SUBMITTAL - # 12

PROJECT:	Maine Medical Center R - 6 - I. C. U. Renovations 22 Bramhall St. PORTLAND, ME. 04102 JOB # 15221
GENERAL CONTRACTOR:	Hebert Construction LLC 9 Gould Rd. Lewiston, Me 04240
SUBMITTED BY:	JOHNSON & JORDAN, INC 765 Congress St. Portland, Me. 04102 (207) 775-1169
SUBCONTRACTOR:	N/A
SUPPLIER:	Mechanical Control Systems 26 Keewaydin Drive Unit B Salem, New Hampshire PHONE (978) 674-7251 FAX Unk.
SPECIFICATION SECTION:	230548
PARAGRAPH:	All
ITEM:	Seismic

JOHNSON & JORDAN
MECHANICAL CONTRACTORS

PHONE: (207) 883-8345 FAX: (207) 883-8619

APPROVED____ APPROVED AS NOTED____
RE-SUBMIT____ REVIEWED____
SUBJECT TO ARCHITECTS APPROVAL____
DATE 7/21/15 BY J.R.J.

REV.	DESCRIPTION	SOURCE of CHANGE	DATE
--	Initial Release		7/20/2015

SEISMIC CALCULATIONS

Suspended Systems

MECHANICAL CONTROL SYSTEMS
26-B Keeywaydin Drive
Salem, NH 03079

JOB: MMC R6 ICU

CUSTOMER: Johnson & Jordan

JOB NUMBER: J5187

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	2 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

TABLE I - SCHEDULE

MMC R6 ICU

TAG	QTY.	MFG.	MODEL	WT. (lbs.)	COMMENT
AHU-10	1	Trane	CSAA012UA	3,744	
EF-29	1	Trane	CSAA012UA	1,644	
See TABLE II for Seismic Restraints					

TABLE II - SEISMIC SUMMARY

MMC R6 ICU

	ANCHOR BOLTS per TAG				
	CONCRETE		STEEL	RESTRAINT	MINIMUM EDGE
TAG	Dia. (in.)	Embedment (in.)	Dia. (in.)		DISTANCE
AHU-10	5/8" (8)	4-1/2"	5/8" (8)	(2) Sets - VMC SB-250 w 1/4" AC Cable	6"
EF-29	5/8" (4)	4-1/2"	5/8" (4)	VMC SB-250 w 1/4" AC Cable	6"

TABLE III - SCHEDULE FOR VIBRATION ISOLATION

MMC R6 ICU

TAG	QTY.	WT. (lbs.)	ISOLATION	DEFL.	COMMENT
AHU-10	1	3,744	(4) HRSA-1E-1400	1.0"	
EF-29	1	1,644	(4) HRSA-1E-650	1.0"	

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	3 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

TABLE I - SCHEDULE FOR SEISMIC RESTRAINT CALCULATIONS
MMC R6 ICU

TAG	Trans.	Long.	WT. (lbs)	DETAIL	RESTRAINT
PIPING - UP TO 2-1/2" Dia.	40	80	9.1 lb/lin. Ft.	5/6	VMC - SB-125 W 1/8" CABLE
PIPING - UP TO 4" Dia.	20	20	18.3 lb/lin. Ft.	5/6	VMC - SB-125 W 1/8" CABLE

TABLE II - SEISMIC SUMMARY
MMC R6 ICU

	ANCHOR BOLTS per TAG					
	CONCRETE		STEEL	BRACE TYPE	MIN. CONC.	MIN. EDGE
TAG	Dia. (in.)	Embedment (in.)	Dia. (in.)		THICKNESS	DISTANCE
PIPING - UP TO 2-1/2" Dia.	1/2"	4"	1/2"	VMC - SB-125 W 1/8" CABLE	6"	6"
PIPING - UP TO 4" Dia.	1/2"	4"	1/2"	VMC - SB-125 W 1/8" CABLE	6"	6"

Seismic Locations		
Drawings	5	6
PL-100	1	0
PL-101	0	0
PL-102	0	0
MH-101	8	2

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	4 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

Table of Contents:

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	5 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

I. Summary of Critical Assumptions and Directive Statements:

1. This analysis does not certify that the equipment is capable of handling the applied seismic loads. Any non-Mechanical Control Systems mounting supports, brackets or other means of attachment must be independently certified. Mechanical Control Systems assumes no responsibility for support structure - for its ability to withstand static or seismic loads, nor for its ability to distribute loads onto restraints.

2. Weight and dimensional data was provided by the customer. The values used in this analysis must be verified. If they vary, disregard these recommendations and notify Mechanical Control Systems of the changes.

3. These calculations will certify seismic restraints for seismic loads identified in Paragraph VI.

4. Housekeeping pads are by others. Per ICC Report ESR-1917, the minimum concrete thickness for Hilti Kwik Bolt TZ is 3-inches or 1.5 x anchor embedment – whichever is greater.

5. Bolt sizes and quantities are the minimum required to withstand the specified seismic forces as applied through the equipment center of gravity. This makes the standard seismic design assumption that all components and modules are connected to respond as a unitary lump mass. Any additional bolting required by the equipment manufacturer must also be installed.

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	6 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

II. PURPOSE:

These calculations are submitted to Johnson & Jordan for MMC R6 ICU, to certify that the seismic restraints provided or recommended by Mechanical Control Systems will safely accept loads resulting from seismic forces.

III. SCOPE:

These calculations are for the seismic restraints supplied or specified by Mechanical Control Systems for use on the equipment per the Table II. These calculations certify that the Mechanical Control Systems components and specified hardware, when properly installed, are capable of safely supporting the specified seismic loads. These calculations do not cover equipment supplied by vendors nor the superstructure or substructure to which the Mechanical Control Systems components or specified hardware are attached. If there are any specs that supersede these assumptions, this analysis is invalid.

IV. STRATEGY AND ASSUMPTIONS:

For the purposes of this analysis, we must assume that the building and its internal structure have been designed to perform safely in response to an earthquake and remain intact and functioning after such an event. The equipment must be restrained and not break away from its supports during an earthquake. Therefore, the sum of the forces and moments acting on the equipment must be equal to zero. The problem can be reduced to a static analysis.

The force generated by the earthquake is composed of a vertical component and a horizontal component which act simultaneously about the equipment's center of gravity. The vertical component is taken to be .2 x S_{ds} multiplied by the equipment weight and added to the weight of the equipment. The compass orientation of the horizontal component is not known, therefore, assume an orientation that produces a worst case loading for a particular system. This information is based upon local and national codes.

V. EXEMPTIONS

PIPE

A. Pipe that passes through a wall or floor penetration. Provide positive attachment. No additional restraint required.

B. Top of pipe is within 12" of the support attachment to the structure. No additional restraint required.

C. Pipe is anchored and/or guided. No additional restraint required.

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	7 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

VI. ALLOWABLE LOADS:

Unless otherwise specified, allowable bolt loads are per the Manual of Steel Construction - AISC 360-10. Concrete is assumed to be fc' = 3,000 psi (minimum) – normal weight. ACI 318

For VMC Seismic Bracing, ratings are based on Manufacturers testing

For Tolco Seismic Bracing & Support Systems, ratings are based on OSHPD – OPM-0052-13

For Hilti TZ Anchors, ratings are based on ICC Report ESR-1917.

VII. SEISMIC FORCES:

IBC / ASCE-7

Portland, ME

MCE Ground Motion
Zip Code - 04102
(sec),(%g)
0.2 , **032.2** ,MCE Value of Ss
1.0 ,007.8,MCE Value of S1
Spectral Parameters for , Site Class D
Fa = **1.547**
Fv = 2.40

$S_S := .322$ $F_A := 1.547$

$S_{DS} := \frac{2}{3} \cdot F_A \cdot S_S$ $S_{DS} = 0.332$ g

$I_p := 1.5$	Component Importance Factor - 1.5 for life safety components, component containing certain quantities of hazardous or flammable materials, certain storage racks; 1.0 for all other components
$a_p := 1$	Component amplification factor -Table 13.6-1
$R_p := 2.5$	Component Response Modification Factor - Table 13.6-1
$z := 1$	Height in structure at point of attachment
$h := 1$	Average roof height relative to base

k is not required to be taken as greater than $k := 1.6 \cdot S_{DS} \cdot I_p$ $k = 0.80$

k shall not be taken as less than $k := .3 \cdot S_{DS} \cdot I_p$ $k = 0.15$

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	8 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

Suspended vibration isolation equipment including in-line duct devices and suspended internally isolated components and components & systems isolated using neoprene elements - above grade

$a_p := 2.5 \qquad R_p := 2.5 \qquad z := 1$

$$k := \frac{.4 \cdot a_p \cdot S_{DS}}{\frac{R_p}{I_p}} \cdot \left(1 + 2 \cdot \frac{z}{h}\right) \qquad k = 0.60 \qquad F_p := 0.60 \cdot W_p$$

Piping - above grade (conservatively use Rp = 4.5) $R_p := 4.5$

$$k := \frac{.4 \cdot a_p \cdot S_{DS}}{\frac{R_p}{I_p}} \cdot \left(1 + 2 \cdot \frac{z}{h}\right) \qquad k = 0.33 \qquad F_p := 0.33 \cdot W_p$$

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	9 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

EQUIPMENT TAG NO. AHU-10

Weight of payload:

$W_p := 3744$ lbs. $F_p := .60 \cdot W_p$ $F_p = 2246$ lbs.

$S_{DS} := .332$ g

The vertical component (F_{pv}) is

$F_{pv} := .2 \cdot S_{DS} \cdot W_p$ $F_{pv} = 249$ lbs.

With the (8) point cable arrangement, there will be effectively 2 cables functioning in each direction. Therefore,

$F_p := \frac{F_p}{2}$ $F_p = 1123$ lbs.

$F_{pv} := \frac{F_{pv}}{2}$ $F_{pv} = 124$ lbs.

SUMMARY - Restraint for Suspended Equipment

Air Handling Units are suspended by threaded rod (by others). They will be restrained with 1/4" AC Cable with the VMC - SB-250 Brace attachment at the structural side and attachment at the equipment side. Attach each brace to exisiting structural steel with (1) 5/8-inch diameter A325 bolt, or to concrete with (1) 5/8-inch diameter Hilti KB TZ wedge anchor. Since there is vibration isolation leave a 1/4" slack in the cable for the unit to deflect.

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	10 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

Evaluate forces on the anchor bolt

When the bracket is subjected to these loads, the bracket tends to pry from the mounting surface. Figure A shows a free body diagram of the bracket with the force vectors. Summing moments and summing forces in the horizontal axis will determine the tensile and shear forces, F_{vb} and F_{tb}, respectively.

For SB-250 Bracket,

$L_1 := 1.57 \qquad L_2 := 1.25$

$\theta := 45$, degrees

$\theta := \frac{\theta \cdot 2 \cdot \pi}{360}$, radians

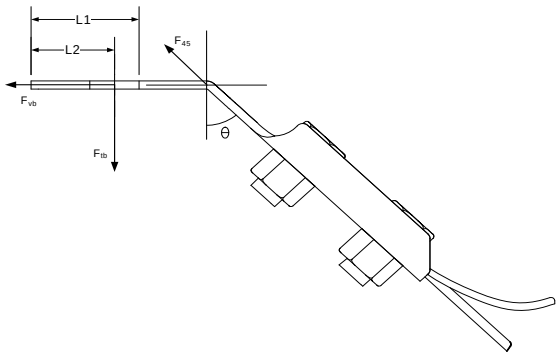


FIGURE A - Schematic of VMC - SB-250

$F_{restraint} := \frac{F_p}{\cos(\theta)}$ lbs. $\qquad F_{restraint} = 1588$ lbs.

These forces are within the capability of the Bracket.

$\Sigma M = 0 = L_1(F_{cable})(\text{Sin}\,\theta) - (L_2)F_{tb}$ Solving for F_{tb},

$F_{tb} := \frac{L_1 \cdot F_{restraint} \cdot \sin(\theta)}{L_2} \qquad F_{tb} = 1411$, lbs.

Summing forces in the horizontal plane yields the following,

$\Sigma Fh = Fvb - Fcable\ (\text{Cos}(\theta))$

$F_{vb} := F_{restraint} \cdot (\cos(\theta)) \qquad F_{vb} = 1123$, lbs.

BOLT SUMMARY - The maximum forces imposed on the single bolt attachment are:

Shear	$F_{vb} = 1123$	, lbs.
Tension	$F_{tb} = 1411$	, lbs.

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	11 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

Combined shear and tension check for A325 Bolt by AISC

Root area for 5/8" dia. bolt = 0.202 in.^{2} - AISC ASD 9th ed.

$$f_{tb} := \frac{F_{tb}}{.202} \qquad f_{tb} = 6984 \qquad \text{, psi - tension}$$

$$f_{vb} := \frac{F_{vb}}{.202} \qquad f_{vb} = 5560 \qquad \text{, psi - shear}$$

Maximum allowable shear stress is 21,000 psi. OK

The maximum allowable tension stress is:

$$f_{t2} := \sqrt{44^2 - 4.39 \cdot \left(\frac{f_{vb}}{1000}\right)^2} \qquad f_{t2} = 42 \qquad \text{ksi}$$

f_{tb} is less than $f_{t2,}$ so the bolt is OK. Use 8 Bolts - 5/8-inch diameter - per ASTM A325

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	12 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

SUMMARY:

Each anchor must be capable of withstanding the following forces:

Tension: $F_{tb} = 1411$, lbs.

Shear: $F_{vb} = 1123$, lbs.

$F_{allT} := 2899$, pounds per anchor - (Tension)

$F_{allS} := 3845$, pounds per anchor (Shear)

For anchors in concrete, subjected to combined tension and shear loads, the interaction formula is used. The anchorage is considered adequate if the Interaction (I) is less than, or equal to, 1.2.

$$I := \left(\frac{F_{tb}}{F_{allT}}\right) + \left(\frac{F_{vb}}{F_{allS}}\right) \qquad I = 0.779$$

I < 1.2 and the anchorage is adequate.

Use for HILTI KWIK BOLT TZ

- 5/8- inch diameter
- 4-1/2- inch embedment
- 3,000 psi concrete (min.) - normal-weight
- cracked or uncracked concrete

Install per Manufacturer's instructions and ESR-1917.

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	13 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

EQUIPMENT TAG NO. EF-29

Weight of payload:

$W_p := 1644$ lbs. $F_p := .60 \cdot W_p$ $F_p = 986$ lbs.

