

# Vantage Titan

## DRAWING CONTENTS

- C1 COVER SHEET
- GN GENERAL NOTES

### SECTION A

- A1 EQUIPMENT LAYOUT
- A2 MAGNETIC FIELD LAYOUT
- A3 DETAILS
- A4 EQUIPMENT ELEVATIONS
- A5 EQUIPMENT ELEVATIONS

### SECTION S

- S1 STRUCTURAL LAYOUT / BASE DETAIL

### SECTION P

- P1 PLUMBING LAYOUT
- P2 WATER COOLING FACILITIES CONFIGURATION
- P3 PLUMBING / MEDICAL GAS DETAILS

### SECTION M

- M1 MECHANICAL LAYOUT
- M2 QUENCH PIPE DETAILS
- M3 QUENCH PIPE DETAILS
- M4 QUENCH PIPE DETAILS

### SECTION E

- E1 ELECTRICAL LAYOUT
- E2 ELECTRICAL SCHEMATIC
- E3 ELECTRICAL DETAILS
- E4 LINE FILTER PANEL
- E5 POWER SYSTEM DIAGRAM / POWER QUALITY REQUIREMENTS
- E6 CABLE LENGTH DIAGRAM (FOR INTERNAL USE ONLY)

**TOSHIBA**  
Leading Innovation >>>

REV	DATE	REVISED SHEET(S)	INT
09-04-13	ORIGINAL FINAL DRAWINGS COMPLETED.	MS	
11-12-13	GN, A1, A2, S1, M1, E1, E2, & E4.	MS	

<b>PINNACLE TRISTAN ASSOCIATES</b>	(MR SCAN ROOM – TITAN)
32 NORTHEAST DRIVE HERSHEY, PA 17033	

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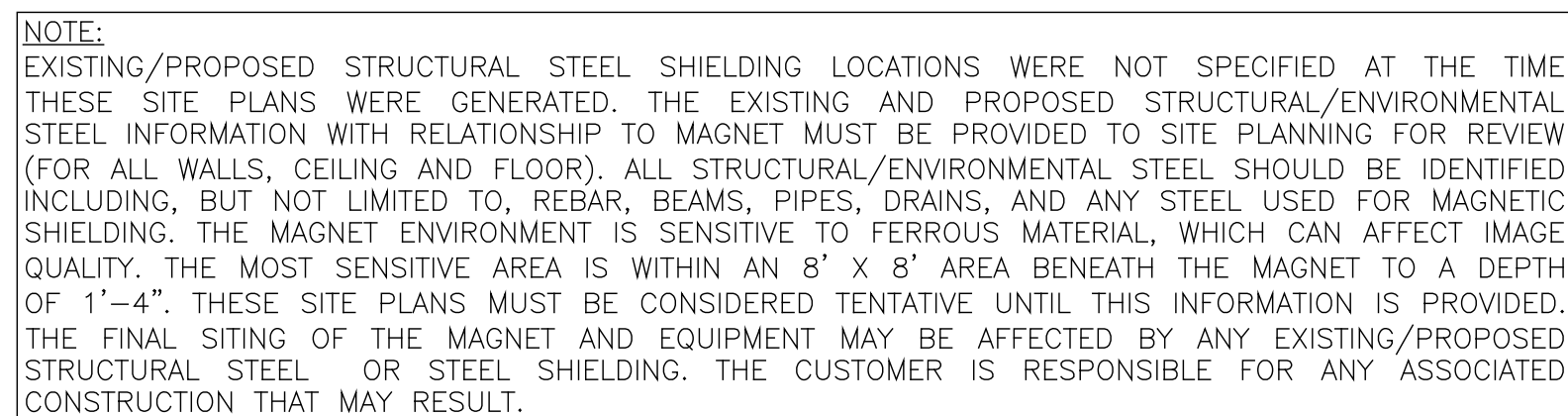
DATE:	11-12-13
SCALE:	NOT TO SCALE
PLANNER:	M.S.
SID:	30008346
PROJECT NO.	<b>130013741MRF1</b>

