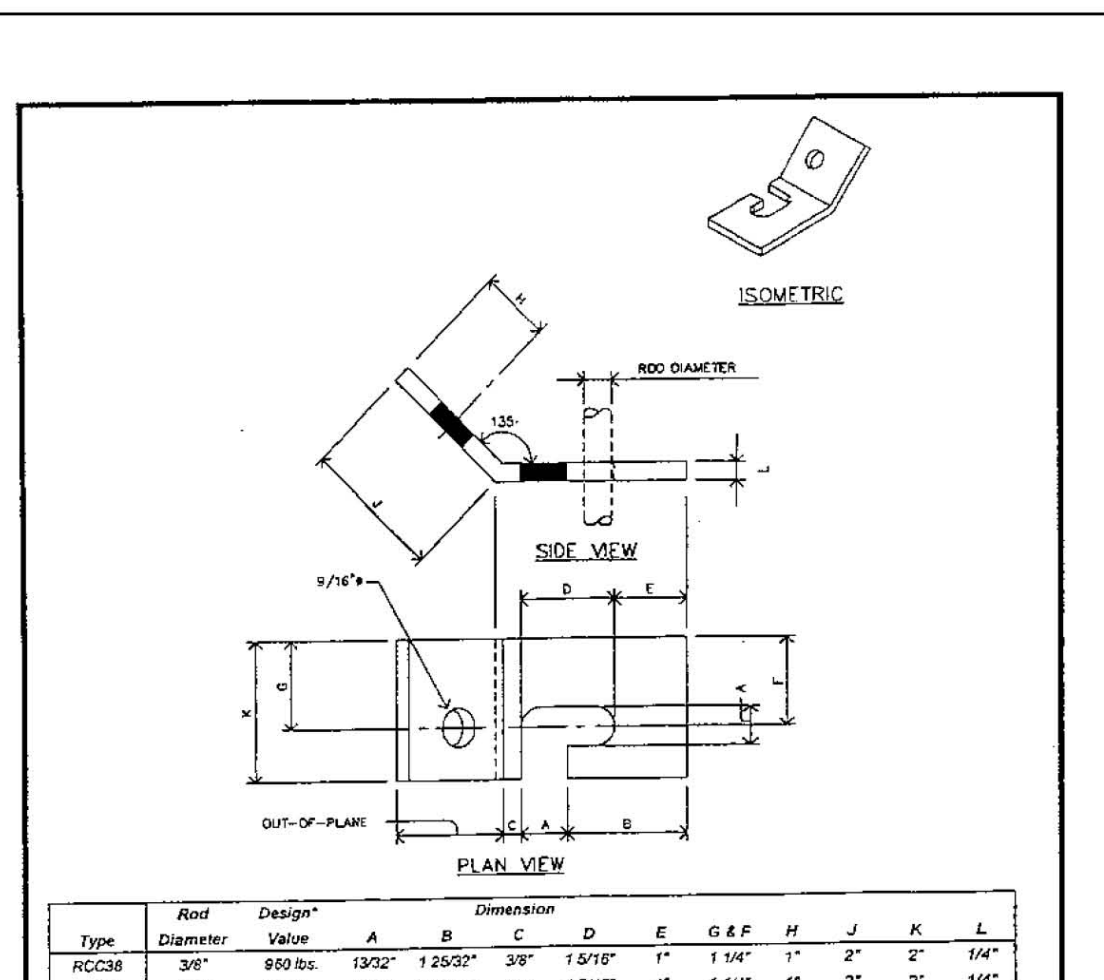


STYLE 'ABHW' ANCHOR BRACKET, HINGED, SHORT  
DESIGN VALUE 1,800 LBS. PATENT NO. 6,950,205



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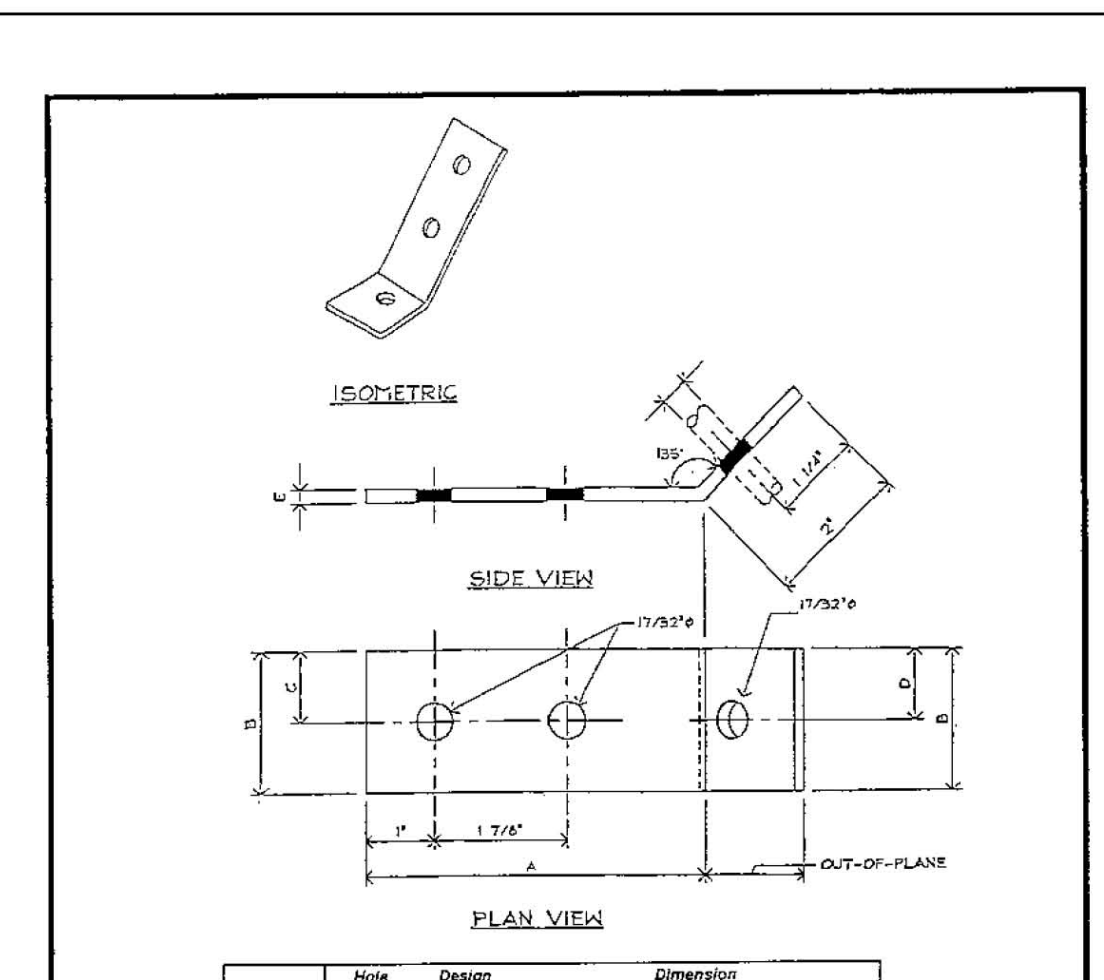


