RIO GRANDE DEPOT HVAC UPGRADE

270 SOUTH RIO GRANDE ST.
SALT LAKE CITY, UTAH 84101

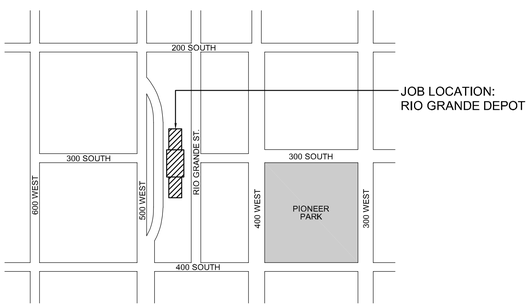
State of Utah–Department of Administrative Services

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

4110 State Office Building/Salt Lake City, Utah 84114/538-3018

DFCM PROJECT NO: 09180080

FEBRUARY 2010



VICINITY PLAN

SCALE: NONE

HEATH
Engineering Company
Mechanical/Electrical/Plumbing Consultants
377 West 800 North Salt Lake City, Utah 84103
Tel: (801) 322-0487 Fax: (801) 322-0490

HEATH ENGINEERING PROJECT NO. 9121

LICENSED PROFESSIONAL ENGINEER
No. 362270
ANDREW J. PASKETT
STATE OF UTAH

DRAWING INDEX

MD101	MECHANICAL DEMOLITION PLAN
MH001	MECHANICAL EQUIPMENT SCHEDULES AND CONTROLS
MH101	MECHANICAL REMODEL PLAN
MH501	MECHANICAL DETAILS
MH502	MECHANICAL DETAILS

CODE ANALYSIS

APPLICABLE CODES

	Year		Year
International Building Code		National Electrical Code	2008
International Mechanical Code	2006	Uniform Code for Building Conservation	
International Plumbing Code		ADA Accessibility Guildelines	
International Fire Code			
International Energy Conservation Code	2006		

A. Occupancy and Group: B A-3 S-2

Change in Use: Yes ____ No X Mixed Occupancy: Yes X No ____

Special Use and Occupancy (e.g. High Rise, Covered Mall): No

B. Seismic Design Category: ____ Design Wind Speed: N/A mph

C. Type of Construction (circle one):

I/A I/B II/A II/B III/A (III/B) IV/HT V/A V/B

D. Fire Resistance Rating Requirements for the Exterior Walls based on the fire separation distance (in hours):

North: 2 South: 2 East: 2 West: 2

E. Mixed Occupancies: Yes Nonseparated Uses: No

F: Sprinklers:

Required: X Provided: Existing Type of Sprinkler System: N/A

G: Number of Stories: 2 Building Height: N/A

H: Actual Area per Floor (square feet): Level 1 - 48,898; Level 2 - 32,455

I: Tabular Area: ____

J: Area Modifications:

a) $A_a = A_t + \left[\frac{A_t\, I_f}{100}\right] + \left[\frac{A_t\, I_s}{100}\right]$ $\quad I_f = 100\left[\frac{F}{P} - 0.25\right]\frac{W}{30}$

b) Sum of the Ratio Calculations for Mixed Occupancies:

$\frac{\text{Actual Area}}{\text{Allowable Area}} \leq 1$

c) Total Allowable Area for:

1) One Story: ____
2) Two Story: A_a (2)____
3) Three Story: A_a (3)____

d) Unlimited Area Building: Yes ____ No ____ Code Section: ____

K. Fire Resistance Rating Requirements for Building Elements (hours).

Element	Hours	Assembly Listing	Element	Hours	Assembly Listing
Exterior Bearing Walls			Floors - Ceiling Floors		
Interior Bearing Walls			Roofs - Ceiling Roofs		
Exterior Non-Bearing Walls			Exterior Doors and Windows		
Structural Frame			Shaft Enclosures		
Partitions - Permanent			Fire Walls		
Fire Barriers			Fire Partitions		
			Smoke Partitions		

L. Design Occupant Load: ____

Exit Width Required: ____ Exit Width Provided: ____

M. Minimum Number of Required Plumbing Facilities:

a) Water Closets - Required (m) ____ (f) ____ Provided (m) ____ (f) ____
b) Lavatories - Required (m) ____ (f) ____ Provided (m) ____ (f) ____
c) Bath Tubs or Showers: ____
d) Drinking Fountains: ____ Service Sinks: ____

FOOTNOTES:

1) In case of conflict with the U.S. Department of Justice Federal Registers Parts I through V - ADA Guidelines and specific reference to the International Building Code Accessibility Chapters, the more restrictive requirement shall govern.

2) Additional Code Information shall be provided at the discretion of the Building Official for Complex Buildings. Including, but not limited to:

a) High Rise Requirements.
b) Atriums.
c) Performance Based Criteria.
d) Means or Egress Analysis.
e) Fire Assembly Locator Sheet.
f) Exterior and Interior Accessibility Route.
g) Fire Stopping, Including Tested Design Number.

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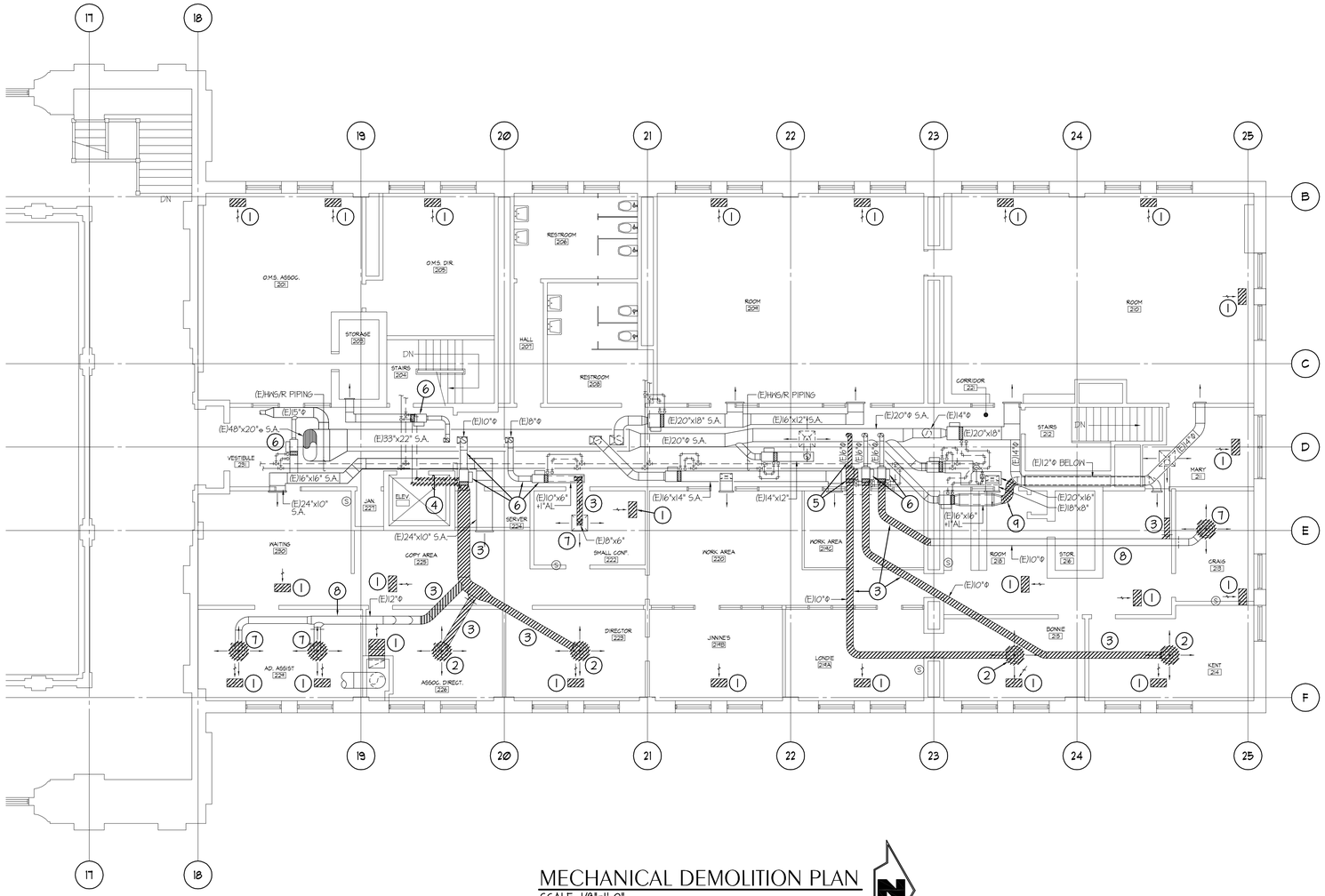