$S_{DS} := .332$, g

The vertical component (F_{pv}) is

$F_{pv} := .2 \cdot S_{DS} \cdot W_p$ $F_{pv} = 109$ lbs.

SUMMARY - Restraint for Equipment

Equipment is suspended by threaded rod (by others). They will be restrained with Seismic Cable with VMC SB-250 Brackets at the structure side and on the equipment side. Attach each brace to steel structural with one (1) 5/8-inch diameter A325 bolt.

Evaluate forces on the anchor bolt

When the bracket is subjected to these loads, the bracket tends to pry from the mounting surface. Figure A shows a free body diagram of the bracket with the force vectors. Summing moments and summing forces in the horizontal axis will determine the tensile and shear forces - F_{vb} and F_{tb}, respectively.

For VMC Bracket,

$L_1 := 1.0$ $L_2 := 1.0$

$\theta := 45$, degrees

$\theta := \frac{\theta \cdot 2 \cdot \pi}{360}$, radians

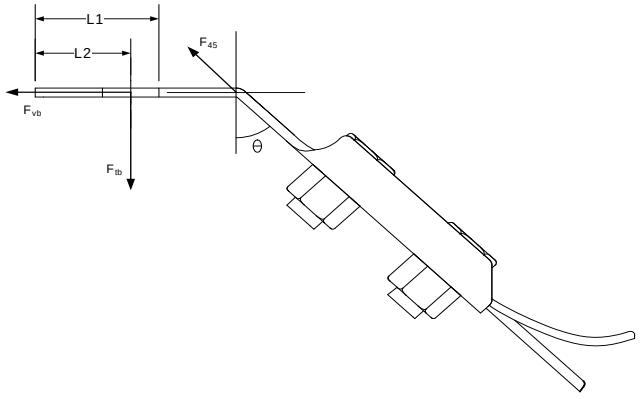


FIGURE A - Schematic of VMC Bracket

$F_{restraint} := \frac{F_p}{\cos(\theta)}$ lbs. $F_{restraint} = 1395$ lbs.

These forces are within the capability of the Bracket.

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	14 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

$\Sigma M = 0 = L_1(F_{cable})(\sin\theta) - (L_2)F_{tb}$ Solving for F_{tb},

$$F_{tb} := \frac{L_1 \cdot F_{restraint} \cdot \sin(\theta)}{L_2} \qquad F_{tb} = 986 \text{ , lbs.}$$

Summing forces in the horizontal plane yields the following,

$\Sigma Fh = Fvb - Fcable\ (Cos\ (\theta))$

$$F_{vb} := F_{restraint} \cdot (\cos(\theta)) \qquad F_{vb} = 986 \text{ , lbs.}$$

BOLT SUMMARY - The maximum forces imposed on the single bolt attachment are:

Shear	$F_{vb} = 986$	, lbs.
Tension	$F_{tb} = 986$	, lbs.

Combined shear and tension check for A325 Bolt per AISC
Root area of 5/8" dia bolt = .202 in^2 - AISC ASD 9th edition

$$f_{tb} := \frac{F_{tb}}{.202} \qquad f_{tb} = 4883 \text{ ,psi}$$

$$f_{vb} := \frac{F_{vb}}{.202} \qquad f_{vb} = 4883 \text{ ,psi}$$

Maximum allowable shear stress is 21,000 psi. OK

The maximum allowable tension stress is:

$$f_{t2} := \sqrt{44^2 - 4.39 \cdot \left(\frac{f_{vb}}{1000}\right)^2} \qquad f_{t2} = 43 \text{ ksi}$$

f_{tb} is less than f_{t2}, so the bolt is OK. Use 4 Bolts - 5/8-inch diameter - per ASTM A325

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	15 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

SUMMARY:

Each anchor must be capable of withstanding the following forces:

Tension: $F_{tb} = 986$, lbs.

Shear: $F_{vb} = 986$, lbs.

Evaluate for HILTI KWIK BOLT TZ

- 5/8- inch diameter
- 4-1/2 - inch embedment
- 3,000 psi concrete (min.) - normal-weight
- cracked or uncracked concrete
- Condition B of ACI-318-05

For optimum anchor spacing and edge distances, allowable forces in tension and shear are as shown below (from ICC Report ESR-1917):

$F_{allT} := 2899$, pounds per anchor - (Tension)

$F_{allS} := 3845$, pounds per anchor (Shear)

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	16 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

For anchors in concrete, subjected to combined tension and shear loads, the interaction formula is used. The anchorage is considered adequate if the Interaction (I) is less than, or equal to, 1.2.

$$I := \left(\frac{F_{tb}}{F_{allT}}\right) + \left(\frac{F_{vb}}{F_{allS}}\right) \qquad I = 0.597$$

I < 1.2 and the anchorage is adequate.

Use HILTI KWIK BOLT TZ

- 5/8 - inch diameter
- 4-1/2 - inch embedment
- 3,000 psi concrete (min.) - normal-weight
- cracked or uncracked concrete
- Condition B of ACI-318-05

Install per Manufacturer's instructions and ESR-1917.

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	17 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

Equipment Tag: **Piping Locations**

Analysis of the **VMC SB-125** Brace Seismic Restraint System, Evaluate 4-inch suspended Pipe:

Evaluation Taken as 18.3 lbs/ft x 20 ft = 366 lbs. as worst case. All other piping locations must be used at all specific locations as defined on the plan drawings associated with this calculations.

Weight of Payload	=	W_p
Horizontal Force	=	F_p
Vertical Force	=	F_{pv}

Horizontal Seismic Force:

$W_p := 366$ lbs. $\quad F_p := .33 \cdot W_p \quad F_p = 121$ lbs.

Vertical Seismic Force:

$S_{DS} := .332$ g $\quad F_{pv} := .2 \cdot S_{DS} \cdot W_p \quad F_{pv} = 24$ lbs.

SUMMARY - Restraint for Piping

Piping is suspended by threaded rod (by others). The system will be restrained with **VMC SB-125** bracing at the structure side. The eyelet will be attached to the equipment side to the threaded rod. (See attached Details) Attach each brace to existing steel structure with one 1/2- inch diameter A325 bolt.

Evaluate forces on the anchor bolt

The following figures represent the load path & sway diagrams. When the bracket is subjected to these loads, the bracket tends to pry from the mounting surface. Summing moments and summing forces in the horizontal axis will determine the tensile and shear forces - F_{vb} and F_{tb}, respectively.

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	18 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

FIGURE - Schematic of Forces on Piping System

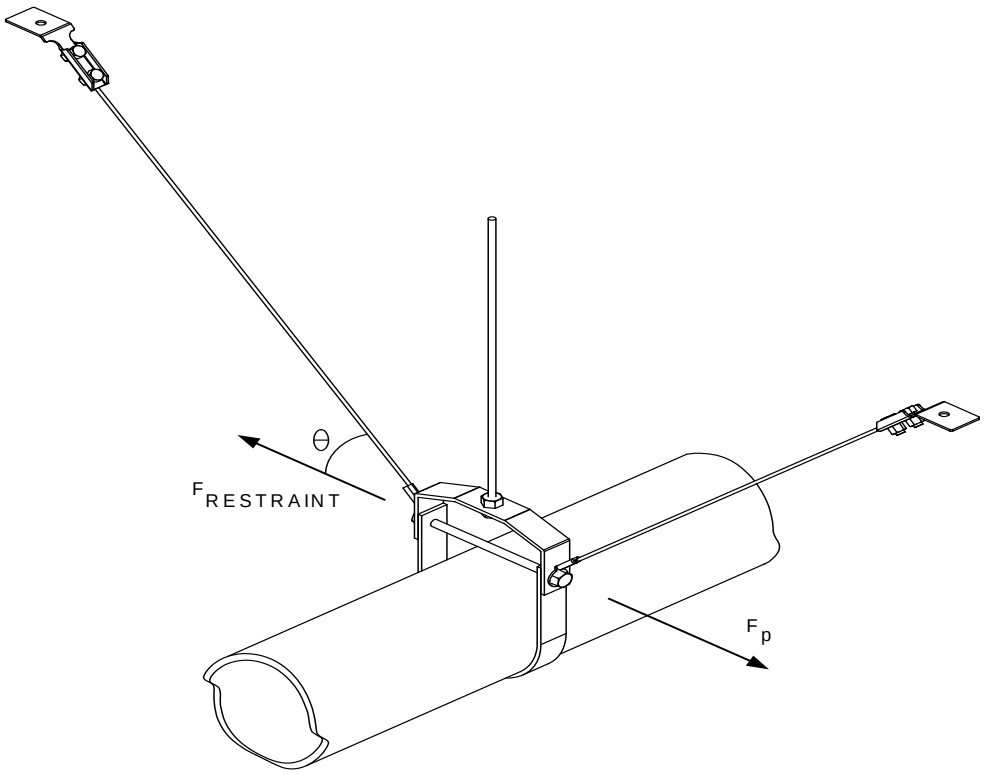
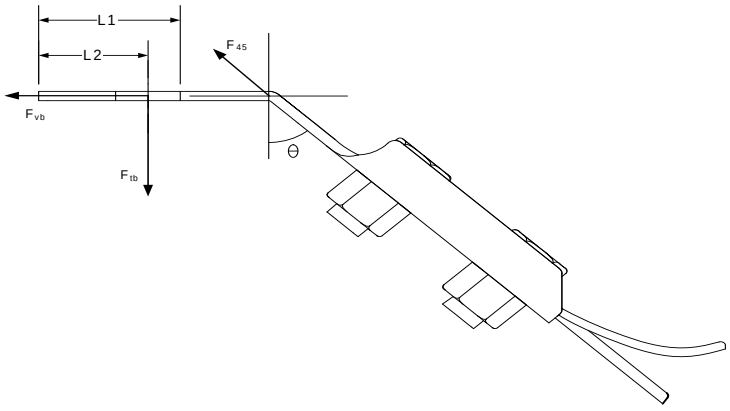


FIGURE - Schematic of **VMC-SB-125**



$L_1 := 1.0$ $L_2 := 1.0$

$\theta := 45$ degrees

$\theta := \frac{\theta \cdot 2 \cdot \pi}{360}$ radians

$F_{restraint} := \frac{F_p}{\cos(\theta)}$ lbs. $F_{restraint} = 171$ lbs.

These forces are within the capability of the 1/8" dia. cable and the mounting bracket, which are rated to 667 pounds.

VMC - SB-125

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	19 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

$SM = 0 = L_1 (F_{RESTRAINT})(\sin\theta) - (L_2) F_{tb}$

$$F_{tb} := \frac{L_1 \cdot F_{restraint} \cdot \sin(\theta)}{L_2} \qquad F_{tb} = 121 \quad \text{lbs.}$$

Summing forces in the horizontal plane yields the following,

$SF_h = F_{vb} - F_{RESTRAINT} \ (\cos\theta)$

$$F_{vb} := F_{restraint} \cdot \cos(\theta) \qquad F_{vb} = 121 \quad \text{lbs.}$$

BOLT SUMMARY - The maximum forces imposed on the single bolt attachment are:

Shear $F_{vb} = 121$ lbs.

Tension $F_{tb} = 121$ lbs.

Evaluate bolt attachment to Steel

Combined shear and tension check for A325 Bolt by AISC

Root are for 1/2" dia. bolt = 0.126 $in.^2$ - AISC ASD 9th ed.

$$f_{tb} := \frac{F_{tb}}{.126} \qquad f_{tb} = 959 \quad \text{psi - tension}$$

$$f_{vb} := \frac{F_{vb}}{.126} \qquad f_{vb} = 959 \quad \text{psi - shear}$$

Maximum allowable shear stress is 21,000 psi. OK

The maximum allowable tension stress is:

$$f_{t2} := \sqrt{44^2 - 4.39 \cdot \left(\frac{f_{vb}}{1000}\right)^2} \qquad f_{t2} = 44 \quad \text{ksi}$$

f_{tb} is less than f_{t2}, so the bolt is OK. Use 1/2- inch dia. bolts - per ASTM A325

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	20 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

Evaluate anchor attachment to concrete

BOLT SUMMARY - The maximum forces imposed on the single bolt attachment are:

Shear $F_{vb} = 121$ lbs.

Tension $F_{tb} = 121$ lbs.

Evaluate for **HILTI KWIK BOLT TZ**

- 1/2- inch diameter
- 3-5/8 - inch embedment
- 3,000 psi concrete (min.) - normal-weight
- cracked or uncracked concrete

For optimum anchor spacing and edge distances, allowable forces in tension and shear are as shown below (from ICC Report ESR-1917):

$F_{allT} := 1050$ pounds per anchor - (Tension)

$F_{allS} := 1490$ pounds per anchor (Shear)

For anchors in concrete, subjected to combined tension and shear loads, the interaction formula is used. The anchorage is considered adequate if the Interaction (I) is less than, or equal to, 1.2.

$$I := \left(\frac{F_{tb}}{F_{allT}}\right) + \left(\frac{F_{vb}}{F_{allS}}\right) \qquad I = 0.196$$

I < 1.2 and the anchorage is adequate.

See FIGURE below for dimensional requirements for installation under metal deck floor and roof assemblies

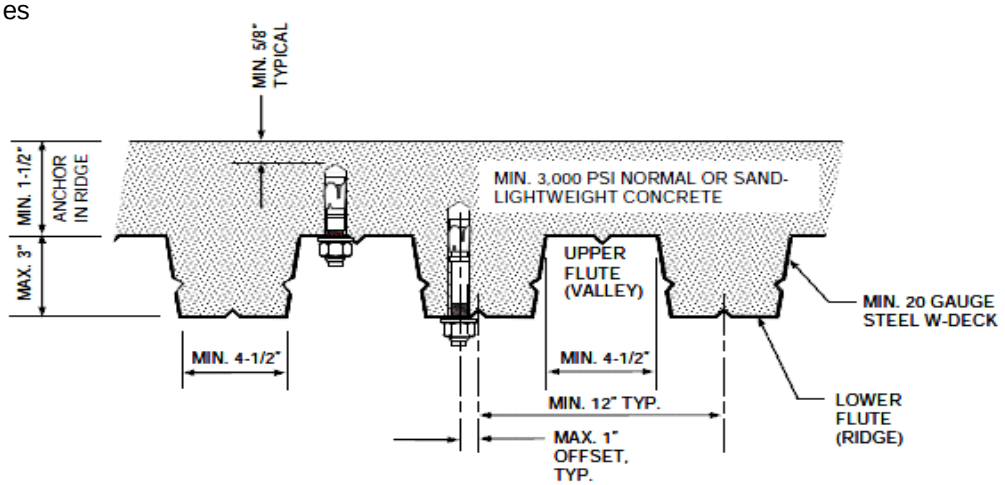


FIGURE 5—INSTALLATION IN THE SOFFIT OF CONCRETE OVER METAL DECK FLOOR AND ROOF ASSEMBLIES

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	21 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

Equipment Tag: **Piping Locations**

Analysis of the **VMC SB-125** Brace Seismic Restraint System, Evaluate 2.5-inch suspended Pipe:

Evaluation Taken as 9.1 lbs/ft x 80 ft = 728 lbs. as worst case. All other piping locations must be used at all specific locations as defined on the plan drawings associated with this calculations.