STYLE 'RCC' ROD CAPTURE CABLE BRACKET  
I.C. & O. # PFC5586

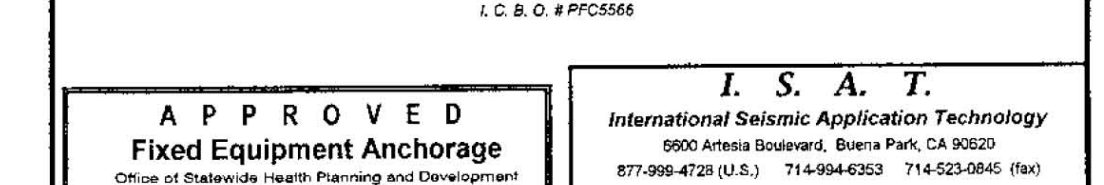


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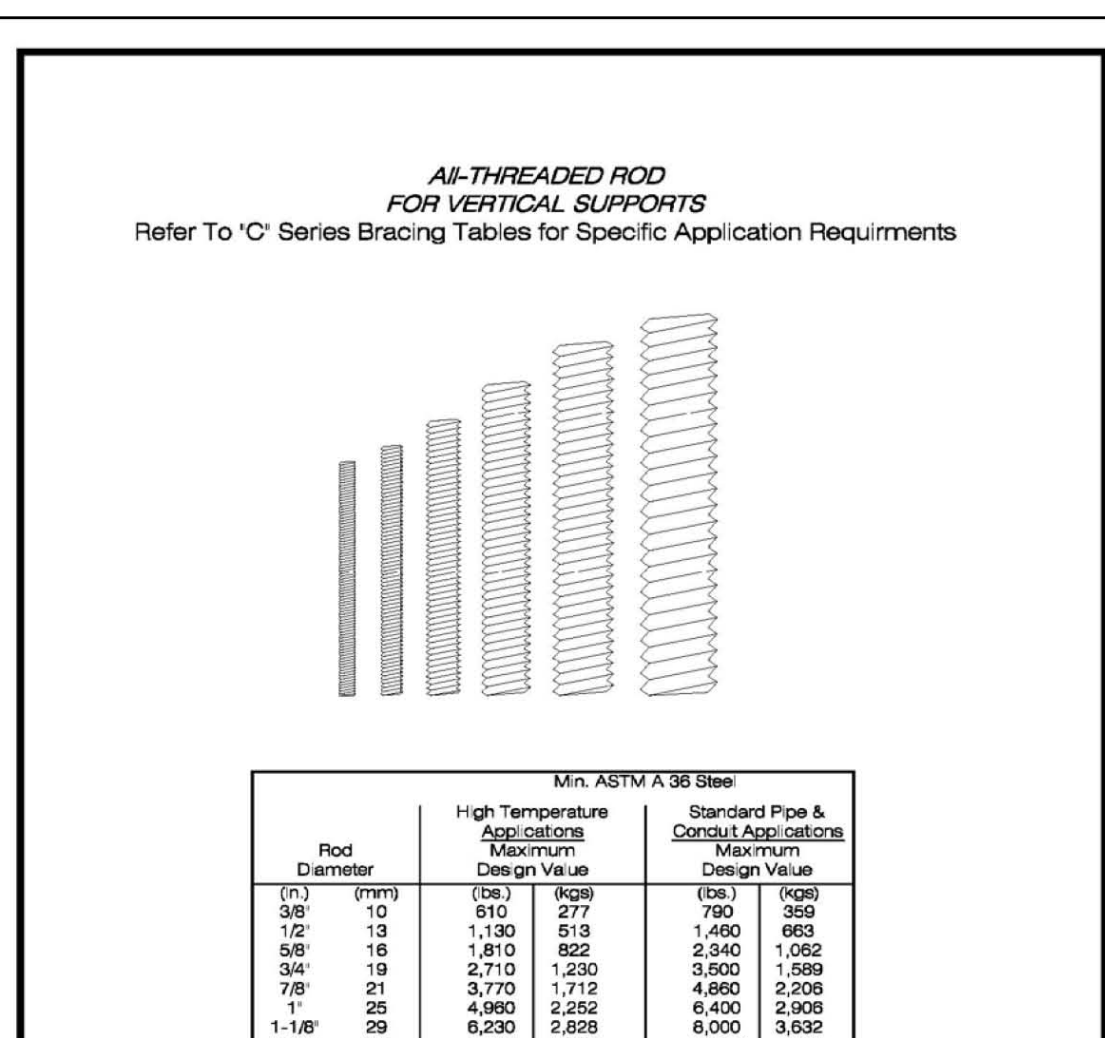


STYLE 'ABF' 45 DEGREE ANGLE BRACKET  
I.C. & O. # PFC5586



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Fixed Equipment Anchorage  
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May-01  
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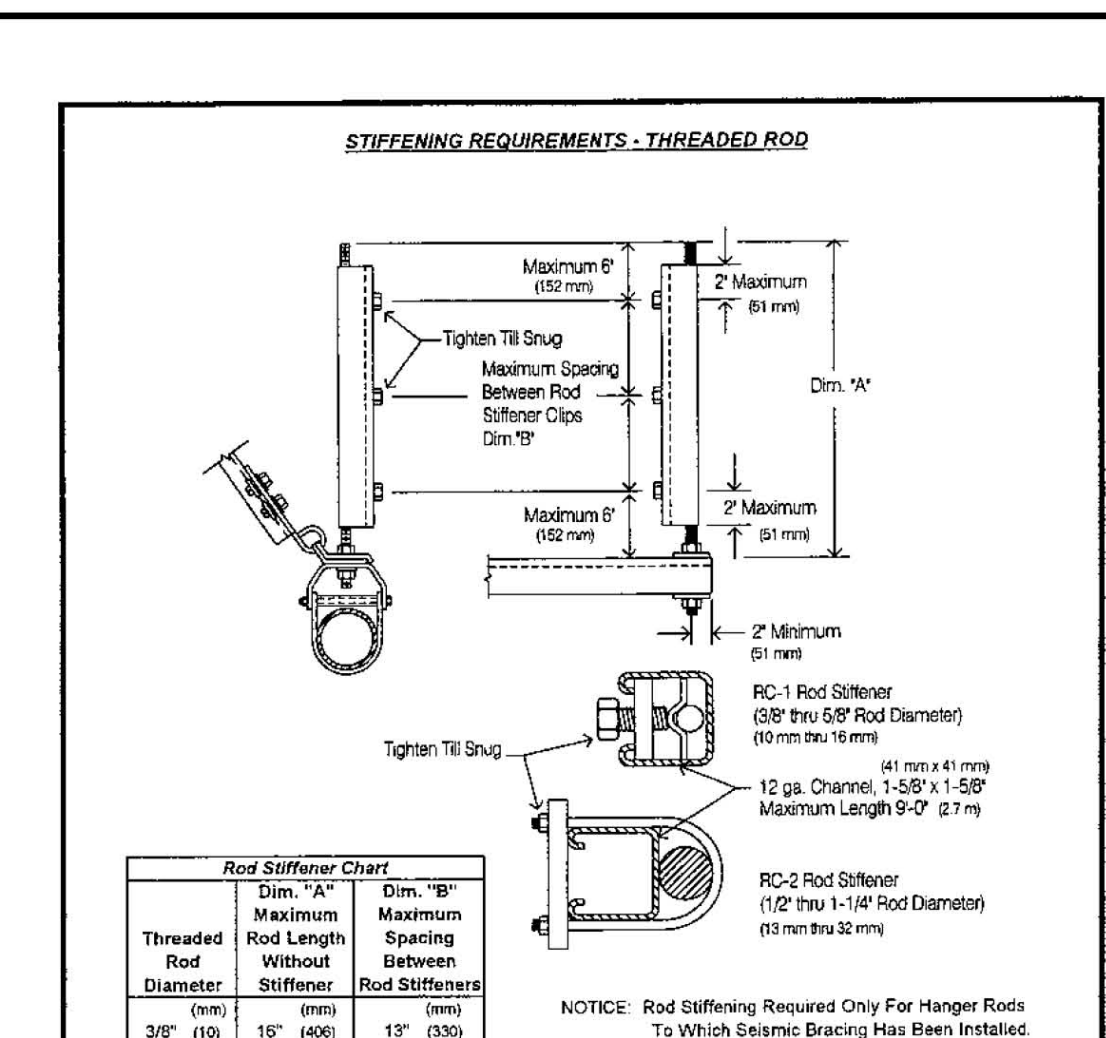


AS-THREADED ROD FOR VERTICAL SUPPORTS  
Refer To 'C' Series Bracing Tables for Specific Application Requirements