MECHANICAL DEMOLITION PLAN

SCALE: 1/8"=1'-0"

10 5 0 10 20

GENERAL NOTES

A. FIELD VERIFY EXACT SIZES AND LOCATIONS OF EXISTING PIPING, DUCTWORK, EQUIPMENT, ETC.

B. DEMOLITION FLOOR PLANS HAVE BEEN CREATED USING AVAILABLE RECORD DRAWINGS. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING EXACT ROUTING OF ALL PIPING, DUCTWORK, ETC. DURING CONSTRUCTION.

C. DEMOLITION OF EXISTING MECHANICAL AND PLUMBING CONSTRUCTION SHALL BE TO THE EXTENT REQUIRED TO ACCOMMODATE THE RENOVATION AND THE ADDITION OF NEW WORK.

D. REFERENCE ARCHITECTURAL DEMOLITION DRAWINGS TO COORDINATE AND VERIFY THE EXTENT OF THE DEMOLITION WORK REQUIRED.

E. ALL PIPING, DUCTWORK ETC. TO REMAIN, SHALL BE PROTECTED THROUGHOUT THE CONSTRUCTION PERIOD.

F. PROVIDE AND INSTALL CAPS ON EXISTING MAIN DUCTWORK AND/OR PIPING BRANCH BEING REMOVED. PROVIDE WALL COVERS AT ALL LOCATIONS WHERE THERMOSTATS HAVE BEEN REMOVED.

G. INDICATED DEMOLITION OF PIPING AND DUCTWORK INCLUDES, BUT IS NOT LIMITED TO THE REMOVAL OF DUCTWORK, PIPING, FITTINGS, VALVES, HANGERS, SUPPORTS, INSULATION, ETC. UNLESS NOTED OTHERWISE.

H. INDICATED DEMOLITION OF MECHANICAL EQUIPMENT INCLUDES BUT IS NOT LIMITED TO THE REMOVAL OF EQUIPMENT, PIPING, VALVES, INSULATION, SEISMIC BRACING, CONTROLS, ELECTRICAL, ETC. UNLESS NOTED OTHERWISE.

I. FIELD VERIFY EXACT LOCATIONS OF THERMOSTATS, SENSOR AND CONTROLLING UNITS.

J. CONTRACTOR SHALL BE RESPONSIBLE FOR PATCHING AND REPAIRING ANY DAMAGE CAUSED BY HIS PERSONNEL TO EXISTING THAT IS TO REMAIN OR TO NEWLY INSTALLED BUILDING COMPONENTS.

K. EXISTING PIPING INSULATION MAY CONTAIN ASBESTOS. THE OWNER IS RESPONSIBLE FOR THE REMOVAL AND HANDLING OF ANY SUSPECT MATERIALS. IF DURING THE COARSE OF THE WORK ANY SUSPECT MATERIALS ARE ENCOUNTERED BY THE CONTRACTOR, THE CONTRACTOR IS TO IMMEDIATELY STOP WORK IN THE AREA AND NOTIFY THE OWNER.

L. PATCH AND SEAL ALL ABANDONED OPENINGS THRU WALLS, CEILING AND FLOORS. MATCH EXISTING SURROUNDING FINISH.

M. ANY EXISTING FIRE PROOFING DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED IN COMPLIANCE WITH CHAPTER 7 OF THE IBC.

DRAWING NOTES

1. REMOVE EXISTING RETURN AIR GRILLE AND PATCH HOLE IN CEILING TO MATCH EXISTING.
2. REMOVE EXISTING SUPPLY AIR DIFFUSER AND ASSOCIATED DUCTWORK.
3. REMOVE EXISTING SUPPLY AIR DUCTWORK.
4. REMOVE EXISTING HEATING WATER SUPPLY AND RETURN PIPING.
5. REMOVE EXISTING VAVR BOX AND ASSOCIATED BRANCH DUCT FROM MAIN.
6. EXISTING VAVR BOX AND DUCTWORK TO REMAIN.
7. REMOVE EXISTING SUPPLY AIR DIFFUSER.
8. EXISTING SUPPLY AIR DUCT TO REMAIN.
9. REMOVE EXISTING FLEX DUCT.

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MECHANICAL DEMOLITION PLAN

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SCALE: 1/8"= 1'-0"
DATE: FEBRUARY 3, 2010
DRAWN BY: S. TERRY
FILE NAME: 9121-M-DP01
SHEET SIZE: 24"x36"

MD101

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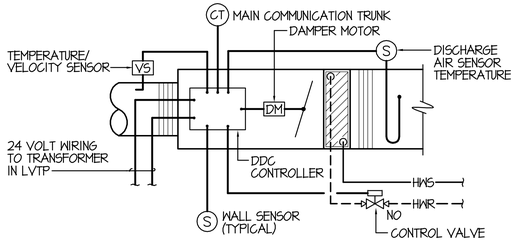
GENERAL NOTES FOR MECHANICAL CONTROLS

1. THE CONTROLS CONTRACTOR SHALL ROUTE ALL CONDUIT FOR MECHANICAL CONTROLS, PULL WIRING REQUIRED FOR MECHANICAL CONTROLS THROUGH THE CONDUITS AND MAKE CONNECTIONS TO MECHANICAL EQUIPMENT, ATC PANELS, SENSORS, ETC, AS INDICATED ON THE PLANS ALL IN ACCORDANCE WITH DIVISION 16000.
2. THE CONTROLS CONTRACTOR SHALL PROVIDE SHOP DRAWINGS FOR CONTROL SYSTEMS CIRCUITS.
3. AUXILIARY RELAYS, LOW VOLTAGE TRANSFORMERS, CONTROL PANEL SWITCHES AND DEVICES, THERMOSTATS, PRESSURE SWITCHES, ELECTRIC OPERATED VALVES, ETC. ARE THE RESPONSIBILITY OF DIVISION 15000.
4. ANY QUESTION OF RESPONSIBILITY SHALL BE CLARIFIED BY THE GENERAL CONTRACTOR.
5. ALL WIRING SHALL TERMINATE AT LABELED TERMINAL STRIPS.