Weight of Payload	=	W_p
Horizontal Force	=	F_p
Vertical Force	=	F_{pv}

Horizontal Seismic Force:

$W_p := 728$ lbs. $\quad F_p := .33 \cdot W_p \quad F_p = 240$ lbs.

Vertical Seismic Force:

$S_{DS} := .332$ g $\quad F_{pv} := .2 \cdot S_{DS} \cdot W_p \quad F_{pv} = 48$ lbs.

SUMMARY - Restraint for Piping

Piping is suspended by threaded rod (by others). The system will be restrained with **VMC SB-125** bracing at the structure side. The eyelet will be attached to the equipment side to the threaded rod. (See attached Details) Attach each brace to existing steel structure with one 1/2- inch diameter A325 bolt.

Evaluate forces on the anchor bolt

The following figures represent the load path & sway diagrams. When the bracket is subjected to these loads, the bracket tends to pry from the mounting surface. Summing moments and summing forces in the horizontal axis will determine the tensile and shear forces - F_{vb} and F_{tb}, respectively.

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	22 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

FIGURE - Schematic of Forces on Piping System

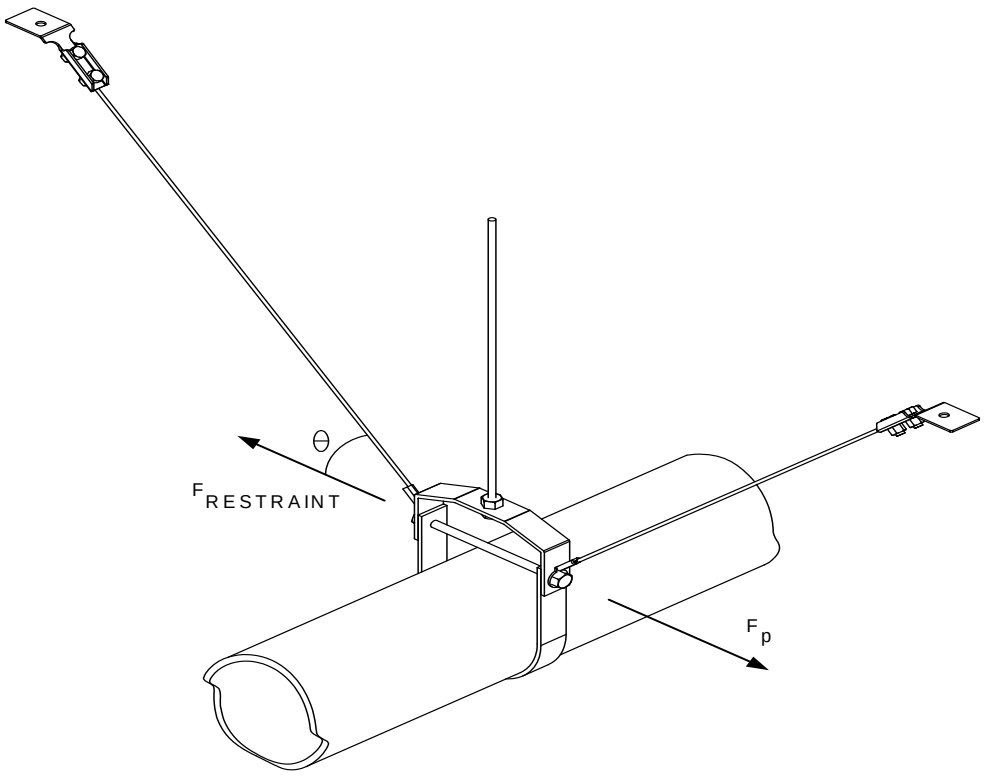
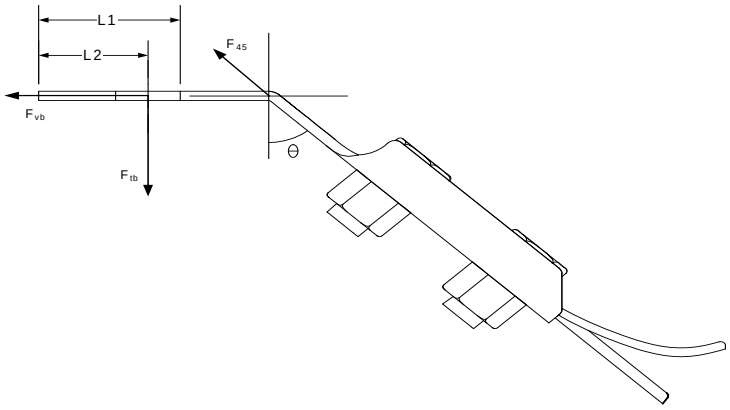


FIGURE - Schematic of **VMC-SB-125**



$L_1 := 1.0$ $L_2 := 1.0$

$\theta := 45$ degrees

$\theta := \frac{\theta \cdot 2 \cdot \pi}{360}$ radians

$F_{restraint} := \frac{F_p}{\cos(\theta)}$ lbs. $F_{restraint} = 340$ lbs.

These forces are within the capability of the 1/8" dia. cable and the mounting bracket, which are rated to 667 pounds.

VMC - SB-125

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	23 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

$SM = 0 = L_1 (F_{RESTRAINT})(\sin\theta) - (L_2) F_{tb}$

$$F_{tb} := \frac{L_1 \cdot F_{restraint} \cdot \sin(\theta)}{L_2} \qquad F_{tb} = 240 \quad \text{lbs.}$$

Summing forces in the horizontal plane yields the following,

$SF_h = F_{vb} - F_{RESTRAINT} \ (\cos\theta)$

$$F_{vb} := F_{restraint} \cdot \cos(\theta) \qquad F_{vb} = 240 \quad \text{lbs.}$$

BOLT SUMMARY - The maximum forces imposed on the single bolt attachment are:

Shear $F_{vb} = 240$ lbs.

Tension $F_{tb} = 240$ lbs.

Evaluate bolt attachment to Steel

Combined shear and tension check for A325 Bolt by AISC

Root are for 1/2" dia. bolt = 0.126 $in.^2$ - AISC ASD 9th ed.

$$f_{tb} := \frac{F_{tb}}{.126} \qquad f_{tb} = 1907 \quad \text{psi - tension}$$

$$f_{vb} := \frac{F_{vb}}{.126} \qquad f_{vb} = 1907 \quad \text{psi - shear}$$

Maximum allowable shear stress is 21,000 psi. OK

The maximum allowable tension stress is:

$$f_{t2} := \sqrt{44^2 - 4.39 \cdot \left(\frac{f_{vb}}{1000}\right)^2} \qquad f_{t2} = 44 \quad \text{ksi}$$

f_{tb} is less than f_{t2}, so the bolt is OK. Use 1/2- inch dia. bolts - per ASTM A325

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	24 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

Evaluate anchor attachment to concrete

BOLT SUMMARY - The maximum forces imposed on the single bolt attachment are:

Shear $F_{vb} = 240$ lbs.

Tension $F_{tb} = 240$ lbs.

Evaluate for **HILTI KWIK BOLT TZ**

- 1/2- inch diameter
- 3-5/8 - inch embedment
- 3,000 psi concrete (min.) - normal-weight
- cracked or uncracked concrete

For optimum anchor spacing and edge distances, allowable forces in tension and shear are as shown below (from ICC Report ESR-1917):

$F_{allT} := 1050$ pounds per anchor - (Tension)

$F_{allS} := 1490$ pounds per anchor (Shear)

For anchors in concrete, subjected to combined tension and shear loads, the interaction formula is used. The anchorage is considered adequate if the Interaction (I) is less than, or equal to, 1.2.

$$I := \left(\frac{F_{tb}}{F_{allT}}\right) + \left(\frac{F_{vb}}{F_{allS}}\right) \qquad I = 0.39$$

I < 1.2 and the anchorage is adequate.

See FIGURE below for dimensional requirements for installation under metal deck floor and roof assemblies

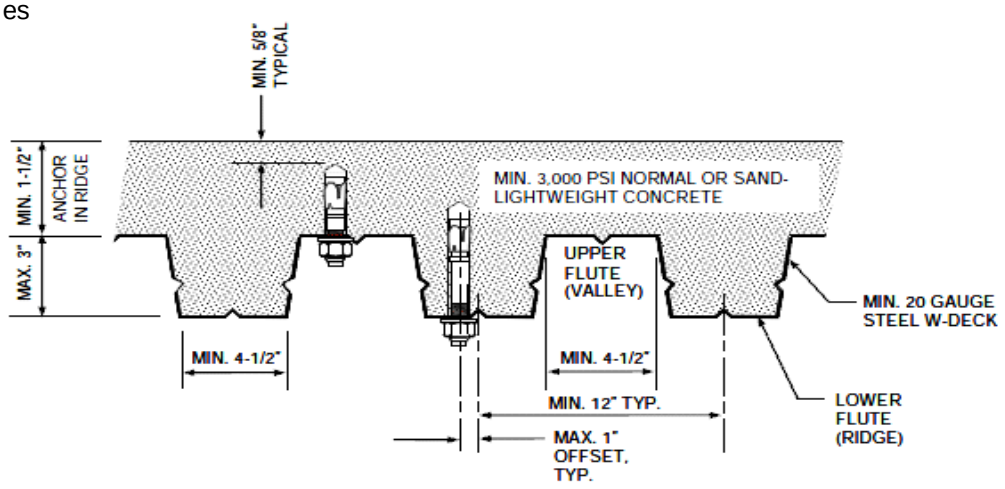
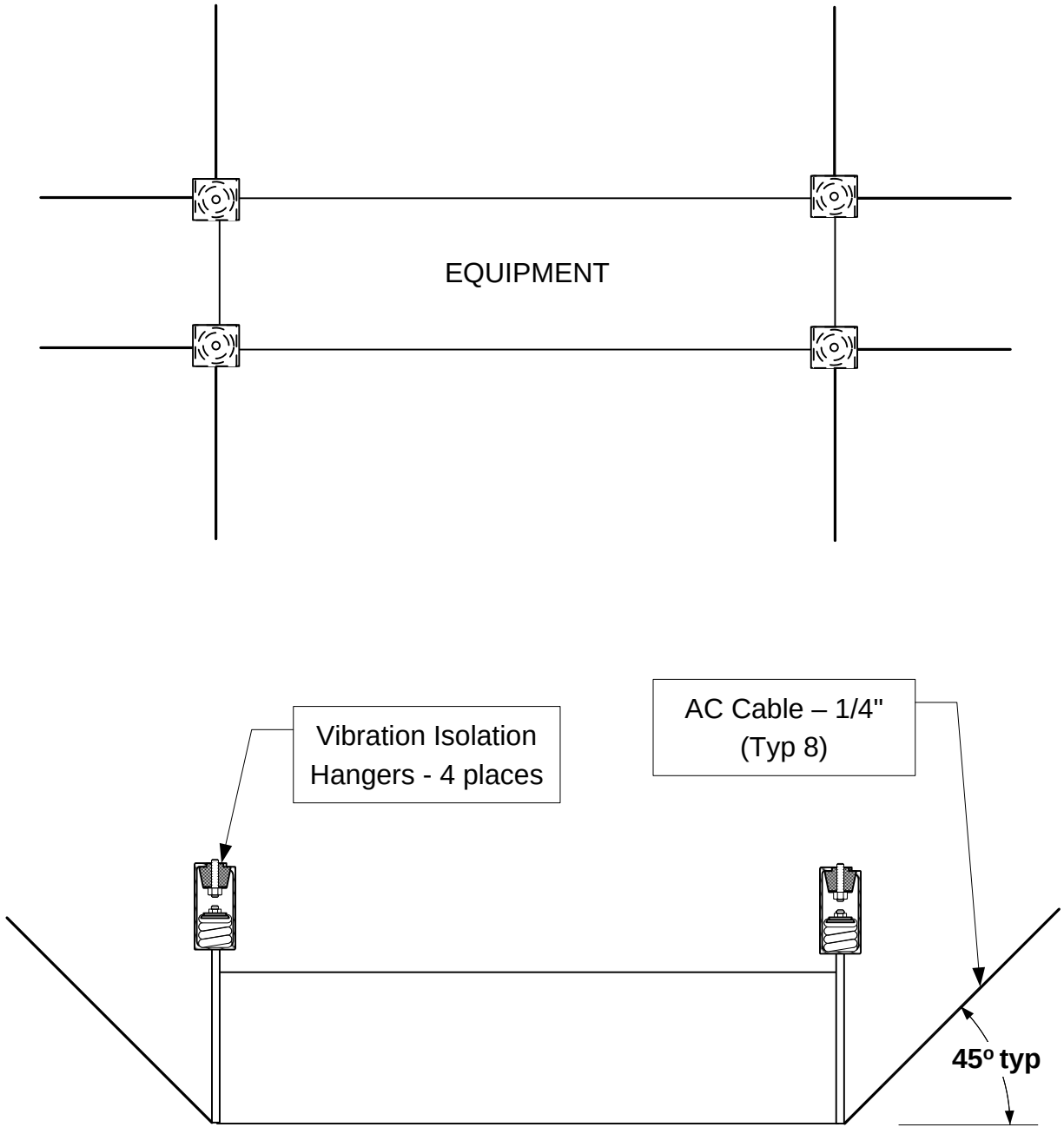