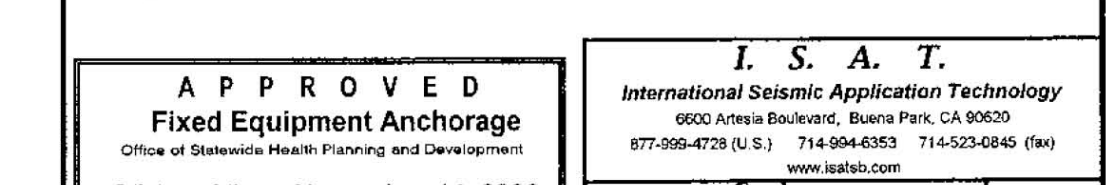


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Aug-02  
Page G1



STIFFNESS REQUIREMENTS - THREADED ROD

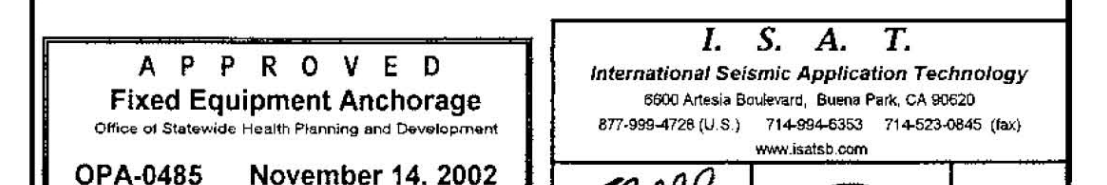


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Sep-02  
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MAXIMUM TRAPEZE SUPPORT LOADS			
SINGLE CHANNEL (12" x 1 1/2" x 1/8")		DOUBLE CHANNEL (12" x 1 1/2" x 1/8" x 3-1/4")	
MAXIMUM UNIFORM LOAD (LBS)	DEFLECTION (INCHES)	MAXIMUM UNIFORM LOAD (LBS)	DEFLECTION (INCHES)
1" x 1 1/2" x 1/8"	0.25	2" x 1 1/2" x 1/8"	0.50
2" x 1 1/2" x 1/8"	0.50	3" x 1 1/2" x 1/8"	0.75
3" x 1 1/2" x 1/8"	0.75	4" x 1 1/2" x 1/8"	1.00
4" x 1 1/2" x 1/8"	1.00	5" x 1 1/2" x 1/8"	1.25
5" x 1 1/2" x 1/8"	1.25	6" x 1 1/2" x 1/8"	1.50
6" x 1 1/2" x 1/8"	1.50	7" x 1 1/2" x 1/8"	1.75
7" x 1 1/2" x 1/8"	1.75	8" x 1 1/2" x 1/8"	2.00
8" x 1 1/2" x 1/8"	2.00	9" x 1 1/2" x 1/8"	2.25
9" x 1 1/2" x 1/8"	2.25	10" x 1 1/2" x 1/8"	2.50
10" x 1 1/2" x 1/8"	2.50	11" x 1 1/2" x 1/8"	2.75
11" x 1 1/2" x 1/8"	2.75	12" x 1 1/2" x 1/8"	3.00
12" x 1 1/2" x 1/8"	3.00	13" x 1 1/2" x 1/8"	3.25
13" x 1 1/2" x 1/8"	3.25	14" x 1 1/2" x 1/8"	3.50
14" x 1 1/2" x 1/8"	3.50	15" x 1 1/2" x 1/8"	3.75
15" x 1 1/2" x 1/8"	3.75	16" x 1 1/2" x 1/8"	4.00
16" x 1 1/2" x 1/8"	4.00	17" x 1 1/2" x 1/8"	4.25
17" x 1 1/2" x 1/8"	4.25	18" x 1 1/2" x 1/8"	4.50
18" x 1 1/2" x 1/8"	4.50	19" x 1 1/2" x 1/8"	4.75
19" x 1 1/2" x 1/8"	4.75	20" x 1 1/2" x 1/8"	5.00

MAXIMUM TRAPEZE SUPPORT LOADS

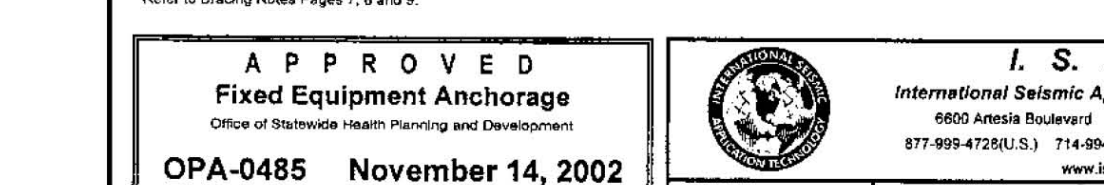


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RIGID BRACING - TRAPEZE MOUNTED PIPE RACK, CONDUIT RACK, HVAC DUCT, CABLE TRAY (Max. 35 LBS/LF)											
TRANSVERSE BRACING REQUIREMENTS						LONGITUDINAL BRACING REQUIREMENTS					
Max. Horizontal Force (kips)	Max. Vertical Force (kips)	Max. Spacing (ft)	Max. Bracing (ft)	Max. Bracing (ft)	Max. Bracing (ft)	Max. Spacing (ft)	Max. Bracing (ft)	Max. Bracing (ft)	Max. Bracing (ft)	Max. Bracing (ft)	Max. Bracing (ft)
0.20	0.20	40	20	20	20	40	20	20	20	20	20
0.30	0.30	40	20	20	20	40	20	20	20	20	20
0.40	0.40	40	20	20	20	40	20	20	20	20	20
0.50	0.50	40	20	20	20	40	20	20	20	20	20
0.60	0.60	40	20	20	20	40	20	20	20	20	20
0.70	0.70	40	20	20	20	40	20	20	20	20	20
0.80	0.80	40	20	20	20	40	20	20	20	20	20
0.90	0.90	40	20	20	20	40	20	20	20	20	20
1.00	1.00	40	20	20	20	40	20	20	20	20	20
1.10	1.10	40	20	20	20	40	20	20	20	20	20
1.20	1.20	40	20	20	20	40	20	20	20	20	20
1.30	1.30	40	20	20	20	40	20	20	20	20	20
1.40	1.40	40	20	20	20	40	20	20	20	20	20
1.50	1.50	40	20	20	20	40	20	20	20	20	20
1.60	1.60	40	20	20	20	40	20	20	20	20	20
1.70	1.70	40	20	20	20	40	20	20	20	20	20
1.80	1.80	40	20	20	20	40	20	20	20	20	20
1.90	1.90	40	20	20	20	40	20	20	20	20	20
2.00	2.00	40	20	20	20	40	20	20	20	20	20

RIGID BRACING - TRAPEZE MOUNTED PIPE RACK, CONDUIT RACK, HVAC DUCT, CABLE TRAY (Max. 35 LBS/LF)



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Nov-00  
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REVISIONS											
REV. BY	ISSUE FOR CONSTRUCTION	DATE									
1	ISSUE FOR CONSTRUCTION	03/21/09									
2	UPDATE LEGEND & DETAILS	04/01/09									

REVISIONS



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Page G3

HVAC DUCT

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RIGID BRACING - TRAPEZE MOUNTED PIPE RACK, CONDUIT RACK, HVAC DUCT, CABLE TRAY (Max. 150 LBS/LF)											
TRANSVERSE BRACING REQUIREMENTS					LONGITUDINAL BRACING REQUIREMENTS						
Max. Spacing (ft)	Min. Spacing (ft)	Min. Brace Area (sq in)	Min. Brace Length (ft)	Min. Brace Spacing (ft)	Max. Spacing (ft)	Min. Brace Area (sq in)	Min. Brace Length (ft)	Min. Brace Spacing (ft)	Max. Spacing (ft)		
0.20	5.00	40	1.697	R7	AMB or ANB	ALB or ALB	50	1.697	R7	AMB or ANB	ALB or ALB
0.30	5.00	40	1.273	R7	AMB or ANB	ALB or ALB	40	1.273	R7	AMB or ANB	ALB or ALB
0.40	5.00	40	1.097	R7	AMB or ANB	ALB or ALB	40	1.097	R7	AMB or ANB	ALB or ALB
0.50	5.00	39	2.000	R10	AMB or ANB	ALB or ALB	39	2.000	R10	AMB or ANB	ALB or ALB
0.60	5.00	32	2.036	R10	AMB or ANB	ALB or ALB	32	2.036	R10	AMB or ANB	ALB or ALB
0.70	5.00	29	2.076	R10	AMB or ANB	ALB or ALB	29	2.076	R10	AMB or ANB	ALB or ALB
0.80	5.00	24	2.036	R10	AMB or ANB	ALB or ALB	24	2.036	R10	AMB or ANB	ALB or ALB
0.90	5.00	21	2.054	R10	AMB or ANB	ALB or ALB	21	2.054	R10	AMB or ANB	ALB or ALB
1.00	5.00	19	2.015	R10	AMB or ANB	ALB or ALB	19	2.015	R10	AMB or ANB	ALB or ALB
1.10	5.00	16	2.056	R10	AMB or ANB	ALB or ALB	16	2.056	R10	AMB or ANB	ALB or ALB
1.40	5.00	14	2.079	R10	AMB or ANB	ALB or ALB	14	2.079	R10	AMB or ANB	ALB or ALB
1.60	5.00	12	2.038	R10	AMB or ANB	ALB or ALB	12	2.038	R10	AMB or ANB	ALB or ALB
1.80	5.00	10	1.938	R9	AMB or ANB	ALB or ALB	10	1.938	R9	AMB or ANB	ALB or ALB

Requires Use of ISAT Brackets/Endbrackets per CBC 07 Report RPPC 0408. Use of Any Substituted Brackets/Endbrackets.  
 @ Max. 4" Depth Indentation. \*\* Min. 3.000 sq. INCH. \*\*Min. 3.000 sq. INCH. \*\*Min. 3.000 sq. INCH. \*\*Min. 3.000 sq. INCH. \*\*Min. 3.000 sq. INCH.  
 Based on Seismic Rating of Channel "The Seismic Design Manual" by NCHRP. Last Issue: 03/19/04. Label Grounded Channel Pipe, or Plastic Pipe.  
 Refer to Bracing Notes Pages 7.4 and 8.

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Office of International Health Planning and Development  
OPA-0485 November 14, 2002  
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Jun-02  
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**SEISMIC BRACING NOTES**  
**HVAC DUCT and MECHANICAL EQUIPMENT**

Seismic bracing is to be installed on all HVAC duct runs and mechanical equipment per ISAT's engineered bracing tables, ISAT's installation details and the following criteria:

- Ductwork shall be constructed in accordance with provisions contained in Part 4, Title 24, California Mechanical Code.
- Install seismic bracing on HVAC ducts meeting the following parameters:
  - All rectangular air-handling ducts equal to or greater than 6 square feet in cross-sectional area.
  - All round air-handling ducts equal to or greater than 28 inches in diameter.
- All trapeze assemblies supporting ducts shall be braced considering the total weight of the duct(s) on the trapeze.
- Seismic bracing may be omitted from all ducts suspended by hangers 12" or less in length from the top of the duct to the bottom of the structural support for the hanger. (On projects under the 1997 UBC, Volume 2 or the 2001 CBC, Volume 2 - applicable only where the hangers are detailed to avoid bending of the hangers and their connections. Where seismic remains are omitted, ducts shall be installed such that lateral motion will not cause damaging impact or loss of vertical support and where the hangers are detailed to avoid bending of the hangers and their connections.)