CONTROL VALVES (CV)

SYMBOL	VALVE TYPE	OPERATOR TYPE	GPM/ LB/HR	MAXIMUM PRESSURE DROP	FLUID	DUTY	REMARKS
HCV-1	2-WAY	ELECTRIC MODULATING	0.5 TO 0.7	5 FEET	HEATING WATER	VAVR-214	SEE VAVR SCHEDULE AND PLANS FOR EXACT FLOW RATES AND QUANTITY OF VALVE TYPES
HCV-2	2-WAY	ELECTRIC MODULATING	0.5 TO 0.7	5 FEET	HEATING WATER	VAVR-215	SEE VAVR SCHEDULE AND PLANS FOR EXACT FLOW RATES AND QUANTITY OF VALVE TYPES
HCV-3	2-WAY	ELECTRIC MODULATING	0.5 TO 0.7	5 FEET	HEATING WATER	VAVR-219A	SEE VAVR SCHEDULE AND PLANS FOR EXACT FLOW RATES AND QUANTITY OF VALVE TYPES
HCV-4	2-WAY	ELECTRIC MODULATING	0.5 TO 0.7	5 FEET	HEATING WATER	VAVR-219B	SEE VAVR SCHEDULE AND PLANS FOR EXACT FLOW RATES AND QUANTITY OF VALVE TYPES
HCV-5	2-WAY	ELECTRIC MODULATING	0.5 TO 0.7	5 FEET	HEATING WATER	VAVR-223	SEE VAVR SCHEDULE AND PLANS FOR EXACT FLOW RATES AND QUANTITY OF VALVE TYPES
HCV-6	2-WAY	ELECTRIC MODULATING	0.5 TO 0.7	5 FEET	HEATING WATER	VAVR-229	SEE VAVR SCHEDULE AND PLANS FOR EXACT FLOW RATES AND QUANTITY OF VALVE TYPES

SEE SPECIFICATION SECTION 15450



VAV COOLING WITH TERMINAL REHEAT CONTROL DIAGRAM

SCALE: NONE

VARIABLE VOLUME AIR BOXES WITH REHEAT (VAVR) SELECTION CHART

SYMBOL	TITUS SIZE	CFM RANGE	KRUEGER MODEL	SYSTEM OPERATING STATIC IN. W.C.	AIR PRESSURE DROP W/ 1 ROW COIL IN. W.C.	COIL DIMENSION INCH.	REMARKS
VAVR_	6	0-349	LMH5	0.75	0.30	12"x8"	
VAVR_	8	350-599	LMH5	0.75	0.30	12"x10"	
VAVR_	9	600-749	LMH5	0.75	0.30	14"x12"-1/2"	
VAVR_	10	750-999	LMH5	0.75	0.30	14"x12"-1/2"	
VAVR_	12	1000-1349	LMH5	0.75	0.30	16"x15"	
VAVR_	14	1350-1899	LMH5	0.75	0.30	20"x17"-1/2"	
VAVR_	16	1900-2399	LMH5	0.75	0.30	24"x18"	
VAVR_	24x16	2400-4800	LMH5	0.75	0.30	38"x18"	

VARIABLE VOLUME WITH REHEAT (VAVR)

SYMBOL	BALANCE AIRFLOW CLG. CFM	MAX. AIRFLOW HTG. CFM	MINIMUM AIRFLOW CFM	HEATING COIL HTG. CAPACITY BTU/HR	HEATING COIL GPM	HEATING COIL EWT DEG F.	HEATING COIL MAX. PRESSURE DROP, FT. W.C.	KRUEGER SIZE	MIN. INLET SIZE IN.	REMARKS
VAVR-211	230	170	60	6,244	0.5	180	0.2	6	6	EXISTING BOX
VAVR-213	180	150	60	5,510	0.5	180	0.2	6	6	EXISTING BOX
VAVR-214	590	345	105	12,685	0.7	180	0.4	8	8	
VAVR-215	560	210	105	7,713	0.5	180	0.2	8	8	
VAVR-218A	170	100	60	2,657	0.5	180	0.2	6	6	EXISTING BOX
VAVR-218B	170	100	60	2,657	0.5	180	0.2	6	6	EXISTING BOX
VAVR-219A	570	225	105	8,250	0.5	180	0.2	8	8	
VAVR-219B	570	225	105	8,250	0.5	180	0.2	8	8	
VAVR-220	540	135	135	4,487	0.5	180	0.2	8	8	EXISTING BOX
VAVR-222	260	155	155	3,444	0.5	180	0.2	6	6	EXISTING BOX
VAVR-223	570	225	105	8,250	0.5	180	0.2	8	8	
VAVR-226	570	220	105	8,088	0.5	180	0.2	8	8	EXISTING BOX
VAVR-229	580	240	105	8,746	0.5	180	0.4	8	8	
VAVR-230	460	135	135	4,687	0.5	180	0.2	8	8	EXISTING BOX

GRILLE AND DIFFUSER SCHEDULE

SYMBOL	FACE PANEL SIZE	TYPE	MODEL	REMARKS
S-1	AS NOTED ON DRAWINGS	CEILING	KRUEGER-RM2PLQ	OR EQUIVALENT FROM PRICE OR TITUS
R-1	AS NOTED ON DRAWINGS	SIDEWALL	KRUEGER-S80	35° BLADE DEFLECTION, OR EQUIVALENT FROM PRICE OR TITUS

SEE SPECIFICATION SECTION 233713
SELECTION BASED ON KRUEGER
SEE DRAWING FOR CFM AND NECK SIZE

DRAWING NOTES

MECHANICAL EQUIPMENT SCHEDULES AND CONTROLS

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LICENSED PROFESSIONAL ENGINEER
No. 362270
ANDREW J. PASKETT
STATE OF UTAH

SCALE: NONE
DATE: FEBRUARY 3, 2010
DRAWN BY: S. TERRY
FILE NAME: 9121-M-SH01
SHEET SIZE: 24"x36"

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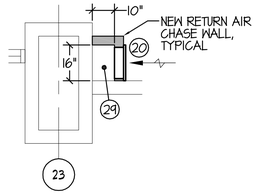
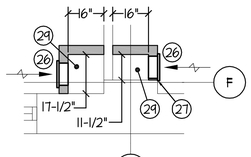


LARGE SCALE R.A. CHASE PLAN G
SCALE: 3/8"=1'-0"



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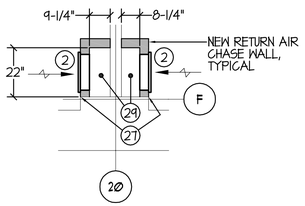

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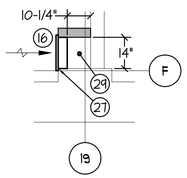