FIGURE 5—INSTALLATION IN THE SOFFIT OF CONCRETE OVER METAL DECK FLOOR AND ROOF ASSEMBLIES

26-B Keewaydin Drive
Salem, NH 03079
P 978.640.9994

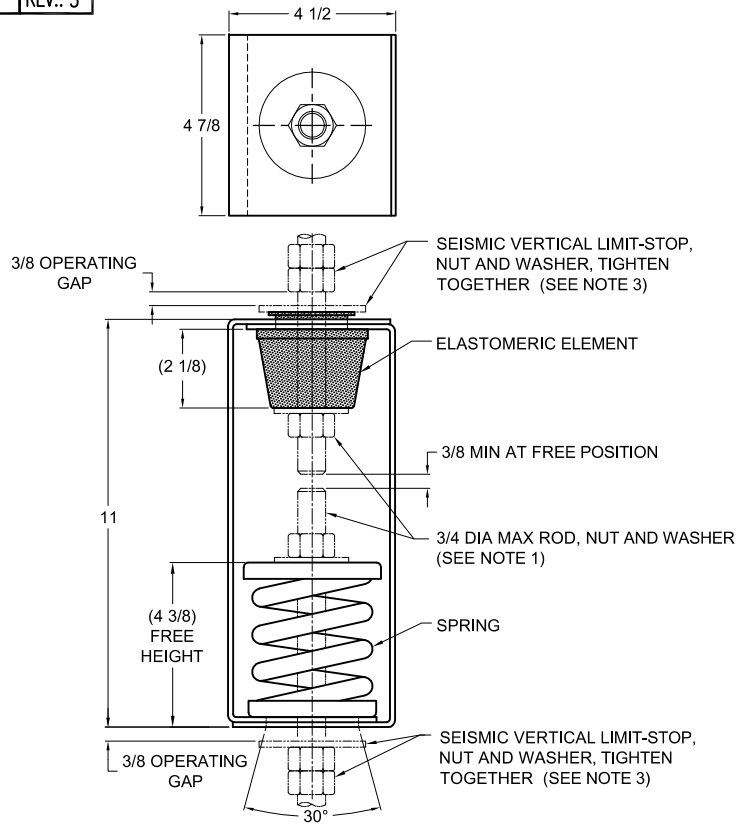
PROJECT		DWG NUMBER	REV. NO.	SHEET NO.
MMC R6 ICU		J5187	--	25 OF 35
ORIGINATOR	DATE	CHECKED	DATE	
TPL	7/20/2015			

Arrangement for Seismic Cable Restraints for Equipment
TAG: AHU-10



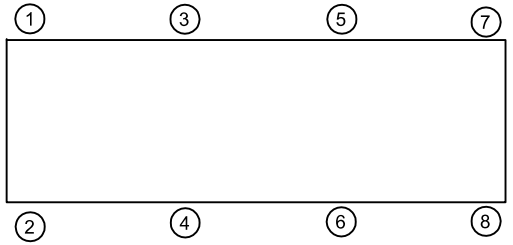
135R–101211 | REV.: 3

REV.	DESCRIPTION	DATE	BY



TYPE HRSA-1E ELASTOMERIC & SPRING ANGULARITY HANGERS FOR 1" NOMINAL DEFLECTION

HANGER	RATED LOAD (LBS)	DEFLECTION (IN)	SPRING RATE (LB/IN)	SPRING COLOR CODE	ELEMENT LOAD & COLOR CODE
HRSA-1E-195	195	2.21	100	DK BLUE	RE-C-380 BLACK
HRSA-1E-400	400	1.70	303	BLACK	RE-C-520 RED
HRSA-1E-650	650	1.44	619	RED	RE-C-840 GREEN
HRSA-1E-1000	1000	1.47	1000	TAN	RE-C-1070 GRAY
HRSA-1E-1400	1400	1.35	1400	PINK	RE-C-2000 BLUE
HRSA-1E-2000	2000	1.61	1802	WHITE	RE-C-2000 BLUE



NOTES:

1. HANGER RODS, NUTS AND WASHERS, AS SHOWN, NOT BY THE VMC GROUP.
2. STANDARD FINISH: HANGER BOX - PAINTED, POWDER COATED OR GALVANIZED STEEL , SPRING - POWDER COAT.
3. SEISMIC VERTICAL-STOP HARDWARE REQUIRED FOR SEISMIC APPLICATIONS, NOT BY THE VMC GROUP. INSTALL WASHER .165 THK. MIN. X 2-7/8 O.D. MIN. WITH REQUIRED INSIDE DIAMETER TO ACCOMMODATE ROD SIZE IN USE. THIS CAN BE ACCOMPLISHED BY USING A SINGLE WASHER OR BY STACKING NOT MORE THAN TWO WASHERS.
4. ALL DIMENSIONS IN INCHES. INTERPRET PER ANSI Y14.
5. ALL DIMENSIONS ARE FOR REFERENCE, DIMENSIONS SHOWN AS NOMINAL.
6. ALL SPRINGS ARE DESIGNED WITH MIN IMUM 50% OVER-TRAVEL.
7. HANGER BOXES ARE AVAILABLE PRE-COMPRESSED UP TO THEIR DESIGNATED MAX. LOAD. PERCENTAGE OF PRE-COMPRESSION TO BE DETERMINED BY ENGINEERED APPLICATION OR AS REQUESTED BY CUSTOMER. CONSULT FACTORY FOR POSSIBLE ADDITIONAL PARAMETERS AND OR LIMITATIONS.
8. HANGER BOXES WITH AN ELASTOMERIC ELEMENT HAVE UP TO AN ADDITIONAL 1/2" NOMINAL DEFLECTION.

ISOLATOR SELECTIONS	
LOC 1: HRSA-1E-1400	LOC 2: HRSA-1E-1400
LOC 3: HRSA-1E-1400	LOC 4: HRSA-1E-1400
LOC 5:	LOC 6:
LOC 7:	LOC 8:
CUSTOMER EQP'T. TAG: AHU-10	

NOTE: MATERIAL SHOWN IS FOR (1) SET.

OTHER MATERIALS, COMPOUNDS, OR FINISHES WITH EQUAL OR SUPERIOR PROPERTIES MAY BE SUBSTITUTED AS THEY BECOME AVAILABLE.

CERTIFIED FOR:

JOB NAME: MMC R6 ICU

CUSTOMER : Johnson & Jordan

CUSTOMER P.O.: _____

SALES ORDER: _____

MODEL HRSA-1E ELASTOMERIC & SPRING ANGULARITY HANGERS 1" NOMINAL DEFLECTION

THE VMC GROUP
The Power of Together
Bloomingdale, NJ 07403
Houston, TX 77041

SCALE : NONE

SHEET: 1 OF 1

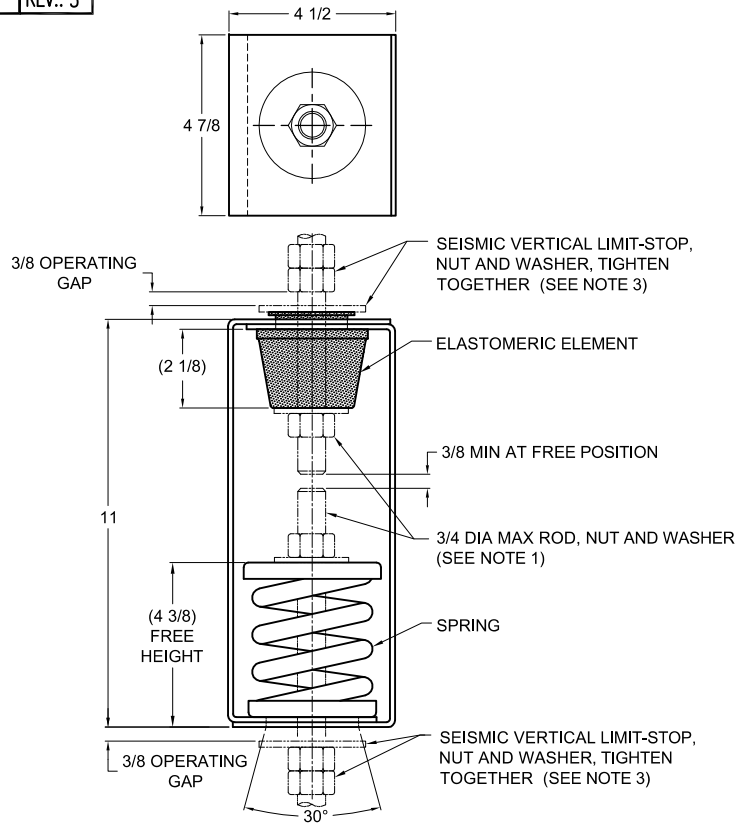
Member VISCMA

DRAWING NO.:

REVISION

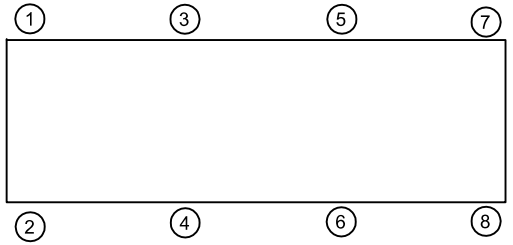
135R–101211 | REV.: 3

REV.	DESCRIPTION	DATE	BY



TYPE HRSA-1E ELASTOMERIC & SPRING ANGULARITY HANGERS FOR 1" NOMINAL DEFLECTION

HANGER	RATED LOAD (LBS)	DEFLECTION (IN)	SPRING RATE (LB/IN)	SPRING COLOR CODE	ELEMENT LOAD & COLOR CODE
HRSA-1E-195	195	2.21	100	DK BLUE	RE-C-380 BLACK
HRSA-1E-400	400	1.70	303	BLACK	RE-C-520 RED
HRSA-1E-650	650	1.44	619	RED	RE-C-840 GREEN
HRSA-1E-1000	1000	1.47	1000	TAN	RE-C-1070 GRAY
HRSA-1E-1400	1400	1.35	1400	PINK	RE-C-2000 BLUE
HRSA-1E-2000	2000	1.61	1802	WHITE	RE-C-2000 BLUE



NOTES:

1. HANGER RODS, NUTS AND WASHERS, AS SHOWN, NOT BY THE VMC GROUP.
2. STANDARD FINISH: HANGER BOX - PAINTED, POWDER COATED OR GALVANIZED STEEL , SPRING - POWDER COAT.
3. SEISMIC VERTICAL-STOP HARDWARE REQUIRED FOR SEISMIC APPLICATIONS, NOT BY THE VMC GROUP. INSTALL WASHER .165 THK. MIN. X 2-7/8 O.D. MIN. WITH REQUIRED INSIDE DIAMETER TO ACCOMMODATE ROD SIZE IN USE. THIS CAN BE ACCOMPLISHED BY USING A SINGLE WASHER OR BY STACKING NOT MORE THAN TWO WASHERS.
4. ALL DIMENSIONS IN INCHES. INTERPRET PER ANSI Y14.
5. ALL DIMENSIONS ARE FOR REFERENCE, DIMENSIONS SHOWN AS NOMINAL.
6. ALL SPRINGS ARE DESIGNED WITH MIN IMUM 50% OVER-TRAVEL.
7. HANGER BOXES ARE AVAILABLE PRE-COMPRESSED UP TO THEIR DESIGNATED MAX. LOAD. PERCENTAGE OF PRE-COMPRESSION TO BE DETERMINED BY ENGINEERED APPLICATION OR AS REQUESTED BY CUSTOMER. CONSULT FACTORY FOR POSSIBLE ADDITIONAL PARAMETERS AND OR LIMITATIONS.
8. HANGER BOXES WITH AN ELASTOMERIC ELEMENT HAVE UP TO AN ADDITIONAL 1/2" NOMINAL DEFLECTION.

ISOLATOR SELECTIONS	
LOC 1: HRSA-1E-650	LOC 2: HRSA-1E-650
LOC 3: HRSA-1E-650	LOC 4: HRSA-1E-650
LOC 5:	LOC 6:
LOC 7:	LOC 8:
CUSTOMER EQP'T. TAG: EF-29	

NOTE: MATERIAL SHOWN IS FOR (1) SET.

OTHER MATERIALS, COMPOUNDS, OR FINISHES WITH EQUAL OR SUPERIOR PROPERTIES MAY BE SUBSTITUTED AS THEY BECOME AVAILABLE.

CERTIFIED FOR:

JOB NAME: MMC R6 ICU

CUSTOMER : Johnson & Jordan

CUSTOMER P.O.: _____

SALES ORDER: _____

MODEL HRSA-1E ELASTOMERIC & SPRING ANGULARITY HANGERS 1" NOMINAL DEFLECTION

THE VMC GROUP
The Power of Together
Bloomingdale, NJ 07403
Houston, TX 77041

SCALE : NONE

SHEET: 1 OF 1

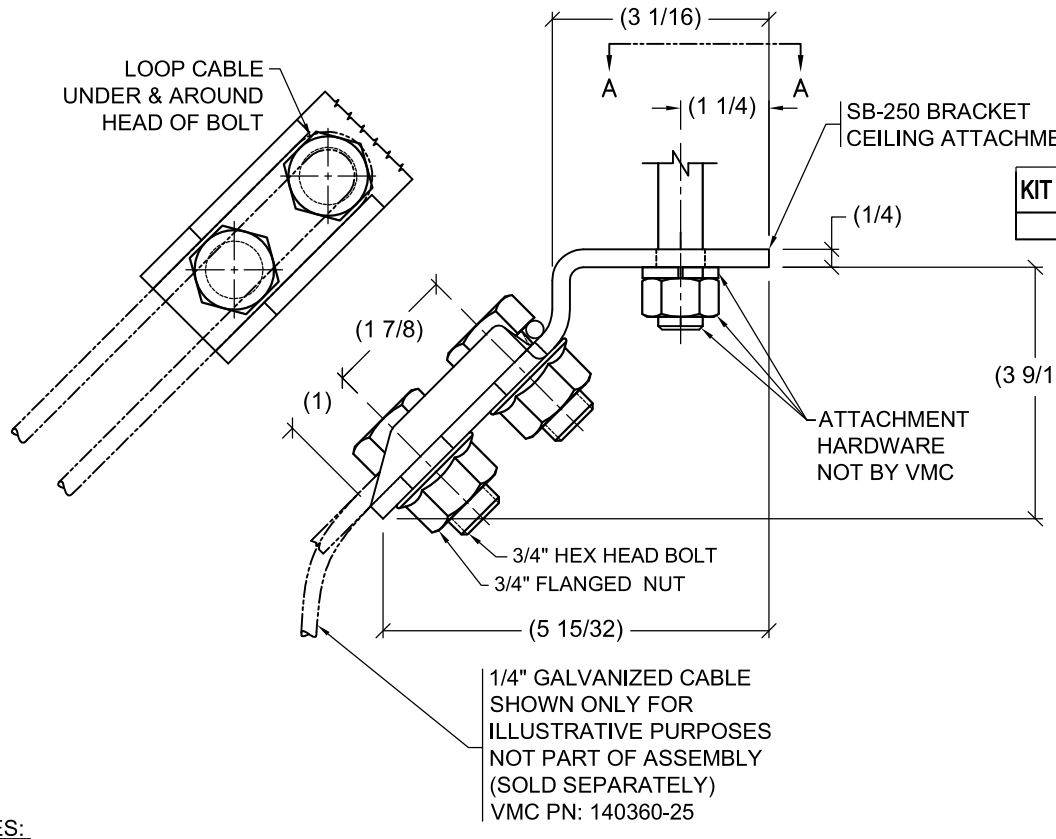
Member VISCMA

DRAWING NO.:

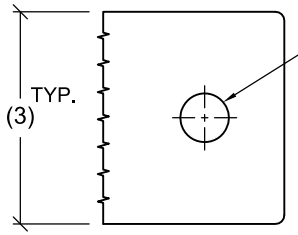
REVISION

154R–101892 | REV.: 5

REV.	DESCRIPTION	DATE	BY

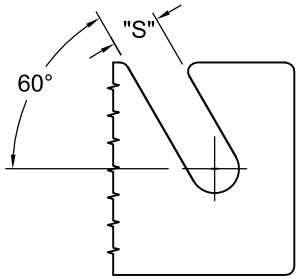


KIT PART NUMBER	"H"	"S"	COLOR CODE	MAX. TENSION ALLOWABLE
SB-250	11/16"	15/16"	CLEAR ZINC COATED	2333 LBS.