**Important Note:**  
Elements 1 thru 4 derive from the 2001 California Building Code, Volume 2, Chapter 16A for state owned facilities and all hospitals or essential facilities under the jurisdiction of OSHPD. These criteria may also be used in other jurisdictions including projects under the 1997 Uniform Building Code subject to the requirements of the project documents, prior approval of the engineer of record and approval of the local code authority.

- All ductwork shall be constructed per the project documents and governing code requirements. In the absence of definitive project documents, HVAC ducts are to be constructed per the latest SMACNA duct construction standards.
- When used to construct a rigid brace arm assembly, 1/2 gauge steel channel may be solid, penced or slotted.

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**SEISMIC BRACING NOTES**  
**HVAC DUCT and MECHANICAL EQUIPMENT - CONTINUED**

- Brace spacing shall not exceed ISAT's maximum allowable 40 foot transverse and 80 foot longitudinal limitations for HVAC Duct. Refer to Index Page C-03 which lists Bracing Charts by aggregate trapeze weight.
- All seismic bracing assemblies shall utilize ISAT's engineered and tested seismic brackets per ICBO Evaluation Services Report Number RPPC 5566. NO SUBSTITUTIONS ALLOWED. Use of any non-ISAT brackets voids all engineering.
- A Transverse Brace shall be installed on either side of a horizontal, ninety degree change in duct direction and within 10 feet of the end of the run on all OSHPD projects.
- A Longitudinal Brace at a 90 degree change in direction may act as a Transverse Brace if it is located within two duct widths of the change in direction and is installed on the larger of the two ducts.
- A Transverse Brace may act as a Longitudinal Brace if it is located within two duct widths of a 90 degree change in direction, if the brace arm has been sized to meet or exceed the requirements of the Longitudinal Brace and the Transverse Brace is installed on the larger of the two ducts.
- The point at which a duct passes through a wall may be considered a Transverse Brace location provided the duct is tightly constrained. Utilize a "listed" freestop assembly detail around the duct perimeter at point of passage through both sides of a rated wall. Utilize a "listed", non-intumescent freestop assembly around smoke damper perimeters.
- Plastic or fiberglass ductwork shall be braced at one-half the spacing identified in the ISAT bracing charts for the equivalent weight metal duct.
- In-line equipment rigidly mounted to the duct shall be braced independently of the ductwork if the unit weight 50 pounds or more. If the equipment is flexibly connected to the ductwork, independently brace all equipment weighing 10 pounds or greater. All mechanical piping connections to the equipment are to be flexible. The nearest transverse brace for the connected duct shall be at a distance away from the equipment of no more than 1/2 the transverse brace spacing allowed by the Bracing Tables.

**Important Note:**  
Elements 1 thru 4 derive from the 2001 California Building Code, Volume 2, Chapter 16A for state owned facilities and all hospitals or essential facilities under the jurisdiction of OSHPD. These criteria may also be used in other jurisdictions including projects under the 1997 Uniform Building Code subject to the requirements of the project documents, prior approval of the engineer of record and approval of the local code authority.

- All ductwork shall be constructed per the project documents and governing code requirements. In the absence of definitive project documents, HVAC ducts are to be constructed per the latest SMACNA duct construction standards.
- When used to construct a rigid brace arm assembly, 1/2 gauge steel channel may be solid, penced or slotted.

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Office of International Health Planning and Development  
OPA-0485 November 14, 2002  
Valid for 3 Years Maximum

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Dec-01  
Page 9.01

**SEISMIC BRACING NOTES**  
**HVAC DUCT and MECHANICAL EQUIPMENT - CONTINUED**

- Vertical support spacing for trapeze mounted duct is to be the lesser of 10 foot or as listed in the project specifications. On OSHPD projects, coordinate with Table 6-F requirements of the California Mechanical Code.
- Vertical duct runs which are mechanically attached to floors at point of penetration may be considered a transverse and longitudinal brace location provided the anchorages and the duct framing accommodate the engineered load and provided the distance to the nearest 90 degree change in direction is no more than two duct widths.
- All vertical duct runs shall include lateral restraint at maximum 30 foot intervals and at the top and bottom of the riser.
- For buildings six stories or more in height, the lateral seismic restraint and the vertical support shall be engineered on an individual job basis.
- On all OSHPD projects, vertical support rods to be continuous from lowest element of duct or equipment support framing upward to point of connection with anchorage to structure. Rod couplers are permitted at top of rod for connection to deck anchorage.

**VIBRATION ISOLATED HVAC DUCT and MECHANICAL EQUIPMENT**

- ISAT includes requirements for the seismic restraint of vibration isolated duct and equipment suspended from spring hangers. However, design of the vibration isolated support system itself must be accomplished separately on a job specific basis by a qualified engineer.
- Install vibration isolation hardware per manufacturer's instructions to achieve the required degree of isolation and/or deflection.
- Unless noted otherwise on the plans or within the project documents, spring isolated hanger supports shall be used at the first three hanger supports on the discharge away from the inlet of duct connected to vibration isolated fans, air handling units or other equipment.

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Rev. 1  
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Page 9.02

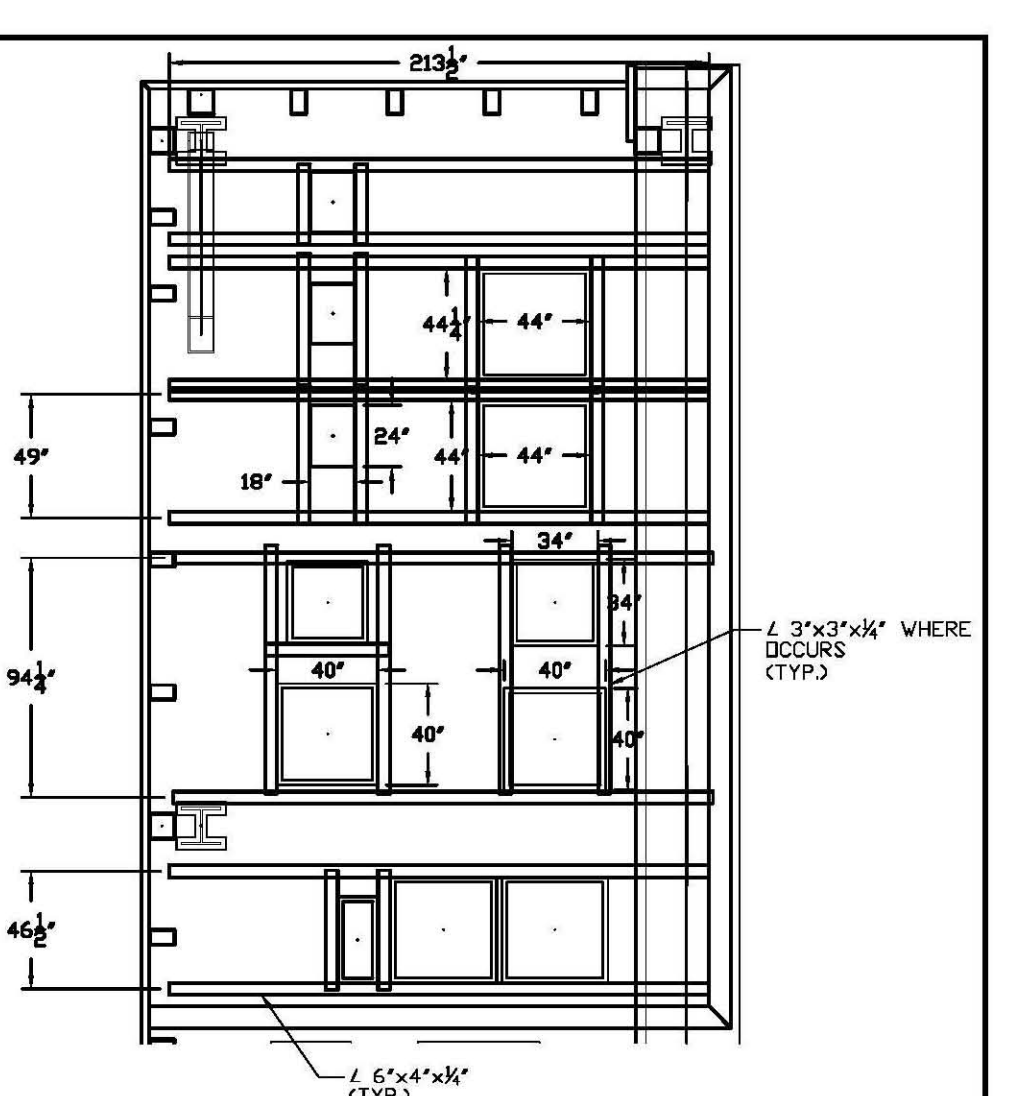
**SEISMIC BRACING NOTES**  
**HVAC DUCT and MECHANICAL EQUIPMENT - CONTINUED**

- Vibration isolated hangers that also require seismic bracing shall be braced using galvanized steel aircraft cable tied to ISAT designed and tested seismic brackets per ICBO Evaluation Services Report RPPC 5566. NO SUBSTITUTIONS. Use of any non-ISAT bracket voids all engineering.
- ISAT cable bracing shall be assembled as shown on Page F4 and installed per individual detail drawings (Index Pages B.02 and B.03).
- Cable to be installed with sufficient slack to accommodate, but not exceed, the vibration isolators calculated deflection. See manufacturer's vibration isolator specifications. Do not tension cables to the extent that they support gravity loads.