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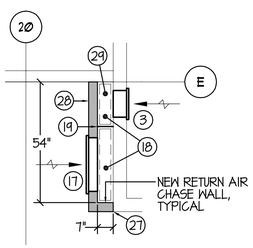

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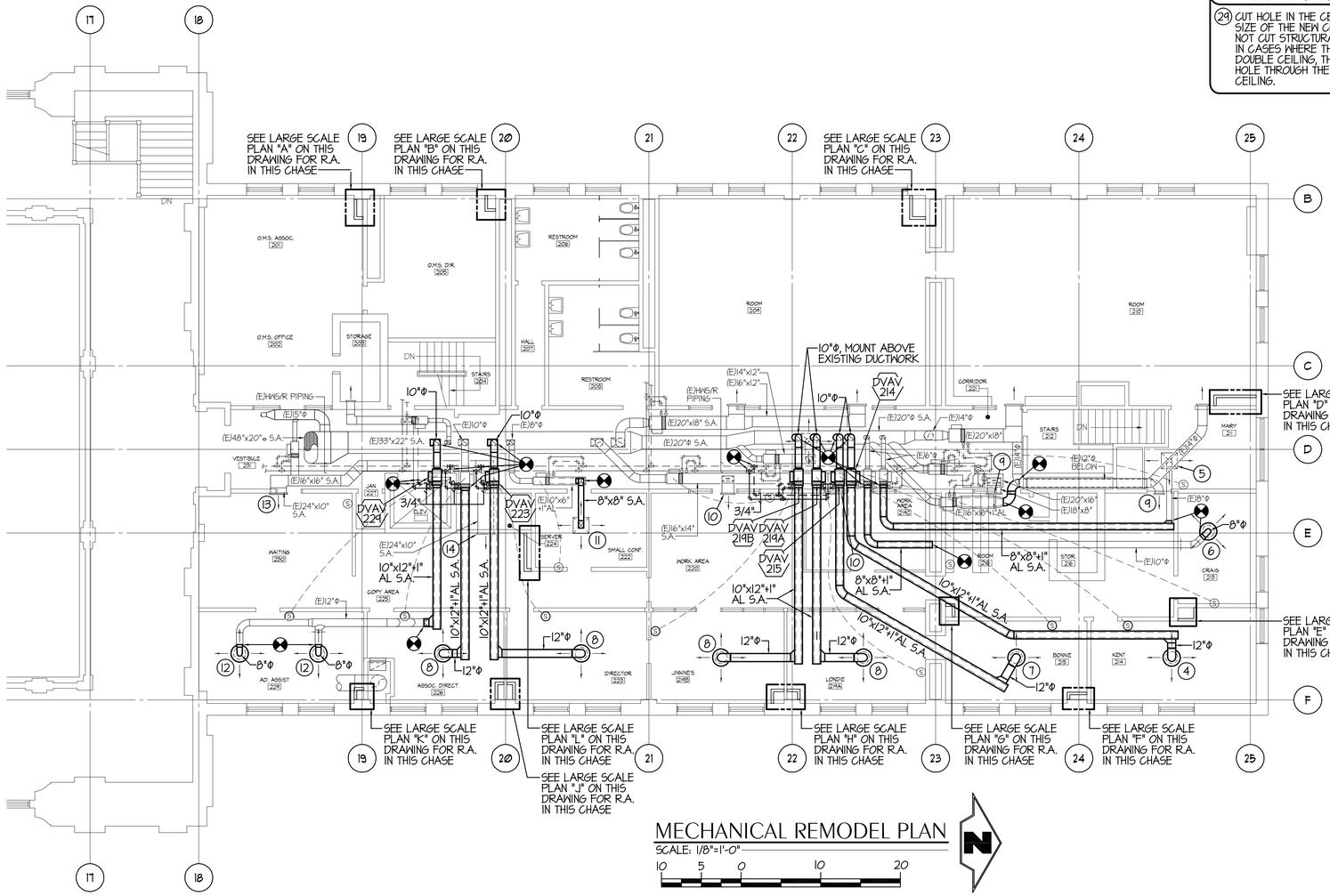

MECHANICAL REMODEL PLAN
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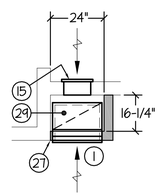

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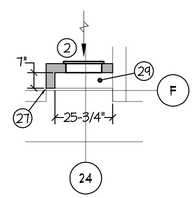
SCALE: 3/8"=1'-0"



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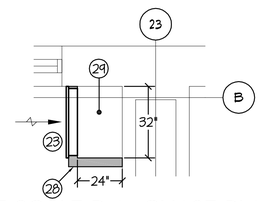

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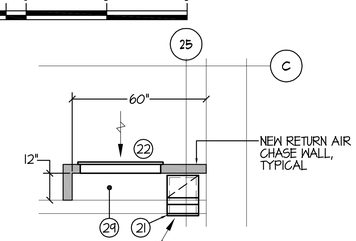

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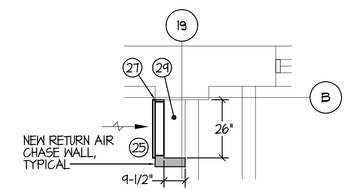

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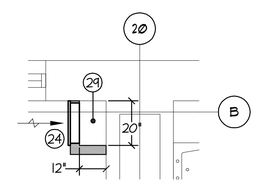

LARGE SCALE R.A. CHASE PLAN B
SCALE: 3/8"=1'-0"

DRAWING NOTES

(29) CUT HOLE IN THE CEILING THE SIZE OF THE NEW CHASE. DO NOT CUT STRUCTURAL MEMBERS. IN CASES WHERE THERE IS A DOUBLE CEILING, THEN EXTEND HOLE THROUGH THE SECOND CEILING.

DRAWING NOTES

1. R-1 20"x10" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD WITH SOUND BOOT RISING 3'-0".
2. R-1 16"x12" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD.
3. R-1 12"x8" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD.
4. S-1 540 CFM, 12"Φ NECK SUPPLY AIR DIFFUSER.
5. BALANCE EXISTING DIFFUSER TO 230 CFM.
6. S-1 180 CFM, 8"Φ NECK SUPPLY AIR DIFFUSER.
7. S-1 560 CFM, 12"Φ NECK SUPPLY AIR DIFFUSER.
8. S-1 570 CFM, 12"Φ NECK SUPPLY AIR DIFFUSER.
9. BALANCE EXISTING DIFFUSER TO 170 CFM.
10. BALANCE EXISTING DIFFUSER TO 270 CFM.
11. BALANCE EXISTING DIFFUSER TO 260 CFM.
12. S-1 290 CFM, 8"Φ NECK SUPPLY AIR DIFFUSER.
13. BALANCE EXISTING DIFFUSER TO 240 CFM.
14. BALANCE EXISTING DIFFUSER TO 220 CFM.
15. R-1 12"x6" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD.
16. R-1 14"x14" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD.
17. R-1 24"x14" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD.
18. ACOUSTIGALLY LINE RETURN AIR SHAFT TO 3'-0" HIGH ABOVE FLOOR.
19. SHEET METAL TO DIVIDE CHASE INTO 2 SECTIONS. LINE BOTH SIDES WITH 1" ACOUSTICAL LINING TO 3'-0" HIGH ABOVE FLOOR.
20. R-1 14"x10" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD.
21. R-1 12"x8" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD WITH SOUND BOOT RISING 3'-0".
22. R-1 36"x14" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD.
23. R-1 30"x26" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD.
24. R-1 18"x12" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD.
25. R-1 24"x12" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD.
26. R-1 10"x20" NECK RETURN AIR GRILLE INSTALLED 2" ABOVE BASEBOARD.
27. ALIGN NEW CHASE WALL WITH EXISTING WALL.
28. MOVE ANY EXISTING ELECTRICAL/ DATA OUTLETES TO NEW CHASE WALL. EXTEND WIRING WHERE NECESSARY. COMPLY WITH CURRENT NEC.