CEILING ATTACHMENT BRACKET

VIEW A-A



PIPING / EQUIPMENT ATTACHMENT BRACKET

(NOT TO BE USED AT CEILING ATTACHMENT)

ALTERNATE VIEW A-A

NOTES:

1) MATERIAL: COLD ROLLED STEEL
2) HARDWARE & BRACKETS ZINC ELECTROPLATE
3) FIELD TORQUE 3/4" FLANGE NUTS TO 100 FT- LBS.
4) 1 KIT CONSISTS OF:
   2 SLOTTED BRACKETS
   2 HOLED BRACKETS
   8 BOLTS
   8 SERRATED FLANGE NUTS
5) CABLE SOLD SEPARATELY.

OTHER MATERIALS, COMPOUNDS, OR FINISHES WITH EQUAL OR SUPERIOR PROPERTIES MAY BE SUBSTITUTED AS THEY BECOME AVAILABLE.

CERTIFIED FOR:

JOB NAME: MMC R6 ICU

CUSTOMER : Johnson & Jordan

CUSTOMER P.O.: _____

SALES ORDER: _____

SB-250 SEISMIC CABLE RESTRAINT KIT

THE VMC GROUP
The Power of Together
Bloomingdale, NJ 07403
Houston, TX 77041

SCALE : NONE

SHEET: 1

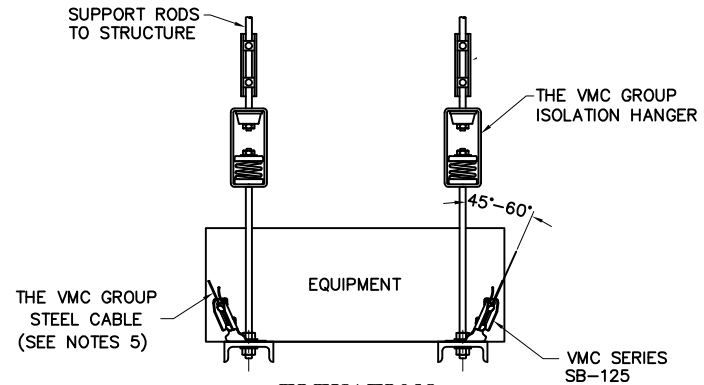
DRAWING NO.:

REVISIO

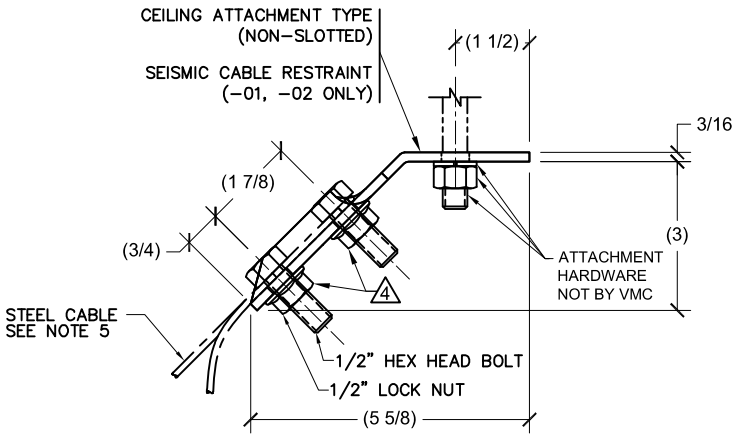
Member VISCMA

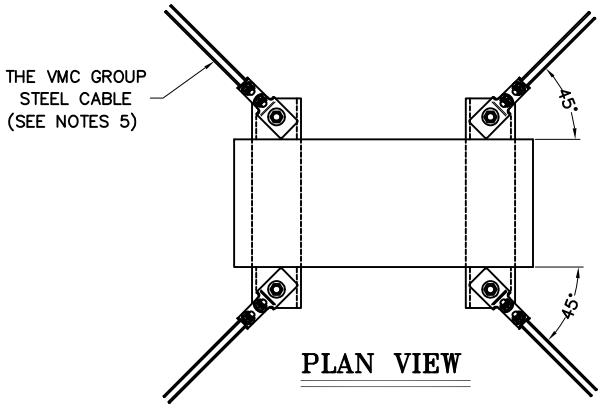
154R–101153	REV.: 6

REV.	DESCRIPTION	DATE	BY



ELEVATION





PLAN VIEW

NOTES:

1. MATERIAL: COLD ROLLED STEEL
2. ELECTRO ZINC PLATED
3. FIELD TORQUE 1/2" LOCK NUT TO 75 FT. LBS.
4. 1 KIT CONSISTS OF:
   - 2 SLOTTED BRACKETS
   - 2 HOLED BRACKETS
   - 8 BOLTS
   - 8 SERRATED FLANGE NUTS
5. CABLE SOLD SEPARATELY.

OTHER MATERIALS, COMPOUNDS, OR FINISHES WITH EQUAL OR SUPERIOR PROPERTIES MAY BE SUBSTITUTED AS THEY BECOME AVAILABLE.

CERTIFIED FOR:

JOB NAME: MMC R6 ICU

CUSTOMER : Johnson & Jordan

CUSTOMER P.O.: _____

SALES ORDER: _____

SB-125 TYPICAL TRANSVERSE AND LONGITUDINAL CABLE BRACING FOR EQUIPMENT

THE VMC GROUP
The Power of Together
Bloomingdale, NJ 07403
Houston, TX 77041

SCALE : NONE

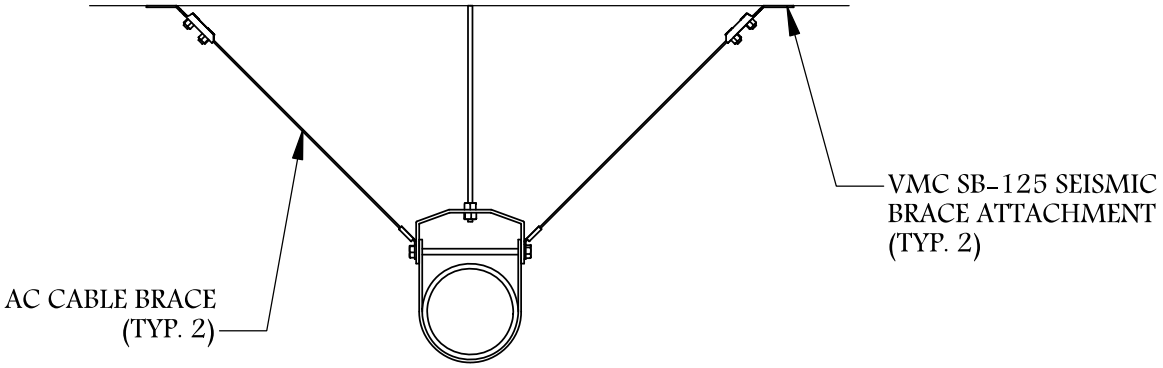
SHEET: 1 OF 1

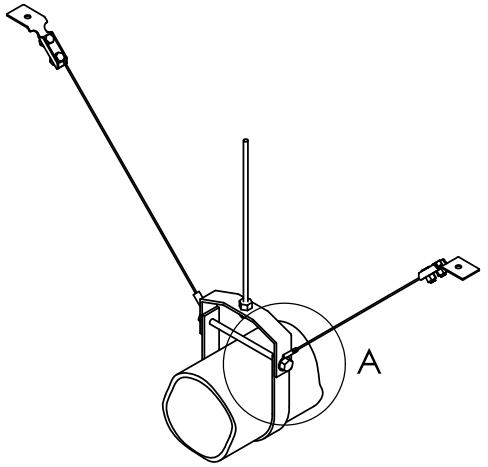
DRAWING NO.:

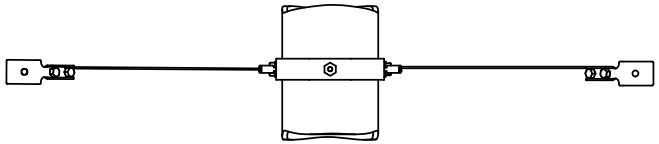
REVISION

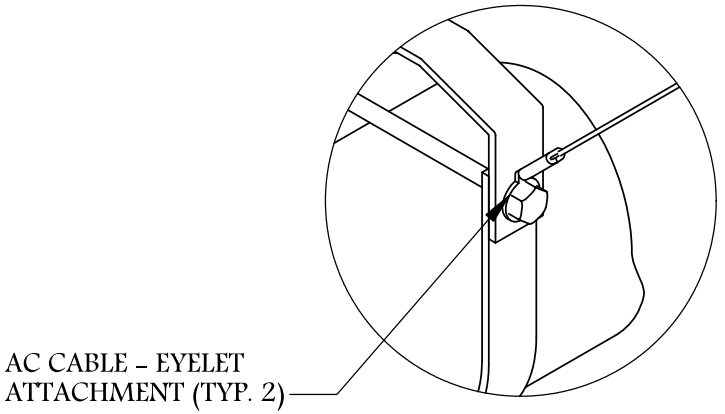
Member VISCMA

Detail 5









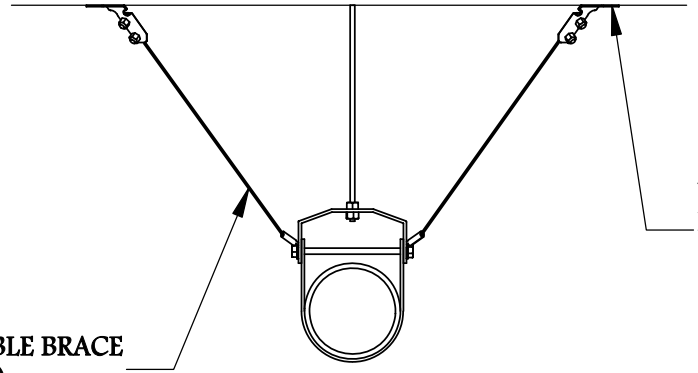
DETAIL A
SCALE 1 : 5

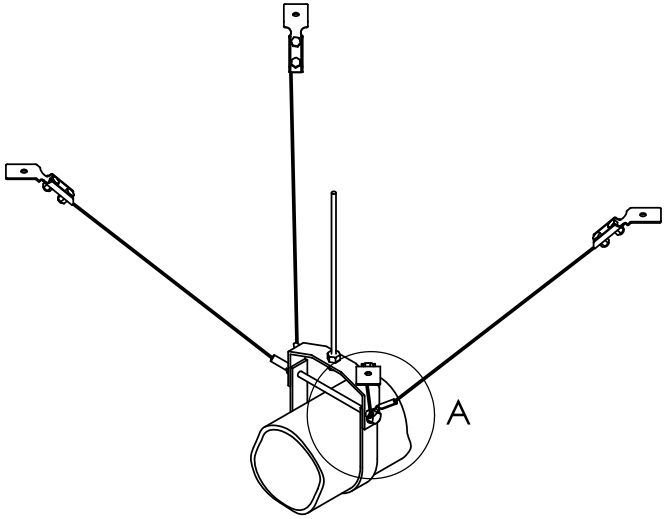
Mechanical Control Systems
1501 Main St. Unit 30
Tewksbury, MA 01876
P - 978.640.9994

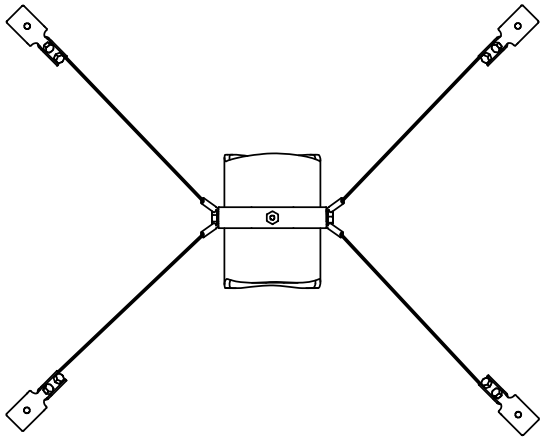
Transverse Cable Bracing
Clevis Hanger
VMC SB-125

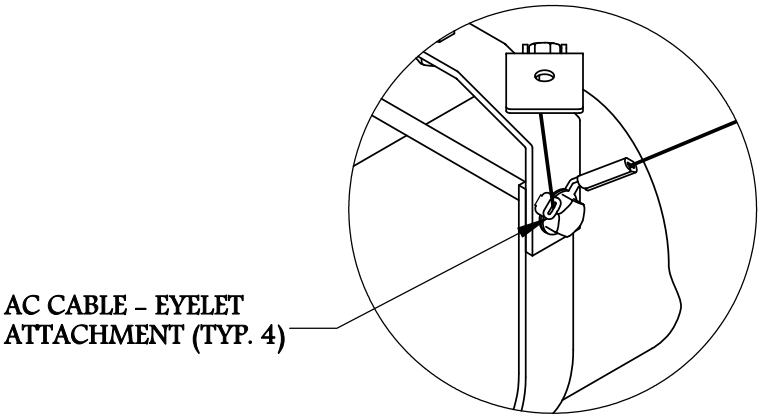
PROJECT: MMC R6 ICU	
CUSTOMER: Johnson & Jordan	
JOB. NO. J5187	REV --