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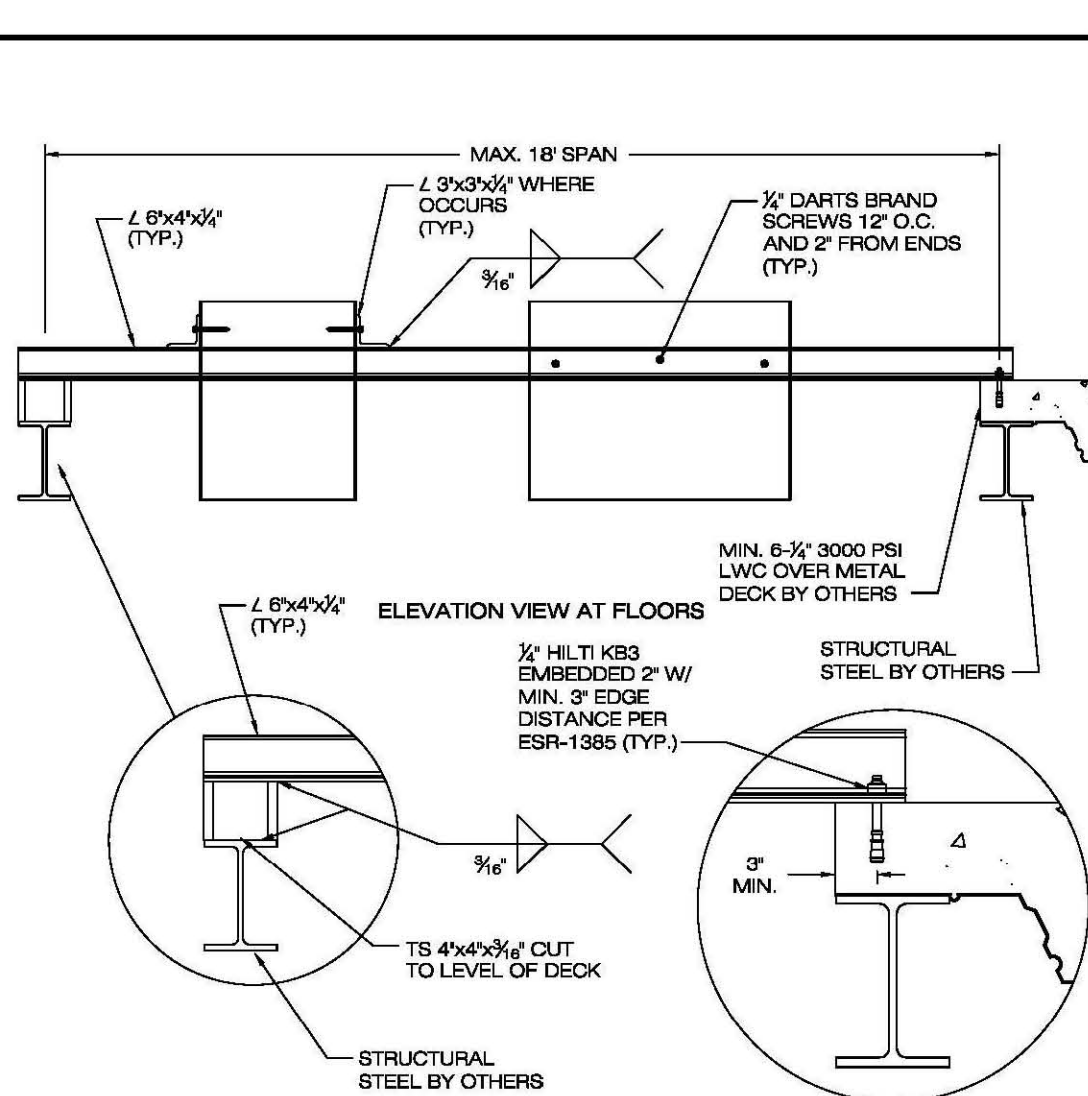
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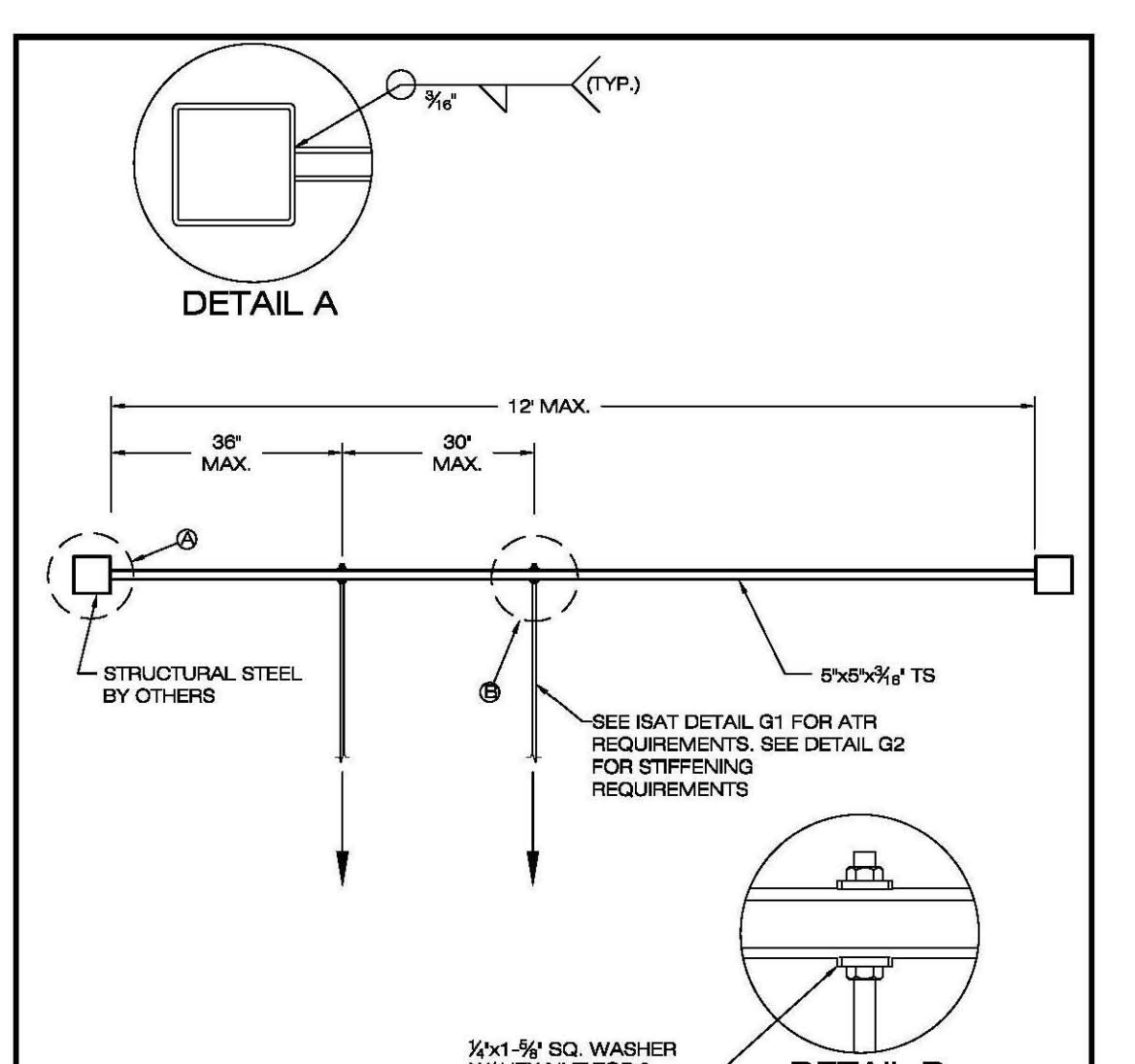
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HVAC DUCT

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DRAWN BY:
CHECKED BY:
APPROVED BY:
JOB NO:
ENG PKG NO:
DATE: 03/27/09
OSHPD:

SCALE: **N.T.S.**

REVISION:		
REV. BY:	ISSUE COMMENTS:	DATE:
1	ISSUE FOR CONSTRUCTION	03/27/09
2	UPDATE LEGEND & DETAILS	04/01/09

SHEET TITLE:

**SEISMIC DETAILS**

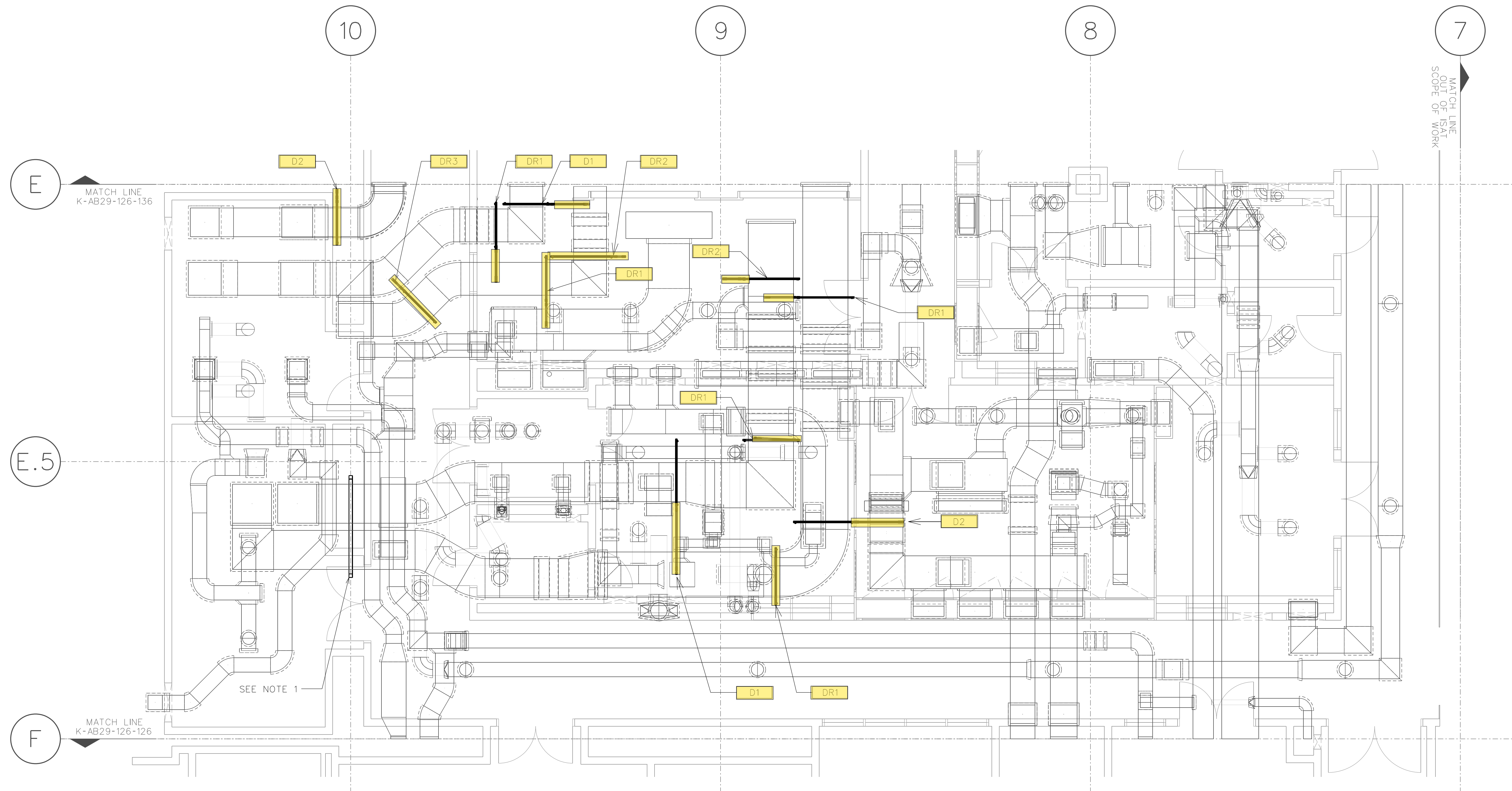
DRAWING NO.:

**K-AB29-126-006**



GENERAL NOTES:

- FOR MOMENT FRAME DETAIL SEE ENGINEERING PACKAGE OR SHEET K-AB29-126-010 DETAIL 08.409. TYP.



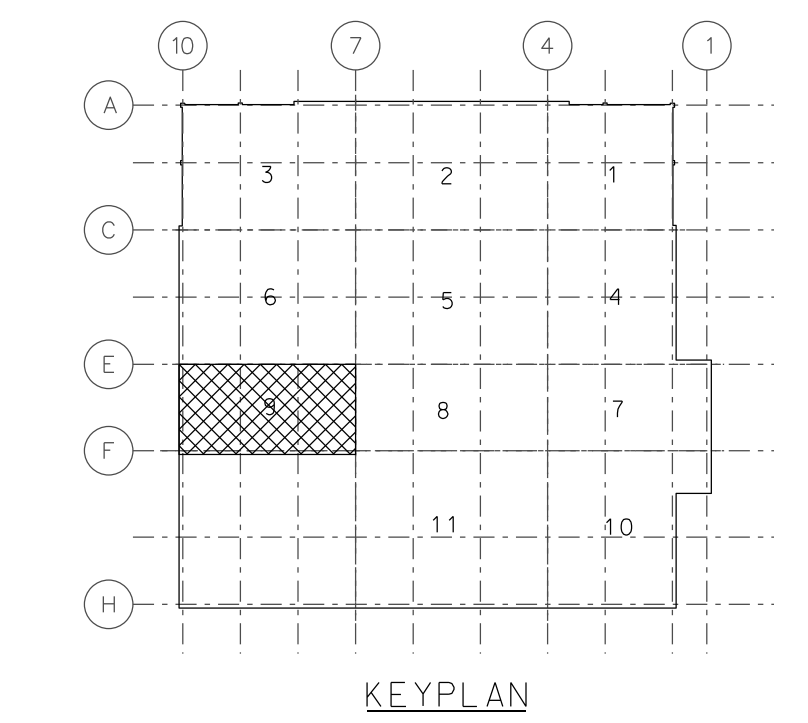
**ISAT** SEISMIC RESTRAINT LEGEND  
SVP - CLEAN UTILITIES

SEE ISAT SEISMIC BRACING LEGEND ON SHEET # SB -1 FOR INFORMATION ON SEISMIC LOCATIONS & ISAT KIT I.D.\*

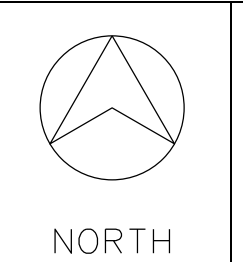
SEISMIC BRACING SHALL NOT BE REQUIRED BASED ON THE FOLLOWING CODE EXCLUSIONS \*

- \*Utility is within 12" of overhead deck.  
(Connectors to the structure are to minimize net bending moment. Provisions shall be made to eliminate seismic impact to components vulnerable to impact.)
- \*Utility is attached directly to structure.
- \*Brace all rectangular air-handling ducts equal to or greater than 6 square feet in cross sectional area.
- \*Brace all round air-handling ducts equal to or greater than 28 inches in diameter.
- \*Brace all plumbing, process and mechanical pipe 2 1/2" trade size and larger.
- \*Brace all hazardous pipe 1" and larger.
- \*Brace all conduit 2 1/2" trade size and larger.
- \*Brace all trusses supporting 10 # pfl and greater.