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MECHANICAL REMODEL PLAN

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MH101

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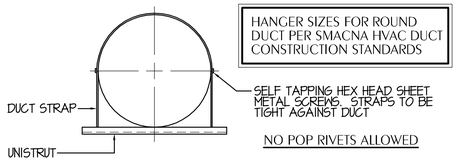
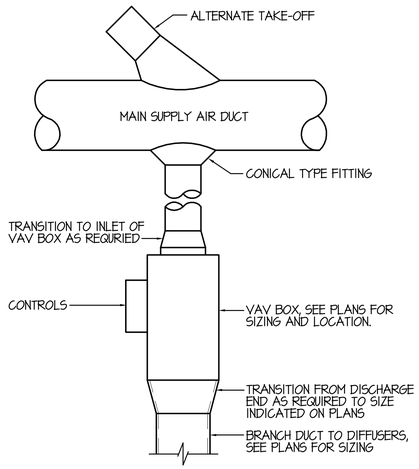


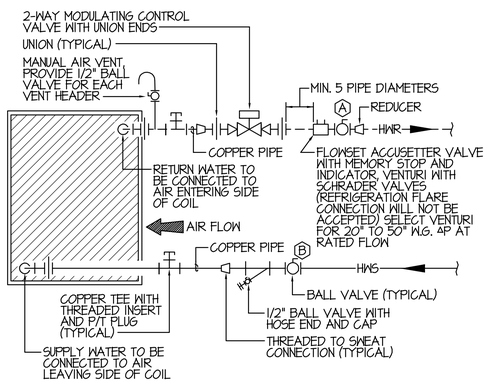
ROUND DUCT HANGER DETAIL (8 / MH501)

SCALE: NONE



VAV BOX DETAIL (9 / MH501)

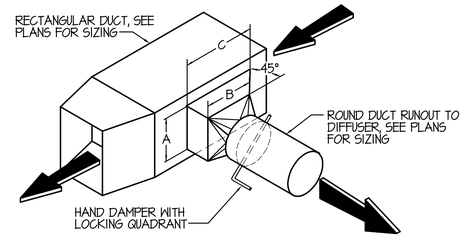
SCALE: NONE



NOTES:
1. INSTALL VALVES AS CLOSE TO COIL AS POSSIBLE.
2. VALVE (B) SHALL BE INSTALLED WITHIN 2'-0" OF VALVE (A)

2-WAY HEATING COIL PIPING DETAIL (10 / MH501)

SCALE: NONE — USE ON VAVR BOXES

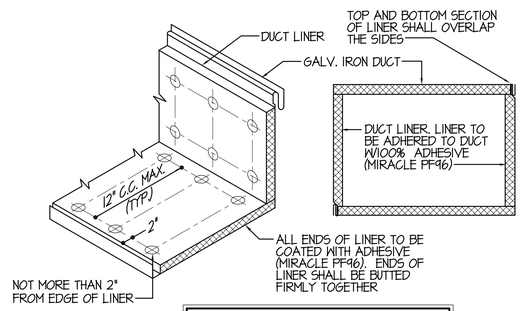


NOTE:
MINIMUM AREA OF AxB SHALL EQUAL CROSS SECTION AREA OF BRANCH DUCT.

AREA OF AxC SHALL BE EQUAL TO 1.5xAREA OF AxB.

DUCT CONNECTION DETAIL (4 / MH501)

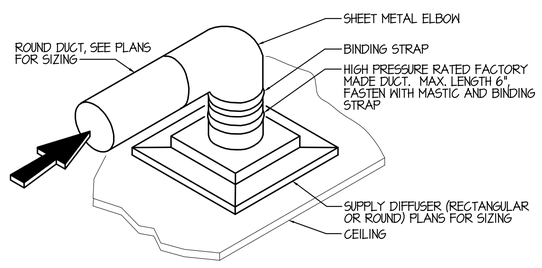
SCALE: NONE



METAL FASTENERS:
OMARK INSUL-PINS, DURA DYNE FASTENERS OR GRIP NAILS. GRIP NAILS SHALL BE INSTALLED BY "GRIP NAIL AIR HAMMER" OR BY "AUTOMATIC FASTENER EQUIPMENT".

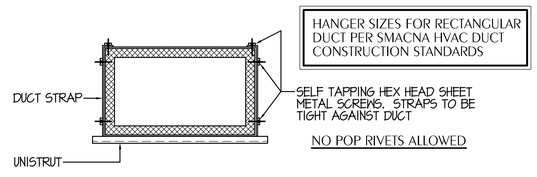
DUCT LINER DETAIL (5 / MH501)

SCALE: NONE



DUCT CONNECTION TO DIFFUSER DETAIL (6 / MH501)

SCALE: NONE



DUCT STRAP HANGER DETAIL (7 / MH501)

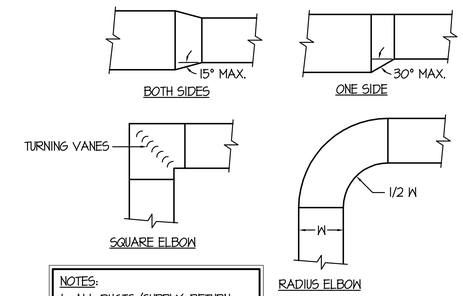
SCALE: NONE

DIMENSION OF LONGEST SIDE (INCHES)	SHEET METAL GAGE (ALL FOUR SIDES)	MINIMUM REINFORCING ANGLE SIZE & MAXIMUM LONGITUDINAL SPACING BETWEEN TRANSVERSE JOINTS &/OR INTERMEDIATE REINFORCING	TRANSVERSE REINFORCING* AT JOINTS: MIN H, IN.	DRIVE SLIP / PLAIN S SLIP	HEMMED S SLIP	ALT BAR SLIP	REIN-FORCED BAR SLIP	BAR SLIP / ANGLE SLIP	STD. SEAM / ANGLE REINFORCED STD. SEAM	POCKET LOCK / ANGLE REINFORCED POCKET LOCK
				RECOM-MENDED GAGE	RECOM-MENDED GAGE	RECOM-MENDED GAGE	RECOM-MENDED GAGE	RECOM-MENDED GAGE	REINFORCED ANGLE SIZE	REINFORCED ANGLE SIZE	RECOM-MENDED GAGE	REINFORCED ANGLE SIZE
UP THRU 12	24	NONE REQUIRED	1	26	26	24	24	24	NOT REQUIRED	NOT REQUIRED	24	NOT REQUIRED
13-18	24	NONE REQUIRED	1	24	24	24	24	24	NOT REQUIRED	NOT REQUIRED	24	NOT REQUIRED
19-30	24	1x1x1/8 @60in.	1	-	24	24	24	24	NOT REQUIRED	NOT REQUIRED	24	NOT REQUIRED
31-42	22	1x1x1/8 @60in.	1	-	-	22	22	22	NOT REQUIRED	NOT REQUIRED	22	NOT REQUIRED
43-54	22	1 1/2x1 1/2x1/8 @60in.	1 1/2	-	-	22	22	22	1 1/2x1 1/2x1/8	NOT REQUIRED	22	NOT REQUIRED
55-60	20	1 1/2x1 1/2x1/8 @60in.	1 1/2	-	-	-	22	22	1 1/2x1 1/2x1/8	NOT REQUIRED	22	NOT REQUIRED
61-84	20	1 1/2x1 1/2x1/8 @60in.	1 1/2	-	-	-	22	22	1 1/2x1 1/2x1/8	1 1/2x1 1/2x1/8	22	1 1/2x1 1/2x1/8