Detail 6









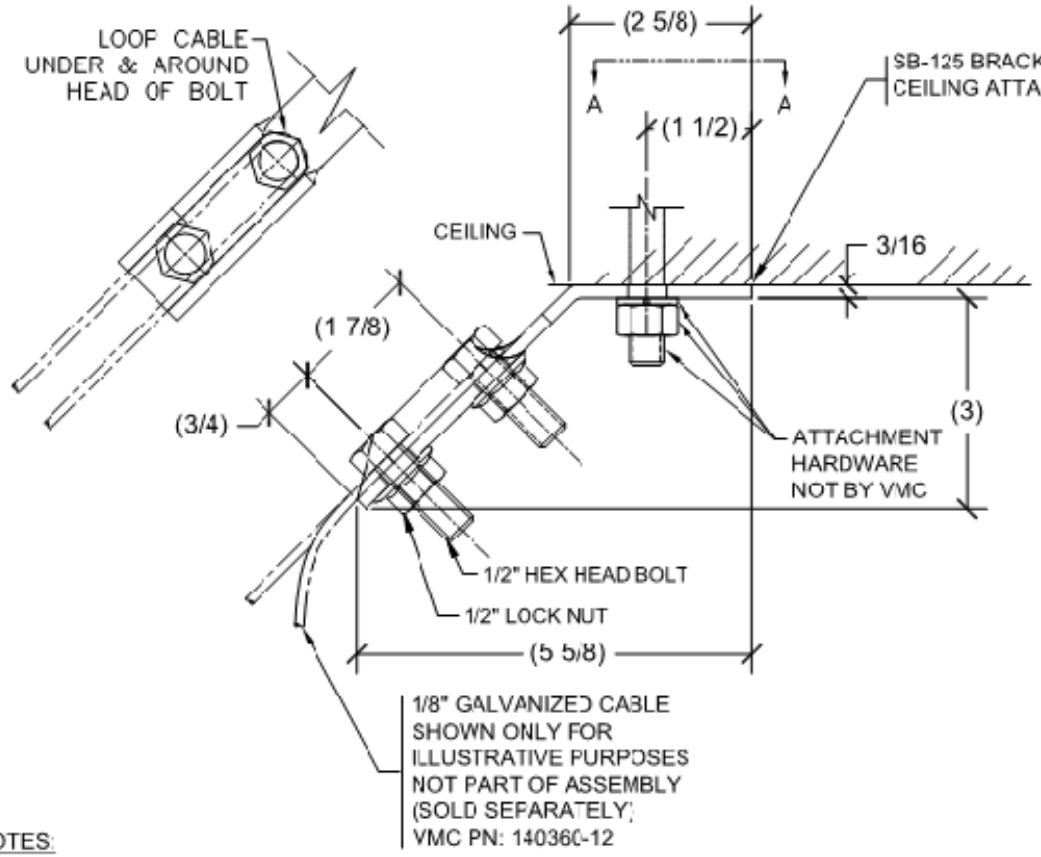
DETAIL A
SCALE 1 : 5

Mechanical Control Systems
1501 Main St. Unit 30
Tewksbury, MA 01876
P - 978.640.9994

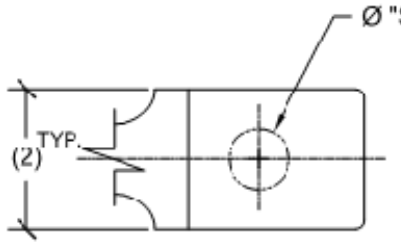
Transverse and Longitudinal bracing
Clevis Hanger
VMC SB-125

PROJECT:	MMC R6 ICU
CUSTOMER:	Johnson & Jordan
JOB. NO.	J5187
REV	--

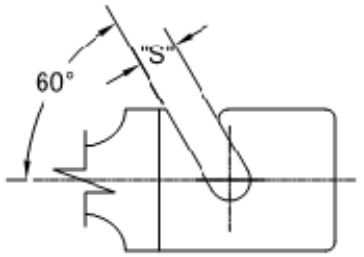
Detail 5 & 6



KIT PART NUMBER	"S"	COLOR CODE	MAX. TENSION ALLOWABLE
SB-125-01	9/16" KIT	CLEAR ZINC COATED	667 LBS.
SB-125-02	11/16" KIT	YELLOW ZINC COATED	667 LBS.



CEILING ATTACHMENT BRACKET



PIPING/EQUIPMENT ATTACHMENT BRACKET (NOT TO BE USED AT CEILING ATTACHMENT)

ALTERNATE VIEW A–A

NOTES:

1) MATERIAL: COLD ROLLED STEEL
2) HARDWARE & BRACKETS ZINC ELECTROPLATE
3) FIELD TORQUE 1/2" LOCK NUTS TO 75 FT.- LBS.
4) 1 KIT CONSISTS OF EITHER 9/16 OR 11/16 ASSEMBLIES CONSISTING OF :
   2 SLOTTED BRACKETS
   2 HOLED BRACKETS
   8 BOLTS
   8 SERRATED FLANGE NUTS
5) CABLE SOLD SEPARATELY.

OTHER MATERIALS, COMPOUNDS, OR FINISHES WITH EQUAL OR SUPERIOR PROPERTIES MAY BE SUBSTITUTED AS THEY BECOME AVAILABLE.

Mechanical Control Systems
1501 Main St. Unit 30
Tewksbury, MA 01876
P - 978.640.9994

VMC SB-125

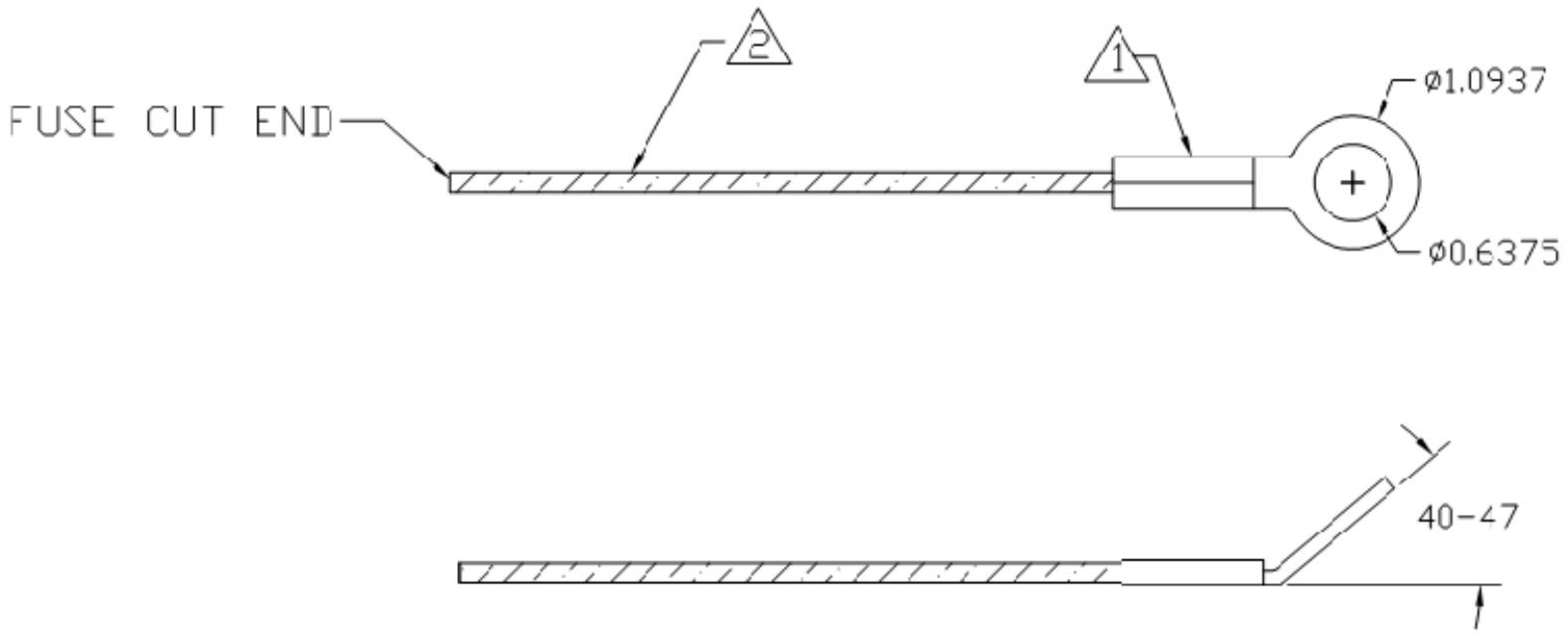
PROJECT: MMC R6 ICU

CUSTOMER: Johnson & Jordan

JOB. NO. J5187

REV --

Detail 5 & 6



NOTES:

1. 560-P-510 EYELET ZINC PLATED CARBON STEEL
2. 1/8" 7X19 GALV. CABLE
3. EYELET RATED – 2,000 LBS. IN TENSION

Mechanical Control Systems
1501 Main St. Unit 30
Tewksbury, MA 01876
P - 978.640.9994

Cable Brace
MCS 4-11' - 1/8" Eyelet

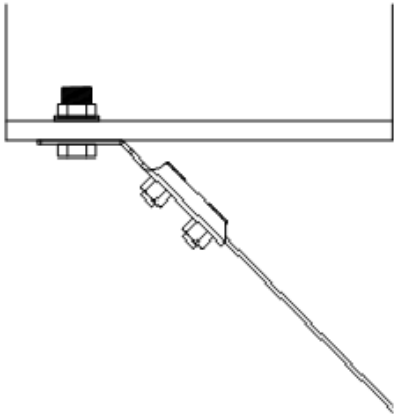
PROJECT: MMC R6 ICU

CUSTOMER: Johnson & Jordan

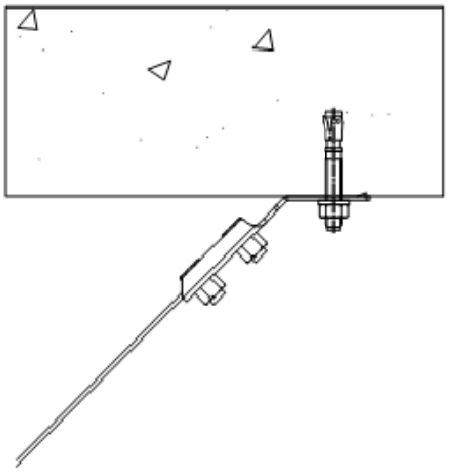
JOB. NO. J5187

REV --

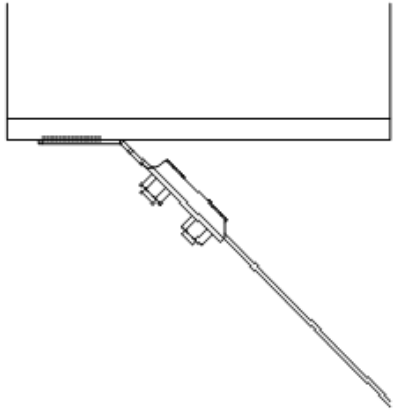
Detail 5 & 6



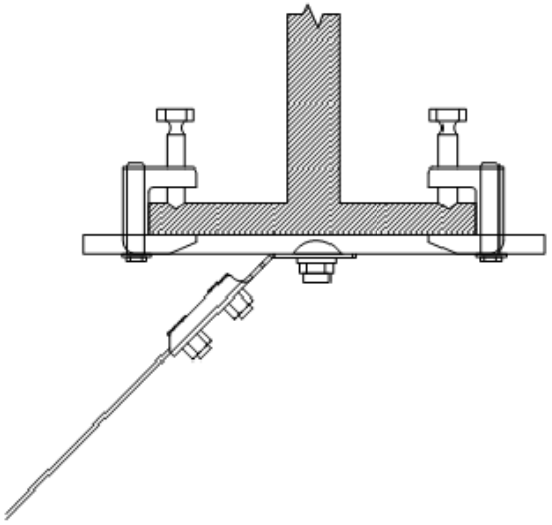
A325 BOLT TO STEEL



WEDGE ANCHOR TO CONCRETE



1/4" FILLET WELD TO STEEL



ATTACHMENT TO DOUBLE SIDED
BEAM CLAMP (CLAMP BY OTHERS)

Mechanical Control Systems
1501 Main St. Unit 30
Tewksbury, MA 01876
P - 978.640.9994

SEISMIC ATTACHMENT DETAIL

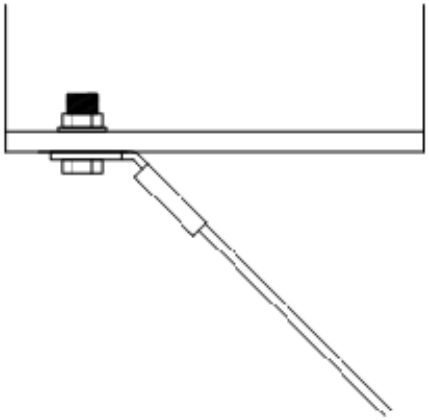
PROJECT: MMC R6 ICU

CUSTOMER: Johnson & Jordan

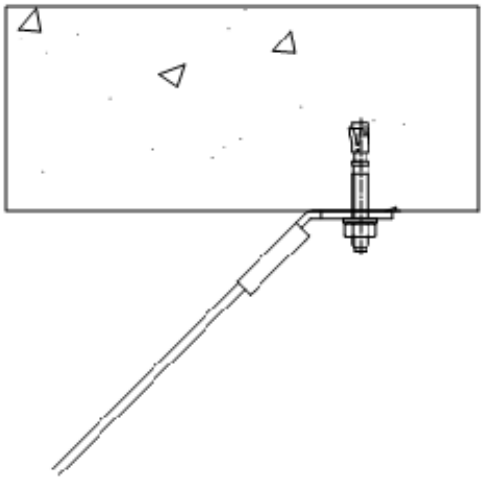
JOB. NO. J5187

REV --

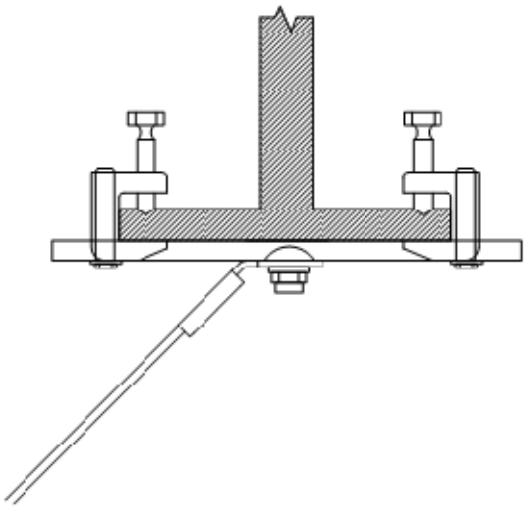
Detail 5 & 6



A325 BOLT TO STEEL



WEDGE ANCHOR TO CONCRETE



ATTACHMENT TO DOUBLE SIDED
BEAM CLAMP (CLAMP BY OTHERS)