All work shall be installed in accordance with the 1997 UBC  
\* See ISAT Manual and Submittal Documents  
Rod Capture Seismic Brackets per ICBO Report RPP05568  
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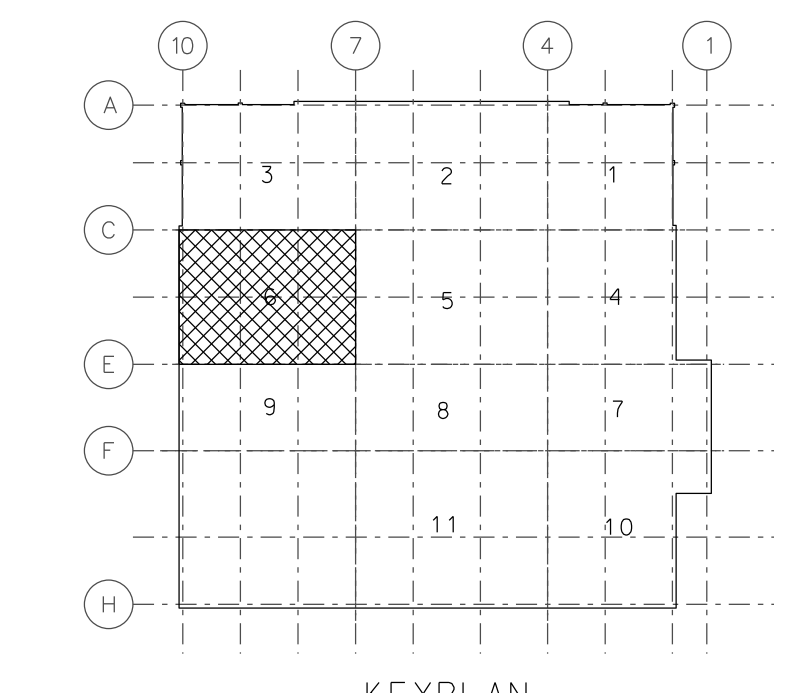
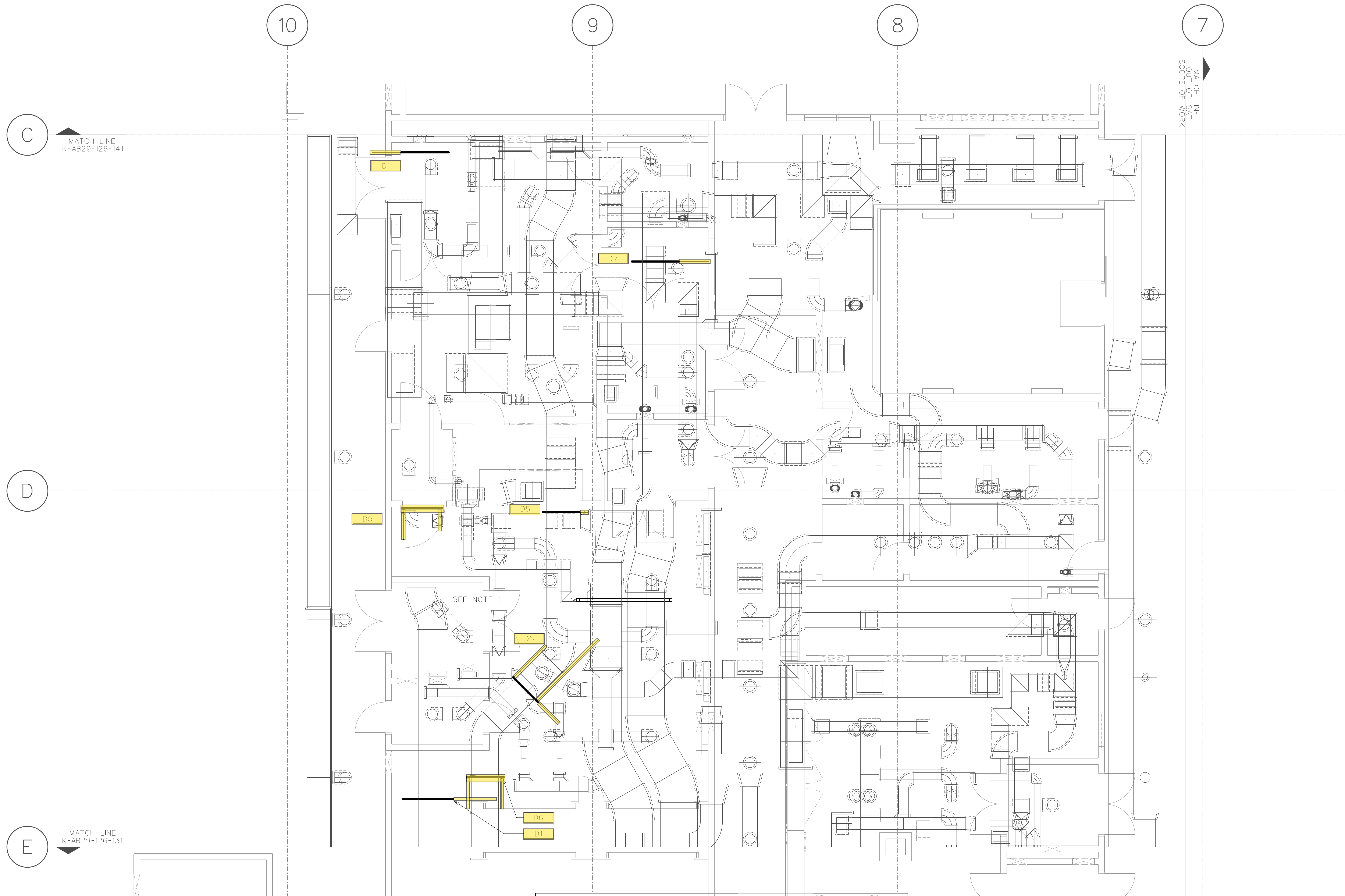
COL. E-F, 7-10  
HVAC SEISMIC PLAN  
FIRST FLOOR INTERSTITIAL

FILE NO: AB29126131.DGN  
DRAWING NO: K-AB29-126-131  
REV. NO: 1

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1																			K-AB29-126-131	1



GENERAL NOTES:  
 1. FOR MOMENT FRAME DETAIL SEE ENGINEERING PACKAGE OR SHEET K-AB29-126-010 DETAIL 08.409. TYP.



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 SVP - CLEAN UTILITIES

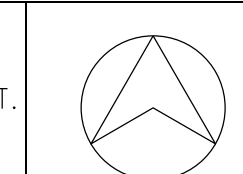
SEE ISAT SEISMIC BRACING LEGEND ON SHEET # SB-1 FOR INFORMATION ON SEISMIC LOCATIONS & ISAT KIT I.D.\*

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All work shall be installed in accordance with the 1997 UBC  
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COL. C-E, 7-10  
 HVAC SEISMIC PLAN  
 FIRST FLOOR INTERSTITIAL

FILE NO: AB29126136.DGN  
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8

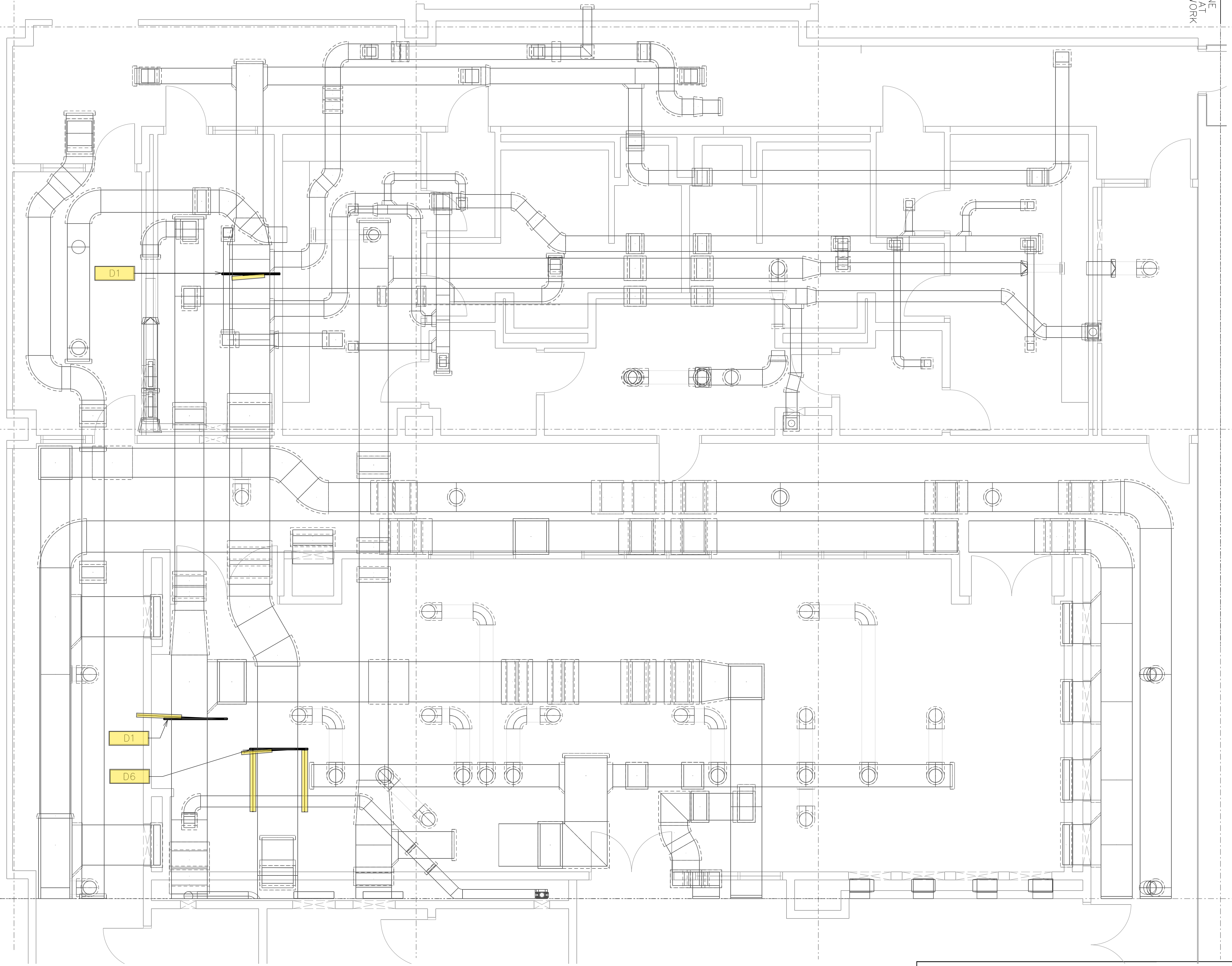
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A