* TRANSVERSE REINFORCING SIZE IS DETERMINED BY DIMENSION OF SIDE TO WHICH ANGLE IS APPLIED

DUCT CONSTRUCTION DETAIL (1 / MH501)

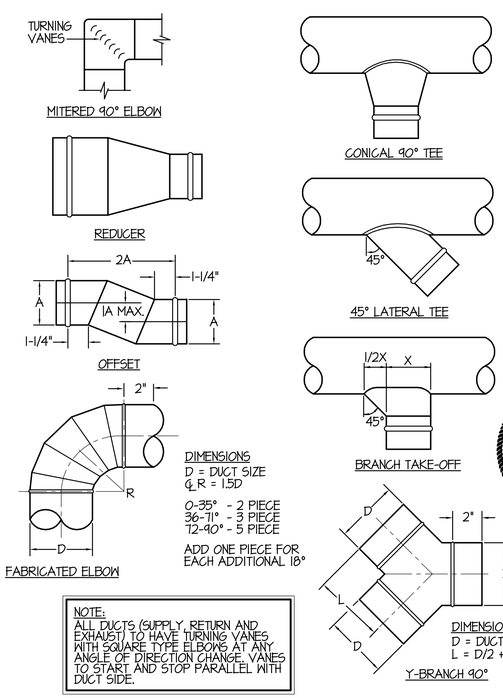
SCALE: NONE



NOTES:
1. ALL DUCTS (SUPPLY, RETURN AND EXHAUST) TO HAVE TURNING VANES IN SQUARE ELBOW.
2. INSIDE SQUARE, OUTSIDE RADIUS ELBOWS NOT ALLOWED.

RECTANGULAR DUCT FITTINGS DETAIL (2 / MH501)

SCALE: NONE



NOTE:
ALL DUCTS (SUPPLY, RETURN AND EXHAUST) TO HAVE TURNING VANES WITH SQUARE TYPE ELBOWS AT ANY ANGLE OF DIRECTION CHANGE. VANES TO START AND STOP PARALLEL WITH DUCT SIDE.

MEDIUM VELOCITY DUCT FITTINGS DETAIL (3 / MH501)

SCALE: NONE

LICENSED PROFESSIONAL ENGINEER
No. 362270
ANDREW J. PASKETT
STATE OF UTAH

DRAWING NOTES

MECHANICAL DETAILS

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HVAC UPGRADE
270 SOUTH RIO GRANDE ST.
SALT LAKE CITY, UTAH 84101

HEATH Engineering Company
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277 West 4800 South Salt Lake City, Utah 84123 Tel. (801) 261-2647 Fax (801) 261-6455

SCALE: NONE
DATE: FEBRUARY 3, 2010
DRAWN BY: S. TERRY
FILE NAME: 9121-M-DT01
SHEET SIZE: 24"x36"

MH501

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PIPE BRACING GENERAL NOTES

1. GENERAL ARE GUIDELINES FOR A LATERAL BRACING SYSTEM. A TYPICAL VERTICAL SUPPORT SYSTEM MUST ALSO BE USED.
2. BRACE ALL PIPES 1-1/2" I.D. AND LARGER.
3. CABLE RESTRAINTS AND BRACING NOT TO EXCEED 30'-0" CENTERS AND SHALL BE PROVIDED AT ALL CHANGES IN DIRECTION OF PIPE. ALL DROPS TO EQUIPMENT, AND ON EACH SIDE OF FLEXIBLE CONNECTIONS. BRACE POINTS SHALL NOT EXCEED 15'-0" FROM FLEXIBLE CONNECTION.
4. ALL HOLES IN ANGLES ARE TO BE 1/16 INCH OVERSIZED. PLACE STANDARD CUT WASHERS BETWEEN SHEET METAL ANGLES AND NUT.
5. EQUIPMENT WHICH ATTACHES TO THE PIPING SYSTEM SHALL BE BRACED INDEPENDENTLY OF THE PIPES.
6. ALL SHEET METAL FOR BRACING TO BE FY=33 KSI MINIMUM. GAUGE FOR SHEET METAL BRACING SHALL BE AS FOLLOWS:
   16 GA = (0.0598 INCH)
   14 GA = (0.0747 INCH)
   12 GA = (0.1046 INCH)
7. MINIMUM DISTANCE FROM EDGE OF ANGLE TO BOLTS SHALL BE AS FOLLOWS:

BOLT DIAMETER	DISTANCE FROM EDGE
1/4" TO 1/2"	1"
5/8"	1 1/8"
3/4"	1 1/4"
7/8"	1 1/2"

8. DO NOT FASTEN RESTRAINT SYSTEM TO TWO DISSIMILAR PARTS OF A BUILDING THAT MAY RESPOND IN A DIFFERENT MODE DURING AN EARTHQUAKE. FOR EXAMPLE, A WALL AND A ROOF.
9. PROVIDE LARGE ENOUGH PIPE SLEEVES THROUGH WALLS OR FLOORS TO ALLOW FOR ANTICIPATED DIFFERENTIAL MOVEMENTS.
10. DO NOT FASTEN ONE RIGID PIPING SYSTEM TO TWO DISSIMILAR PARTS OF A BUILDING THAT MAY RESPOND IN A DIFFERENT MODE DURING AN EARTHQUAKE. FOR EXAMPLE, A WALL AND A ROOF.
11. BRACING DETAILS, SCHEDULE AND NOTES ARE TO BE USED WITH THE FOLLOWING TYPES OF PIPE: STEEL PIPE SCHEDULE 40 AND 80, COPPER PIPE TYPE K,L,M (ONLY SILVER SOLDERED BRAZED JOINTS TO BE USED WITH COPPER PIPE).
12. FOR GAS PIPING, THE BRACING DETAILS, SCHEDULES AND NOTES MAY BE USED EXCEPT THAT RESTRAINTS SHALL BE INSTALLED AT EVERY 20'-0" O.C. ALSO ALL PIPE 1 INCH AND LARGER SHALL BE BRACED.
13. WASTE, VENT AND ROOF DRAINAGE PIPING SYSTEMS ARE EXCLUDED FROM THE RESTRAINT GUIDELINES.
14. ALTERNATE EVERY OTHER CABLE RESTRAINT IN OPPOSITE DIRECTION.
15. WHERE TOP OF PIPING IS SUSPENDED LESS THAN 12" FROM STRUCTURAL MEMBERS, NO SEISMIC BRACING IS REQUIRE AND NO SEISMIC BRACING WILL BE PROVIDED.