**C1**

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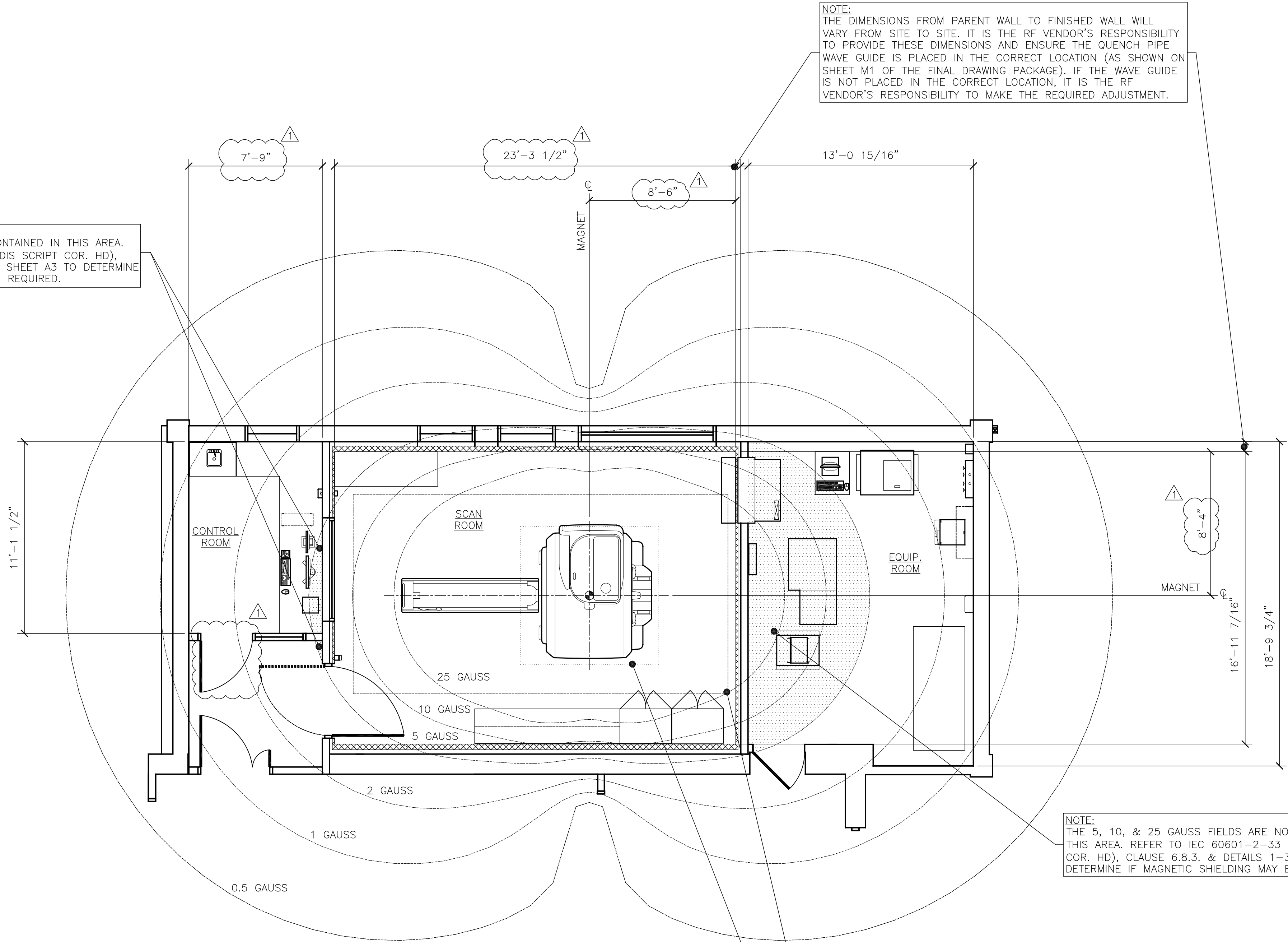
LRM:
DATE:

PINNACLE TRISTAN ASSOCIATES			
REV	DATE	DESCRIPTION	INT
A	09-04-13	ORIGINAL FINAL DRAWINGS COMPLETED.	MS
A	11-12-13	UPDATED ARCH. BACKGROUND. MOVED MAGNET.	MS
A	11-12-13	UPDATED NOTE.	MS
(MR SCAN ROOM – TITAN)			
32 NORTHEAST DRIVE HERSHEY, PA 17033			

## References

**FOR REFERENCE ONLY. NOT TO BE USED FOR CONSTRUCTION PURPOSES.**

NOTE:  
THE 5 GAUSS FIELD IS NOT CONTAINED IN THIS AREA.  
REFER TO IEC 60601-2-33 (FDIS SCRIPT COR. HD),  
CLAUSE 6.8.3. & DETAILS 1-3, SHEET A3 TO DETERMINE  
IF MAGNETIC SHIELDING MAY BE REQUIRED.