B

C

MATCH LINE  
OUT OF ISAT  
SCOPE OF WORK



MATCH LINE  
K-AB29-126-136

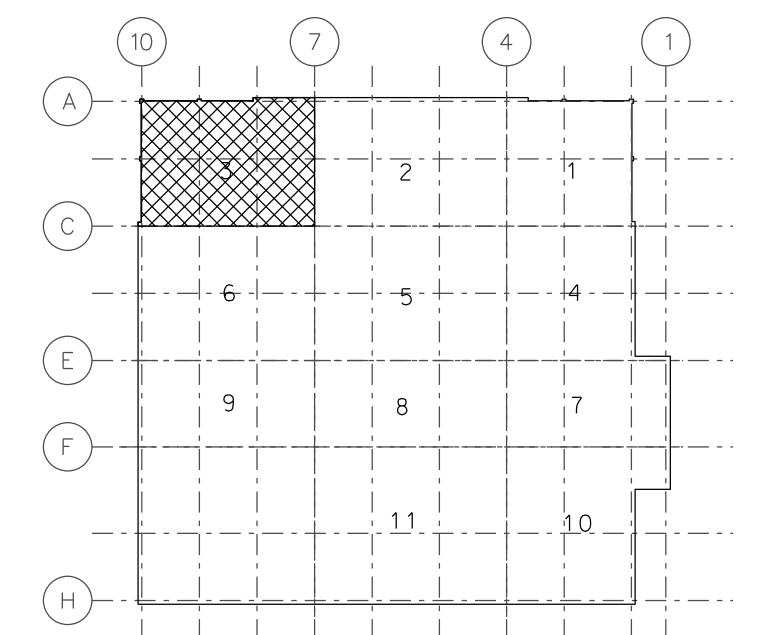
**ISAT** SEISMIC RESTRAINT LEGEND  
SVP - CLEAN UTILITIES

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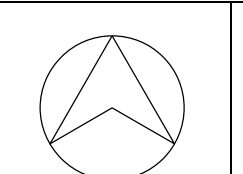
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KEY PLAN

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ON THE CADD SYSTEM

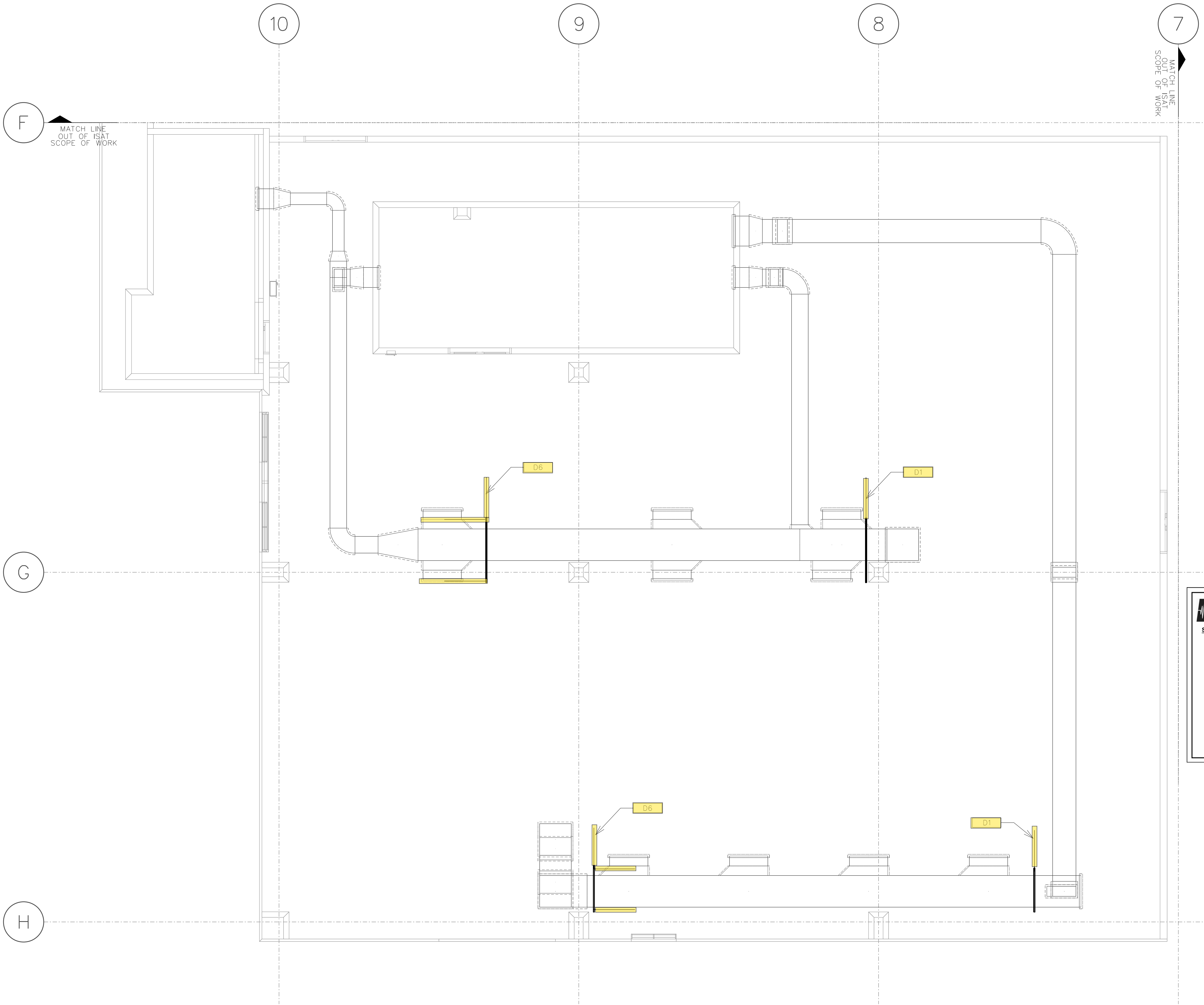


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COL. A-C, 7-10  
HVAC SEISMIC PLAN  
FIRST FLOOR INTERSTITIAL

FILE NO: AB29126141.DGN  
DRAWG. NO: K-AB29-126-141  
REV. NO: 1

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MATCH LINE  
OUT OF ISAT  
SCOPE OF WORK

MATCH LINE  
OUT OF ISAT  
SCOPE OF WORK

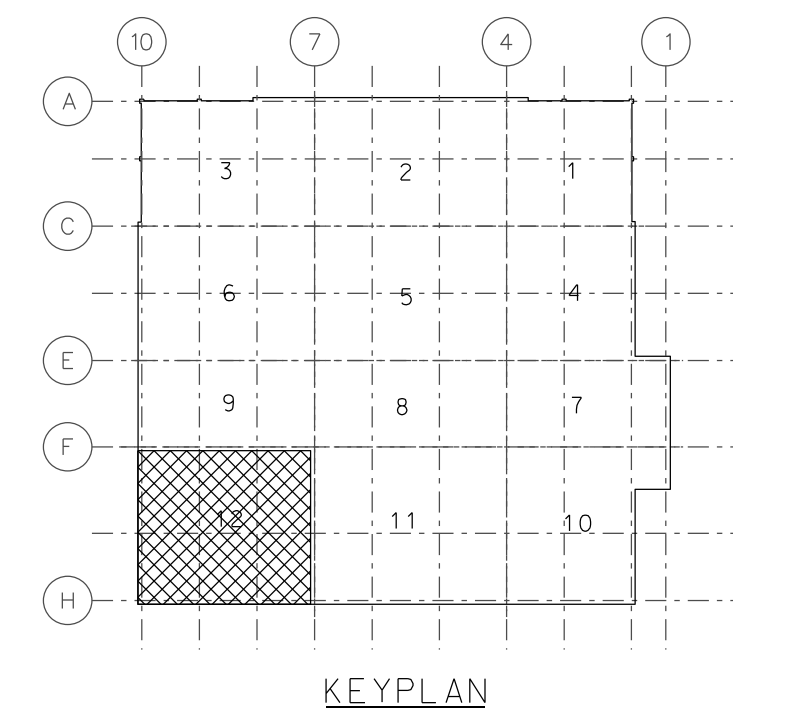
**ISAT** SEISMIC RESTRAINT LEGEND  
SVP - CLEAN UTILITIES

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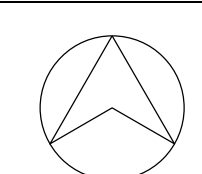
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COL. F-H,7-10  
HVAC SEISMIC PLAN  
SECOND FLOOR

FILE NO. AB29126146.DGN  
NO. K-AB29-126-146