PIPE CABLE BRACING SCHEDULE

PIPE SIZE	HANGER ROD SIZE	MAX. ROD LENGTH	HANGER TYPE	BOLTS TO CABLE	CABLE SIZE *	CABLE TYPE **	ANCHOR CONN. TYPE
1-1/2"	1/2"	25"	CLEVIS	3/8"	1/8"	7x19 GALV	I
2"	1/2"	25"	CLEVIS	3/8"	1/8"	7x19 GALV	I
2-1/2"	5/8"	31"	CLEVIS	3/8"	1/8"	7x19 GALV	I
3"	5/8"	31"	CLEVIS	3/8"	3/16"	7x19 GALV	II
3-1/2"	5/8"	31"	CLEVIS	3/8"	3/16"	7x19 GALV	II
4"	3/4"	37"	CLEVIS	3/8"	3/16"	7x19 GALV	II
5"	3/4"	37"	CLEVIS	1/2"	1/4"	7x19 GALV	III
6"	3/4"	37"	CLEVIS	5/8"	1/4"	7x19 GALV	IV

NOTES:
1. FOR ANCHOR CONNECTIONS SEE LIST. SEE PIPE BRACING DETAIL.

*2. TWO CABLES REQUIRED AT EACH RESTRAINT POINT. EACH CABLE TO BE INSTALLED 45 DEG. TO HORIZONTAL AND 45 DEG. TO LONGITUDINAL DIRECTION OF PIPE.

**3. CABLE SYSTEM TO BE EQUAL TO AMBER BOOTH C/W CLAMPS, THIMBLES AND GROMMETS.

DUCT BRACING GENERAL NOTES

1. GUIDELINES ARE FOR A LATERAL BRACING SYSTEM. A TYPICAL VERTICAL SUPPORT SYSTEM MUST ALSO BE USED.
2. BRACE ALL RECTANGULAR DUCTS OF AREA 6 SQ. FT. AND LARGER. BRACE ALL ROUND DUCTS 28" IN DIAMETER AND LARGER.
3. CABLE RESTRAINTS AND BRACING NOT TO EXCEED 30'-0" CENTERS AND SHALL BE PROVIDED AT EACH TURN, AT THE END OF EACH DUCT RUN, AND ON EACH SIDE OF FLEXIBLE CONNECTIONS. BRACE POINTS SHALL NOT EXCEED 15'-0" FROM FLEXIBLE CONNECTION.
4. WHEN COMBINING DUCT GROUPS ON COMMON BRACING SYSTEMS, USE WEIGHTS AND DIMENSIONS FROM BRACING LIST.
5. ALL HOLES IN ANGLES ARE TO BE 1/16 INCH OVERSIZED. PLACE STANDARD CUT WASHERS BETWEEN SHEET METAL ANGLES AND NUT.
6. DUCTS NOT BRACED SHALL BE INSTALLED WITH A 6" MIN. CLEARANCE TO VERTICAL CEILING HANGER WIRES.
7. WHERE TOP OF DUCT IS SUSPENDED LESS THAN 12" FROM STRUCTURAL MEMBERS, NO SEISMIC BRACING ISREQUIRED AND NO SEISMIC BRACING WILL BE PROVIDED.
8. ALL SHEET METAL FOR BRACING TO BE FY = 33 KSI MINIMUM. GAUGE FOR SHEET METAL BRACING SHALL BE AS FOLLOWS:
   16 GA = (0.0598 INCH)
   14 GA = (0.0747 INCH)
   12 GA = (0.1046 INCH)
9. MINIMUM DISTANCE FROM EDGE OF ANGLE TO BOLTS SHALL BE AS FOLLOWS:

BOLT DIAMETER	DISTANCE FROM EDGE
1/4" TO 1/2"	1"
5/8"	1 1/8"
3/4"	1 1/4"
7/8"	1 1/2"

10. DO NOT FASTEN RESTRAINT SYSTEM TO TWO DISSIMILAR PARTS OF A BUILDING THAT MAY RESPOND IN A DIFFERENT MODE DURING AN EARTHQUAKE. FOR EXAMPLE, A WALL AND A ROOF.
11. ALTERNATE EVERY OTHER CABLE RESTRAINT IN OPPOSITE DIRECTION.

DUCT CABLE BRACING LIST

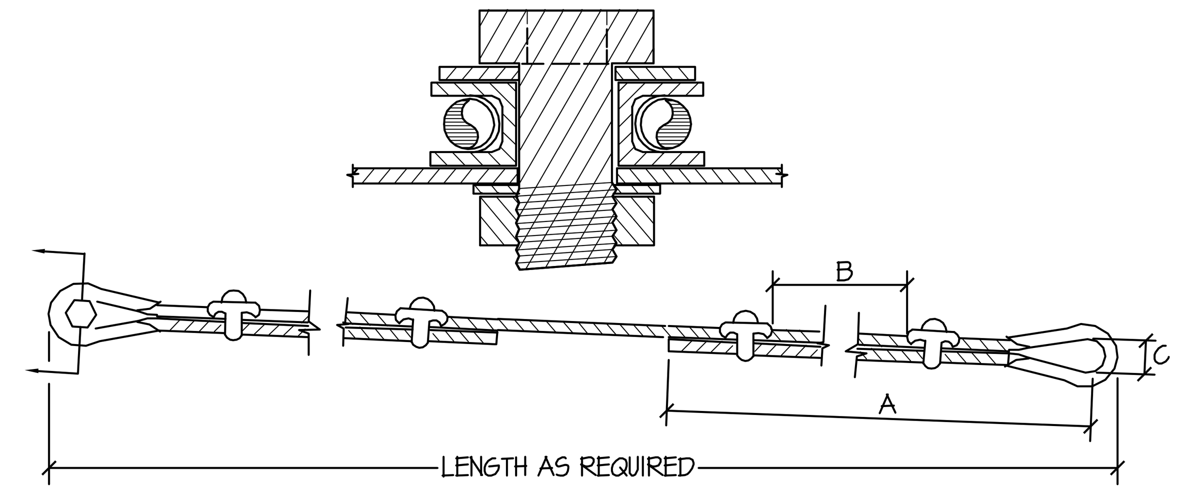
DUCT SIZE (MAX.)	*WT/ LIN FT (MAX)	BOLT SIZE	HORIZONTAL ANGLE	VERTICAL ANGLE	CABLE DIA.**	CABLE DES.	ANCHOR CONN. TYPE
12"	5#	3/8"	2 X 2 X 16 GA	2 X 2 X 12 GA	1/8"	7x19 GALV	I
18"	8#	3/8"	2 X 2 X 16 GA	2-1/2 X 2-1/2 X 12 GA	1/8"	7x19 GALV	I
24"	10#	3/8"	2 X 2 X 16 GA	2-1/2 X 2-1/2 X 12 GA	1/8"	7x19 GALV	I
30"	13#	3/8"	2 X 2 X 16 GA	2-1/2 X 2-1/2 X 12 GA	1/8"	7x19 GALV	I
42"	20#	3/8"	2-1/2 X 2-1/2 X 16 GA	4 X 4 X 12 GA	3/16"	7x19 GALV	II
54"	27#	3/8"	2-1/2 X 2-1/2 X 16 GA	4 X 4 X 12 GA	3/16"	7x19 GALV	II
60"	36#	3/8"	3 X 3 X 16 GA	4 X 4 X 12 GA	3/16"	7x19 GALV	II
84"	53#	3/8"	4 X 4 X 14 GA	4 X 4 X 1/4	1/4"	7x19 GALV	III
96"	80#	1/2"	4 X 4 X 12 GA	5 X 3 X 1/4	5/16"	7x19 GALV	IV