NOTE:  
THE DIMENSIONS FROM PARENT WALL TO FINISHED WALL WILL  
VARY FROM SITE TO SITE. IT IS THE RF VENDOR'S RESPONSIBILITY  
TO PROVIDE THESE DIMENSIONS AND ENSURE THE QUENCH PIPE  
WAVE GUIDE IS PLACED IN THE CORRECT LOCATION (AS SHOWN ON  
SHEET M1 OF THE FINAL DRAWING PACKAGE). IF THE WAVE GUIDE  
IS NOT PLACED IN THE CORRECT LOCATION, IT IS THE RF  
VENDOR'S RESPONSIBILITY TO MAKE THE REQUIRED ADJUSTMENT.

NOTE:  
THE 5, 10, & 25 GAUSS FIELDS ARE NOT CONTAINED IN  
THIS AREA. REFER TO IEC 60601-2-33 (FDIS SCRIPT  
COR. HD), CLAUSE 6.8.3. & DETAILS 1-3, SHEET A3 TO  
DETERMINE IF MAGNETIC SHIELDING MAY BE REQUIRED.

NOTE:  
ALL EXISTING AND PROPOSED MAGNETIC STEEL  
PLACEMENTS (IN THE WALLS ONLY) MUST BE  
LOCATED OUTSIDE THIS EXCLUSION AREA  
(11'-7" X 21'-9"). SEE GENERAL NOTE "P"  
ON SHEET "GN" FOR SPECIAL CONSIDERATIONS.

NOTE:  
SEE GENERAL NOTES "P" & "Q" ON SHEET "GN" FOR SPECIAL  
CONSIDERATIONS WITHIN THIS 8' X 8' AREA BENEATH MAGNET.

- RF / MAGNETIC SHIELDING**
- A. CUSTOMER/CONTRACTOR RESPONSIBLE FOR OBTAINING A SHIELDING VENDOR, TO MODEL, DESIGN, AND BUILD REQUIRED MAGNETIC AND RF SHIELDING.
  - B. MAGNET LEGS MUST BE INSULATED (ISOLATED) FROM RF ENCLOSURE.
  - C. GAUSS LINES IN THESE DRAWINGS ARE REPRESENTED WITHOUT MAGNETIC SHIELDING.
  - D. RF SHIELDING WEIGHT WILL VARY FROM SITE TO SITE. CUSTOMER'S STRUCTURAL ENGINEER MUST CONSULT WITH RF ENCLOSURE VENDOR FOR RF SHIELDING WEIGHTS.
  - E. THE EXISTING/FUTURE STEEL INFORMATION WITH RELATIONSHIP TO MAGNET MUST BE PROVIDED TO SITE PLANNING FOR REVIEW (ALL SIDES OF THE ROOM, INCLUDING CEILING AND FLOOR).
  - F. ANY STEEL BENEATH THE MAGNET MUST BE LOCATED A MINIMUM OF 4'-7" FROM MAGNET ISOCENTER. SOME STEEL REBAR COULD BE ACCEPTABLE, CONSULT WITH TOSHIBA INSTALLATION PROJECT MANAGER FOR APPROVAL OF ANY STEEL IN THIS CRITICAL AREA.
  - G. MAGNETOMETER SURVEY MUST BE PERFORMED BY TOSHIBA BEFORE SUBMITTING FINAL DRAWINGS (120V POWER IS REQUIRED FOR TOSHIBA TO BEGIN SURVEY. A MINIMUM OF 50'F IS REQUIRED FOR SURVEY AREA).
  - H. THE SHIELDING WORK IS REQUIRED TO SUPPRESS EXTERNAL LEAKAGE OF THE ELECTROMAGNETIC RADIATION GENERATED BY THE SYSTEM.
  - I. THE SHIELD MUST ATTENUATE ELECTROMAGNETIC RADIATION IN THE FREQUENCY BAND OF 63.86 MHz  $\pm$  0.5 MHz BY AT LEAST 90 dB.
    - 90 dB OR MORE FROM 64.36 MHz TO 70 MHz
    - 80 dB OR MORE FROM 70 MHz TO 300 MHz
    - 50 dB OR MORE FROM 300 MHz TO 350 MHz
    - 40 dB OR MORE FROM 350 MHz TO 1 GHz