Mechanical Control Systems
1501 Main St. Unit 30
Tewksbury, MA 01876
P - 978.640.9994

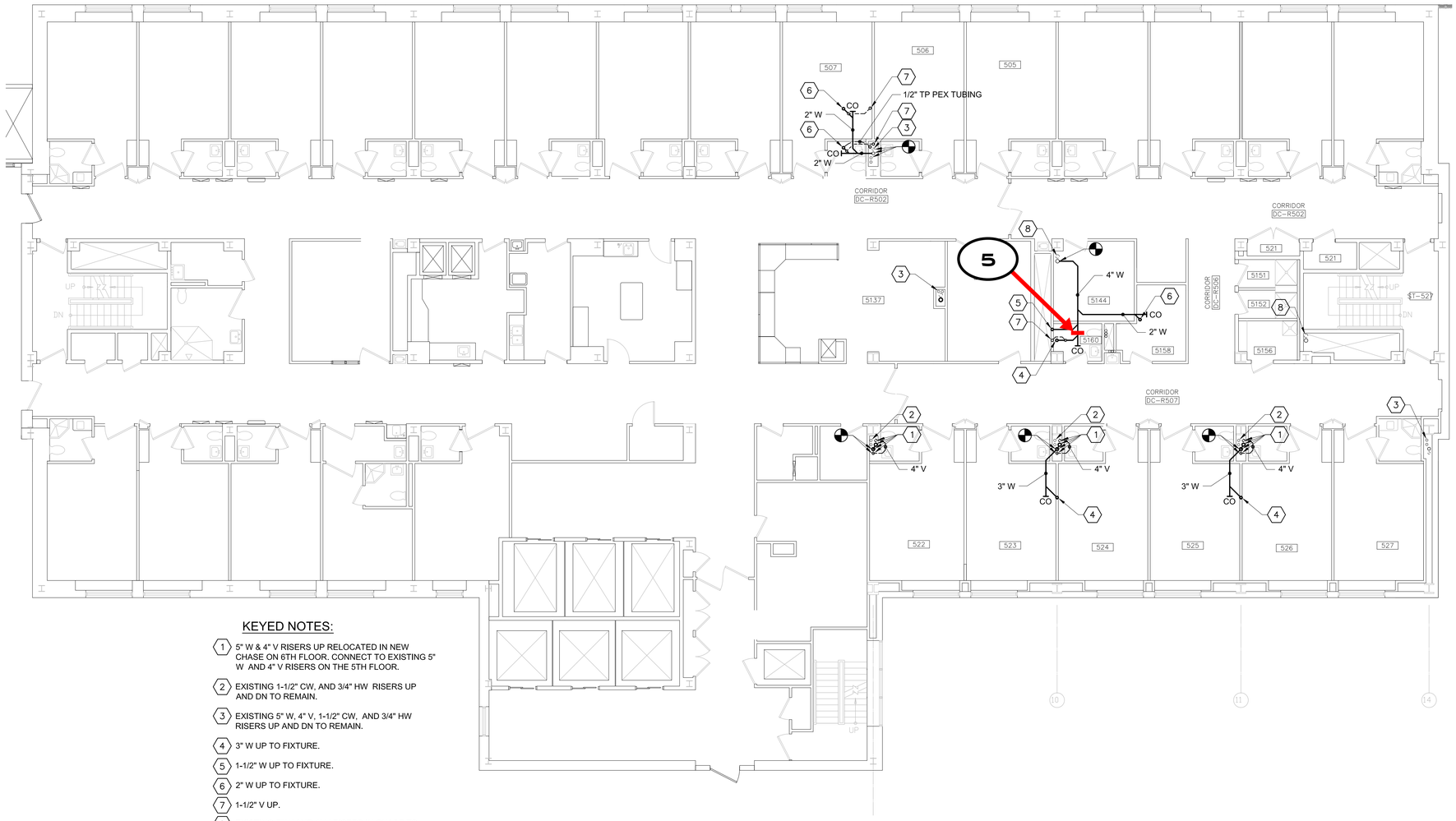
SEISMIC EYELET ATTACHMENT DETAIL

PROJECT: MMC R6 ICU

CUSTOMER: Johnson & Jordan

JOB. NO. J5187

REV --



KEYED NOTES:

1. 5" W & 4" V RISERS UP RELOCATED IN NEW CHASE ON 6TH FLOOR. CONNECT TO EXISTING 5" W AND 4" V RISERS ON THE 5TH FLOOR.
2. EXISTING 1-1/2" CW, AND 3/4" HW RISERS UP AND DN TO REMAIN.
3. EXISTING 5" W, 4" V, 1-1/2" CW, AND 3/4" HW RISERS UP AND DN TO REMAIN.
4. 3" W UP TO FIXTURE.
5. 1-1/2" W UP TO FIXTURE.
6. 2" W UP TO FIXTURE.
7. 1-1/2" V UP.
8. EXISTING 5" W AND 4" V RISERS IN CHASE TO REMAIN.

		Seismic Restraint		Anchor	
Detail	Orientation	Bracket	Brace	Diameter	Embedment
1	Transverse	Tolco Fig-980/981	1-5/8" - 12 GA Channel	5/8"	4-1/2"
2	Transverse and Longitudinal	Tolco Fig-980/981	1-5/8" - 12 GA Channel	5/8"	4-1/2"
3	Transverse	VMC SB-250	1/4" AC Cable	5/8"	4-1/2"
4	Transverse and Longitudinal	VMC SB-250	1/4" AC Cable	5/8"	4-1/2"
5	Transverse	VMC SB-125	1/8" AC Cable	1/2"	4"
6	Transverse and Longitudinal	VMC SB-125	1/8" AC Cable	1/2"	4"

Exemptions
1. Pipe / Duct that passes through a wall of floor penetration. Provide positive attachment. No additional restraint req
2. Top of Pipe / Duct Hanger is within 12" of the support attachment to the structure. No additional restraint require
3. Pipe is anchored and/or guided. No additional restraint required

PLAN NORTH

Winton Scott Architects
5 Milk Street
Portland, Maine 04101
207 774 4811
www.wintonscott.com

Architecture / Planning
Preservation Architecture
Interior Architecture

Allied Engineering
Structural Mechanical Electrical Commissioning
160 Veranda Street
Portland, Maine 04103
T: 207.221.2260
F: 207.221.2266
Web: www.allied-eng.com

STATE OF MAINE IAN A. MACDONALD No. 8990 LICENSED PROFESSIONAL ENGINEER

REVISIONS

NUMBER	DATE	BY	DESCRIPTION

Date: 27 APRIL, 2015
Drawn By: SCL
Checked By: IAM
Project Mgr: IAM
Project No: 14014
Cad File: 14014_M.DWG
Graphic Scale: 0 1"

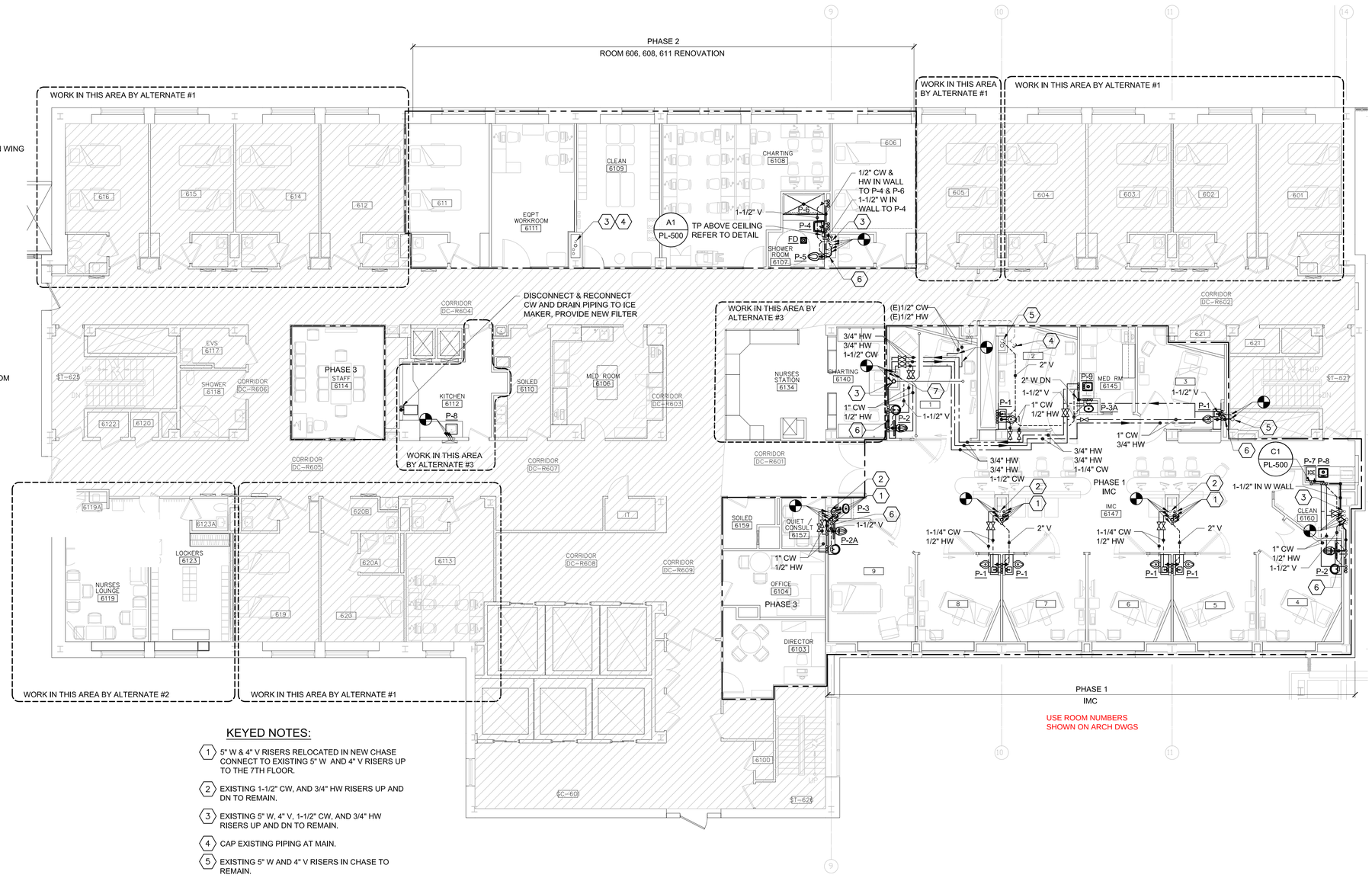
PLUMBING OVER ALL PLAN
FIFTH FLOOR

R6 Intermediate Care Unit
Richards Wing Sixth Floor
PORTLAND MAINE

PL-100

A1	PLUMBING OVER ALL PLAN - FIFTH FLOOR
1/8"=1'-0"	

N:\Projects\2014\14014 ~ MMC R6 2014 Intermediate Care Unit\00 Drawing Files\14014_P.dwg Apr 27, 2015 - 11:09am



KEYED NOTES:

1. 5" W & 4" V RISERS RELOCATED IN NEW CHASE CONNECT TO EXISTING 5" W AND 4" V RISERS UP TO THE 7TH FLOOR.
2. EXISTING 1-1/2" CW, AND 3/4" HW RISERS UP AND DN TO REMAIN.
3. EXISTING 5" W, 4" V, 1-1/2" CW, AND 3/4" HW RISERS UP AND DN TO REMAIN.
4. CAP EXISTING PIPING AT MAIN.
5. EXISTING 5" W AND 4" V RISERS IN CHASE TO REMAIN.
6. RUN 3" W IN WALL OR IN FIXTURE BACK OF CABINET COMPARTMENT AND CONNECT TO EXISTING 5" W RISER IN CHASE.
7. INSTALL SHUT OFF VALVE (NC) AT (E) 3/4" RISER TO CREATE HOT WATER LOOP ON THE 6TH FL.

MECHANICAL CONTROL SYSTEMS
1501 MAIN ST. UNIT 30
TEWKSBURY, MA 01876

THIS DRAWING HAS BEEN REVIEWED FOR CONFORMANCE WITH THE SPECIFICATIONS AND APPLICABLE BUILDING CODES REGARDING SEISMIC RESTRAINTS. NO SEISMIC RESTRAINTS ARE REQUIRED ON PIPE / DUCT ON THIS DRAWING.