* MAXIMUM WEIGHT OF DUCTS OR COMBINATIONS OF DUCTS PER LINEAR FOOT. THE DUCTS MAXIMUM DIMENSION SHALL GOVERN WHAT BRACING IS REQUIRED. FOR ANCHOR CONNECTIONS SEE LIST. SEE DUCT BRACING DETAILS.

** TWO CABLES REQUIRED AT EACH RESTRAINT POINT, EACH CABLE TO BE INSTALLED 45 DEG. TO HORIZONTAL AND 45 DEG. TO LONGITUDINAL DIRECTION OF DUCT.

GENERAL NOTES:

1. INSTALLATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 230548, IBC SECTION 1613.1 \AND SMACNA.
2. CONTRACTOR TO PROVIDE SEISMIC DRAWING CERTIFIED AND STAMPED.



NOTES:
1. CABLES, THIMBLES, CLIPS, GROMMETS AND FLAT WASHERS ARE TO BE FURNISHED BY RESTRAINT MANUFACTURER. ALL OTHER HARDWARE TO BE PROVIDED BY CONTRACTOR.
2. ENTIRE SYSTEM TO BE EQUAL TO AMBER BOOTH.
3. CABLE CLIPS MUST BE ORIENTED AS SHOWN WITH SHORT END OF CABLE ON THE CURVED PART OF THE CLIP.

CABLE SCHEDULE

CABLE DIA.	CABLE DESIGN	A	B	C	BOLT SIZE	ALLOWABLE LOAD (lbf)	BREAKING STRENGTH (lbf)
1/8"	7X19 GALV.	5-1/4"	1-5/8"	5/8"	3/8"	660	2000
3/16"	7X19 GALV.	5-3/4"	1-7/8"	5/8"	3/8"	1400	4200
1/4"	7X19 GALV.	6-3/4"	2-3/8"	11/16"	3/8"	2330	7000
5/16"	7X19 GALV.	7-3/8"	2-5/8"	13/16"	5/8"	3260	9800
3/8"	7X19 GALV.	8-7/8"	3-1/4"	1"	5/8"	4800	14400
7/16"	6X19 IWRC	17"	3-5/8"	1"	5/8"	5920	17800
1/2"	6X19 IWRC	18"	3-7/8"	1-1/8"	3/4"	7660	23000

CABLE RESTRAINT DETAIL
SCALE: NONE

1 / MH502

SCHEDULE FOR TYPICAL CONNECTIONS TO STRUCTURAL SUPPORTING MEMBERS

TYPE	MAX. LOAD CAPACITY POUNDS	PHILLIP'S REDHEAD ANCHORS TO CONC. LT. WT.	PHILLIP'S REDHEAD ANCHORS TO CONC. HARD ROCK	CONC. CAST-IN PLACE INSERT	BOLT OF STL.BM. CLAMP
I II	500 1000	3/8" 3/8"	3/8" 3/8"	3/8" 1/2"	3/8" 3/8"
III IV	1500 2000	3/8" 1/2"	3/8" 1/2"	1/2" 5/8"	3/8" 1/2"
V VI	3000 4000	2-1/2" 2-5/8"	2-1/2" 2-5/8"	2-1/2" 2-5/8"	5/8" 5/8"

TYPE	SPREADER SIZE	BOLT THRU WOOD	SPAN-CRETE ROD	ANGLE TO SUPPORTING STRUCTURAL MEMBER	ROD SIZE FOR PIPES
I II	C4X5.4 C5X6.7	1/2" 3/4"	3/8" 3/8"	3X2X1/4"X0'-3" LLH 3-1/2X2-1/2X5/16X0'-3" LLH	1/2" 1/2"
III IV	C6X8.5 C8X11.5	*** ***	1/2" 1/2"	3-1/2X2-1/2X7/16X0'-4" LLH 5X3X1/2X0'-4" LLH	5/8" 3/4"
V VI	C9X13.4 C10X15.3	***		2-3-1/2X2-1/2X7/16X0'-4" 2-5X3X1/2X0'-4"	7/8" * 7/8" **

NOTES:
1. FOR SLABS LESS THAN 5" THICK ONLY, THIN SLAB INSERTS MAY BE USED.

*2. FOR USE WITH CONCRETE CAST-IN PLACE INSERTS OR PHILLIPS REDHEAD IN HARD ROCK ONLY.

**3. FOR USE WITH CONCRETE CAST-IN PLACE INSERTS ONLY.

***4. WHERE TYPE III CONNECTIONS ARE REQUIRED FOR WOOD SYSTEMS, TYPE II CONNECTIONS SHALL BE USED WITH REDUCED RESTRAINT SPACING TO 20 FT. O.C. WHERE TYPE IV CONNECTIONS ARE REQUIRED FOR WOOD SYSTEMS, TYPE II CONNECTIONS SHALL BE USED WITH REDUCED RESTRAINT SPACING TO 15 FT. O.C. WHERE TYPE V CONNECTIONS ARE REQUIRED FOR WOOD SYSTEMS, TYPE II CONNECTIONS SHALL BE USED WITH REDUCED RESTRAINT SPACING TO 10 FT. O.C.

5. THE MECHANICAL CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO THE STRUCTURAL ENGINEER AND THEN TO THE MECHANICAL ENGINEER, SHOWING CONNECTION TYPE AND LOCATION OF ALL RESTRAINT CONNECTIONS TO THE STRUCTURE.
6. FOR ESSENTIAL FACILITIES WHERE CONCRETE ANCHOR BOLTS OF THE "REDHEAD" EXPANSION TYPE ARE LOADED IN PULL OUT, 50 PERCENT OF THE BOLTS (ALTERNATE BOLTS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE LOAD. IF THERE ARE FAILURES, THE IMMEDIATELY ADJACENT BOLTS MUST THEN ALSO BE TESTED.
7. "HILTI" AND "RAMSET" ANCHORS ARE EQUAL SUBSTITUTES FOR "REDHEAD".

LICENSED PROFESSIONAL ENGINEER
No. 362270
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DRAWING NOTES

MECHANICAL DETAILS

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SCALE: NONE
DATE: FEBRUARY 3, 2010
DRAWN BY: S. TERRY
FILE NAME: 9121-M-DT02
SHEET SIZE: 24"x36"

MH502

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