PLAN NORTH

A1	PLUMBING OVER ALL PLAN - SIXTH FLOOR
1/8"=1'-0"	

Winton Scott Architects
5 Milk Street
Portland, Maine 04101
207 774 4811
www.wintonscott.com

Architecture / Planning
Preservation Architecture
Interior Architecture

Allied Engineering
Structural Mechanical Electrical Commissioning
160 Veranda Street
Portland, Maine 04103
T: 207.221.2260
F: 207.221.2266
Web: www.allied-eng.com

STATE OF MAINE IAN A. MACDONALD No. 8990 REGISTERED PROFESSIONAL ENGINEER

REVISIONS

DESCRIPTION	BY	DATE	NUMBER

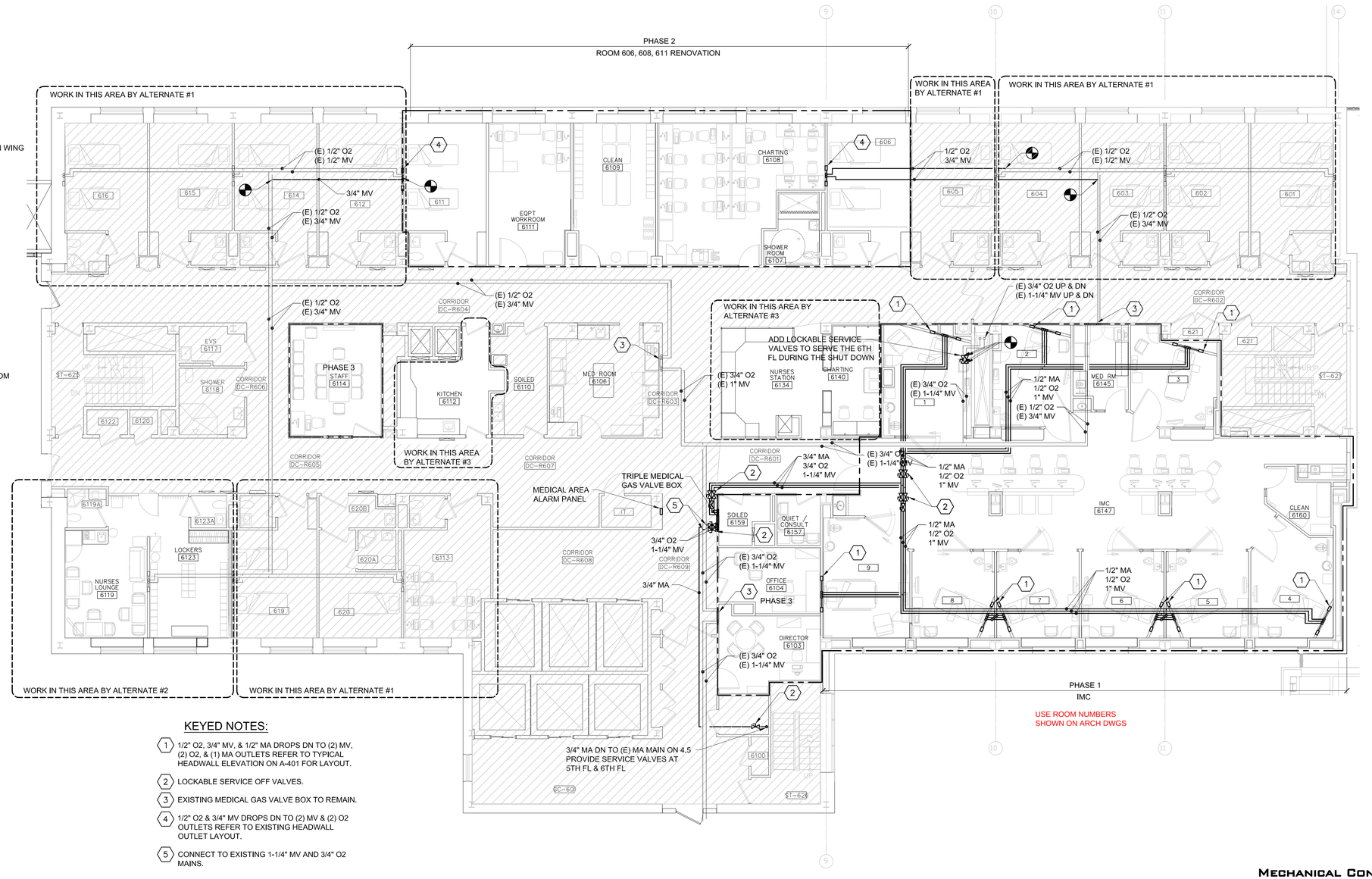
Date: 27 APRIL, 2015
Drawn By: SCL
Checked By: IAM
Project Mgr: IAM
Project No: 14014
Cad File: 14014_M.DWG
Graphic Scale: 0 1"

PLUMBING OVER ALL PLAN
SIXTH FLOOR

R6 Intermediate Care Unit
Richards Wing Sixth Floor
PORTLAND MAINE

PL-101

N:\Projects\2014\14014 ~ MMC R6 2014 Intermediate Care Unit\00 Drawing Files\14014_P.dwg Apr 27, 2015 - 11:10am



KEYED NOTES:

1. 1/2" O2, 3/4" MV, & 1/2" MA DROPS DN TO (2) MV, (2) O2, & (1) MA OUTLETS REFER TO TYPICAL HEADWALL ELEVATION ON A-401 FOR LAYOUT.
2. LOCKABLE SERVICE OFF VALVES.
3. EXISTING MEDICAL GAS VALVE BOX TO REMAIN.
4. 1/2" O2 & 3/4" MV DROPS DN TO (2) MV & (2) O2 OUTLETS REFER TO EXISTING HEADWALL OUTLET LAYOUT.
5. CONNECT TO EXISTING 1-1/4" MV AND 3/4" O2 MAINS.

MECHANICAL CONTROL SYSTEMS
1501 MAIN ST. UNIT 30
TEWKSBURY, MA 01876

THIS DRAWING HAS BEEN REVIEWED FOR CONFORMANCE WITH THE SPECIFICATIONS AND APPLICABLE BUILDING CODES REGARDING SEISMIC RESTRAINTS. NO SEISMIC RESTRAINTS ARE REQUIRED ON PIPE / DUCT ON THIS DRAWING.

PLAN NORTH

A1	MEDICAL GAS PIPING OVER ALL PLAN - SIXTH FLOOR
1/8"=1'-0"	

WSA
Winton Scott Architects
5 Milk Street
Portland, Maine 04101
207 774 4811
www.wintonscott.com

Architecture / Planning
Preservation Architecture
Interior Architecture

Allied Engineering
Structural Mechanical Electrical Commissioning
160 Veranda Street
Portland, Maine 04103
T: 207.221.2260
F: 207.221.2266
Web: www.allied-eng.com

STATE OF MAINE IAN A. MACDONALD No. 8990 REGISTERED PROFESSIONAL ENGINEER

REVISIONS

DESCRIPTION	BY	DATE	NUMBER

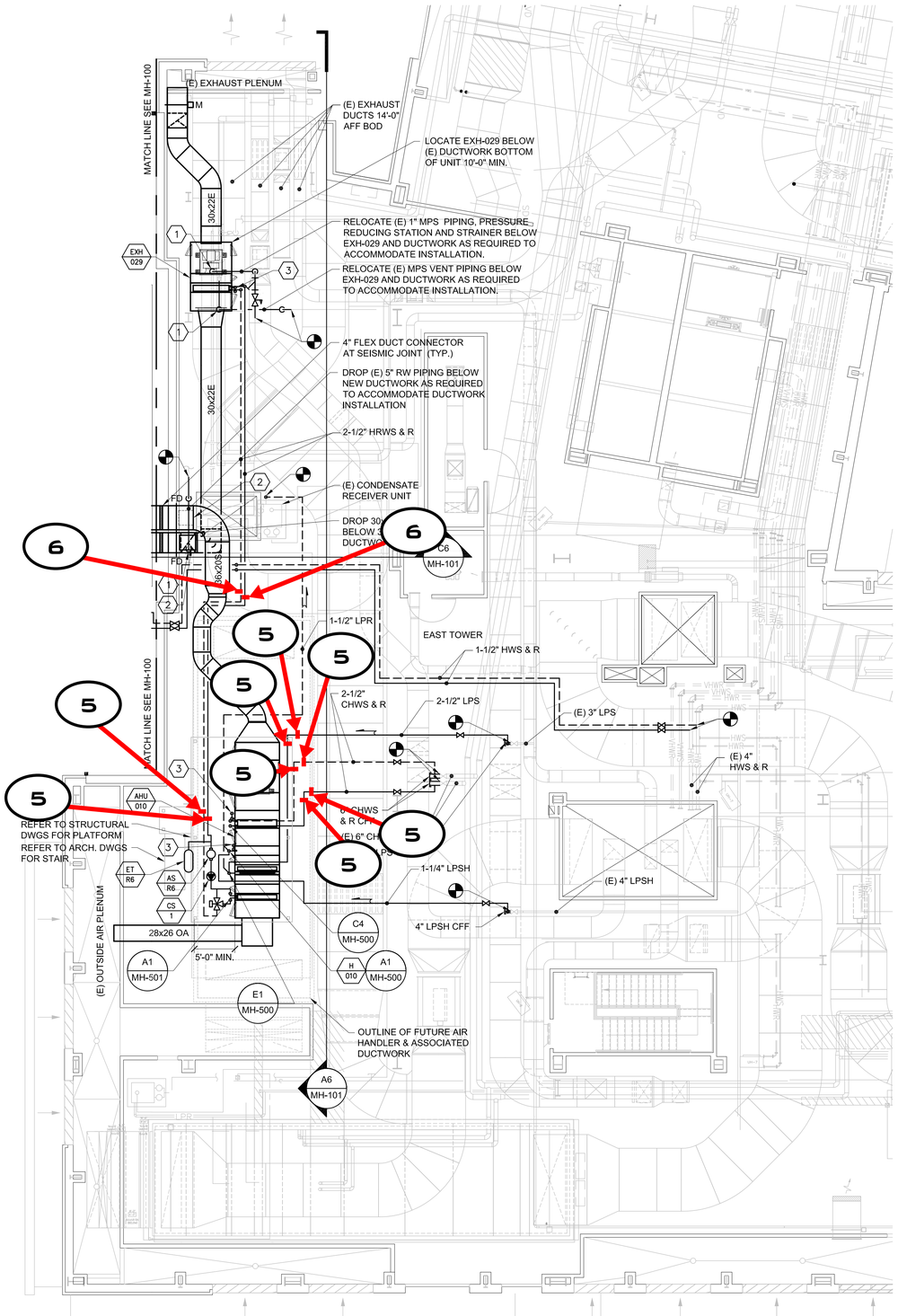
Date: 27 APRIL, 2015
Drawn By: SCL
Checked By: IAM
Project Mgr: IAM
Project No: 14014
Cad File: 14014_M.DWG
Graphic Scale: 0 1"

MEDICAL GAS PIPING OVER ALL PLAN
SIXTH FLOOR

R6 Intermediate Care Unit
Richards Wing Sixth Floor
PORTLAND MAINE

PL-102

N:\Projects\2014\14014 ~ MMC R6 2014 Intermediate Care Unit\00 Drawing Files\14014_P.dwg Apr 27, 2015 - 11:10am



A1	MECHANICAL EAST TOWER PART PLAN - PENTHOUSE
1/8"=1'-0"	

Detail	Orientation	Seismic Restraint		Anchor	
		Bracket	Brace	Diameter	Embedment
1	Transverse	Tolco Fig-980/981	1-5/8" - 12 GA Channel	5/8"	4-1/2"
2	Transverse and Longitudinal	Tolco Fig-980/981	1-5/8" - 12 GA Channel	5/8"	4-1/2"
3	Transverse	VMC SB-250	1/4" AC Cable	5/8"	4-1/2"
4	Transverse and Longitudinal	VMC SB-250	1/4" AC Cable	5/8"	4-1/2"
5	Transverse	VMC SB-125	1/8" AC Cable	1/2"	4"
6	Transverse and Longitudinal	VMC SB-125	1/8" AC Cable	1/2"	4"
Exemptions	1. Pipe / Duct that passes through a wall of floor penetration. Provide positive attachment. No additional restraint re				
	2. Top of Pipe / Duct Hanger is within 12" of the support attachment to the structure. No additional restraint require				
	3. Pipe is anchored and/or guided. No additional restraint required				

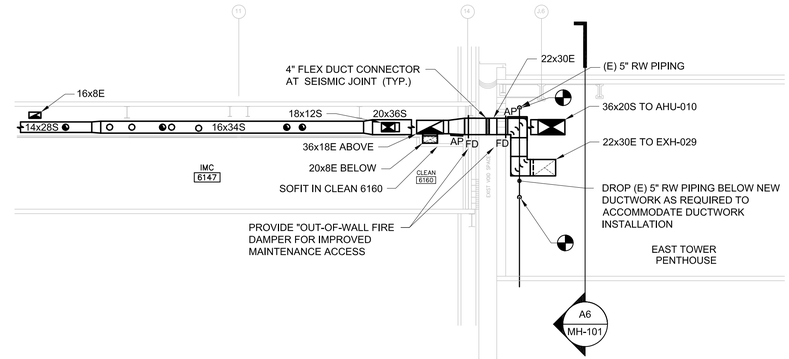
GENERAL NOTES:

1. RELOCATE EXISTING LIGHTS BELOW AHU-010 AND EXH-029.
2. RE-WORK EXISTING UNISTRUT HANGERS AS REQUIRED TO INSTALL AHU-010, EXH-029 AND DUCTWORK.

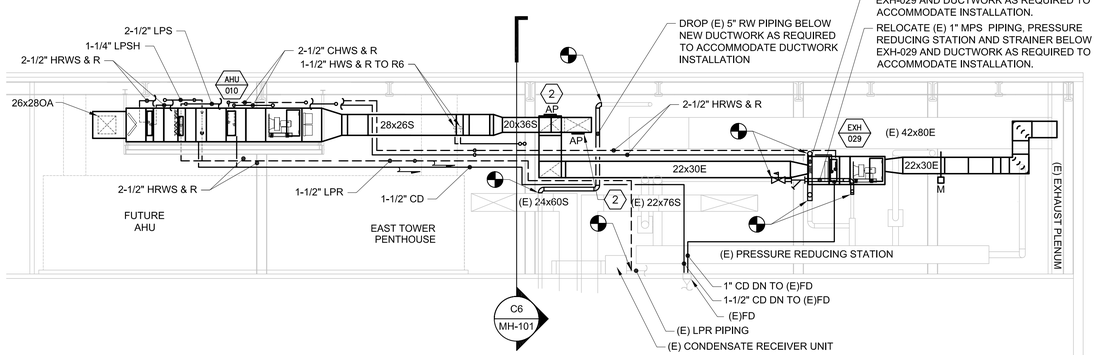
KEYED NOTES:

1. CONNECT TO EXISTING PIPE RISER.
2. ALL FIRE DAMPERS MUST BE ACCESSIBLE WITH A 24X24 MIN. ACCESS PANELS TO TEST PER JOINT COMMISSION.
3. 1" CD PIPING DN REFER TO SECTION A6 / MH-101 FOR ROUTING TO (E) FD.

E6	MECHANICAL KEY NOTES
1/8"=1'-0"	



C6	PENTHOUSE ~ SECTION
1/8"=1'-0"	



A6	PENTHOUSE ~ SECTION
1/8"=1'-0"	

Winton Scott Architects
5 Milk Street
Portland, Maine 04101
207 774 4811
www.wintonscott.com

Architecture / Planning
Preservation Architecture
Interior Architecture

Allied Engineering
Structural Mechanical Electrical Commissioning
160 Veranda Street
Portland, Maine 04103
T: 207.221.2260
F: 207.221.2266
Web: www.allied-eng.com

STATE OF MAINE IAN A. MACDONALD No. 8990 LICENSED PROFESSIONAL ENGINEER

REVISIONS

NUMBER	DATE	BY	DESCRIPTION

Date: 27 APRIL 2015
Drawn By: SCL
Checked By: IAM
Project Mgr: IAM
Project No: 14014
Cad File: 14014_M.DWG
Graphic Scale: 0 1"

MECHANICAL EAST TOWER OVER ALL PLAN
PENTHOUSE

R6 Intermediate Care Unit
Richards Wing Sixth Floor
PORTLAND MAINE

MH-101

N:\Projects\2014\14014 ~ MMC R6 2014 Intermediate Care Unit\00 Drawing Files\14014_M.dwg Apr 27, 2015 - 11:24am