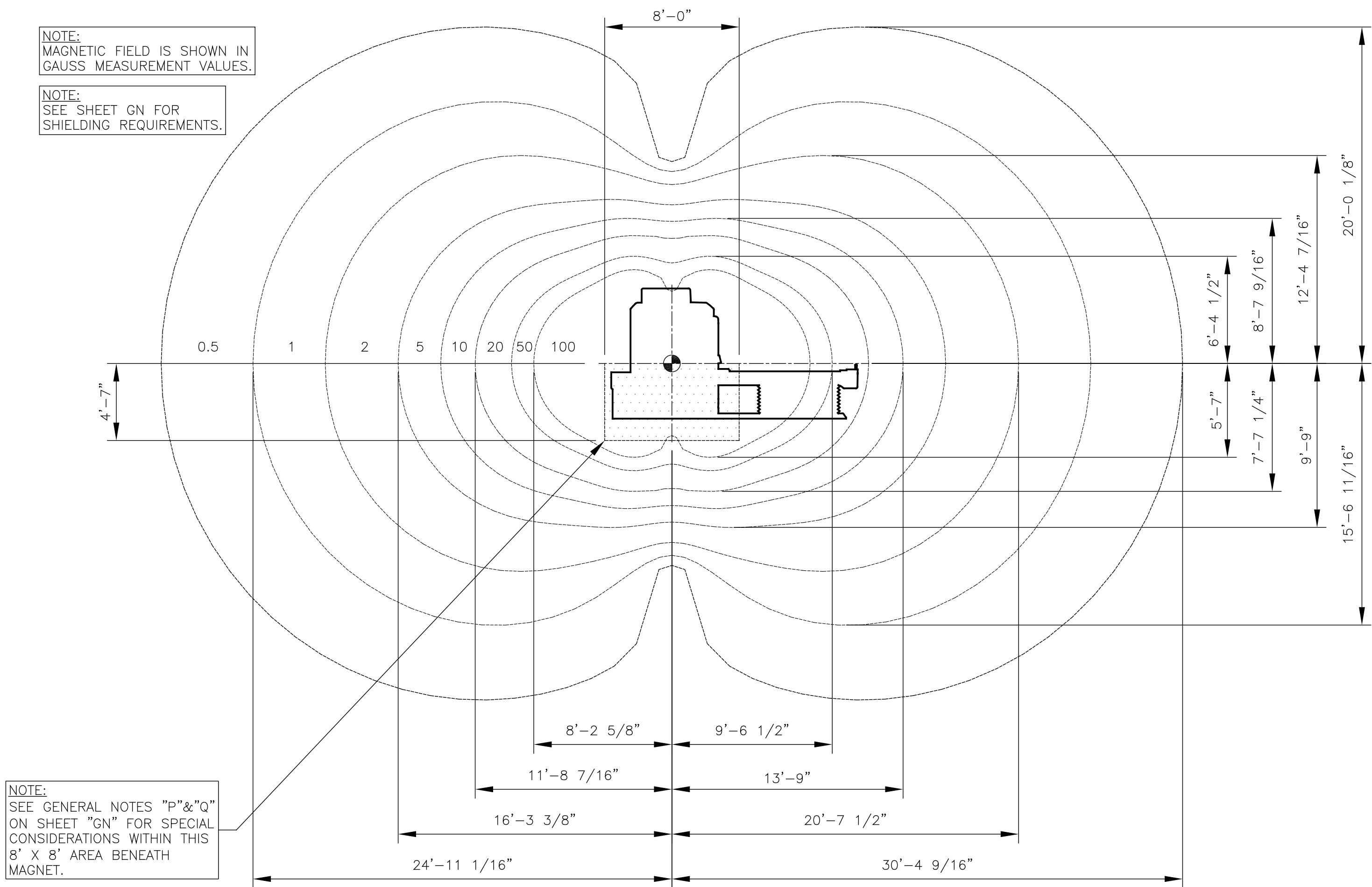
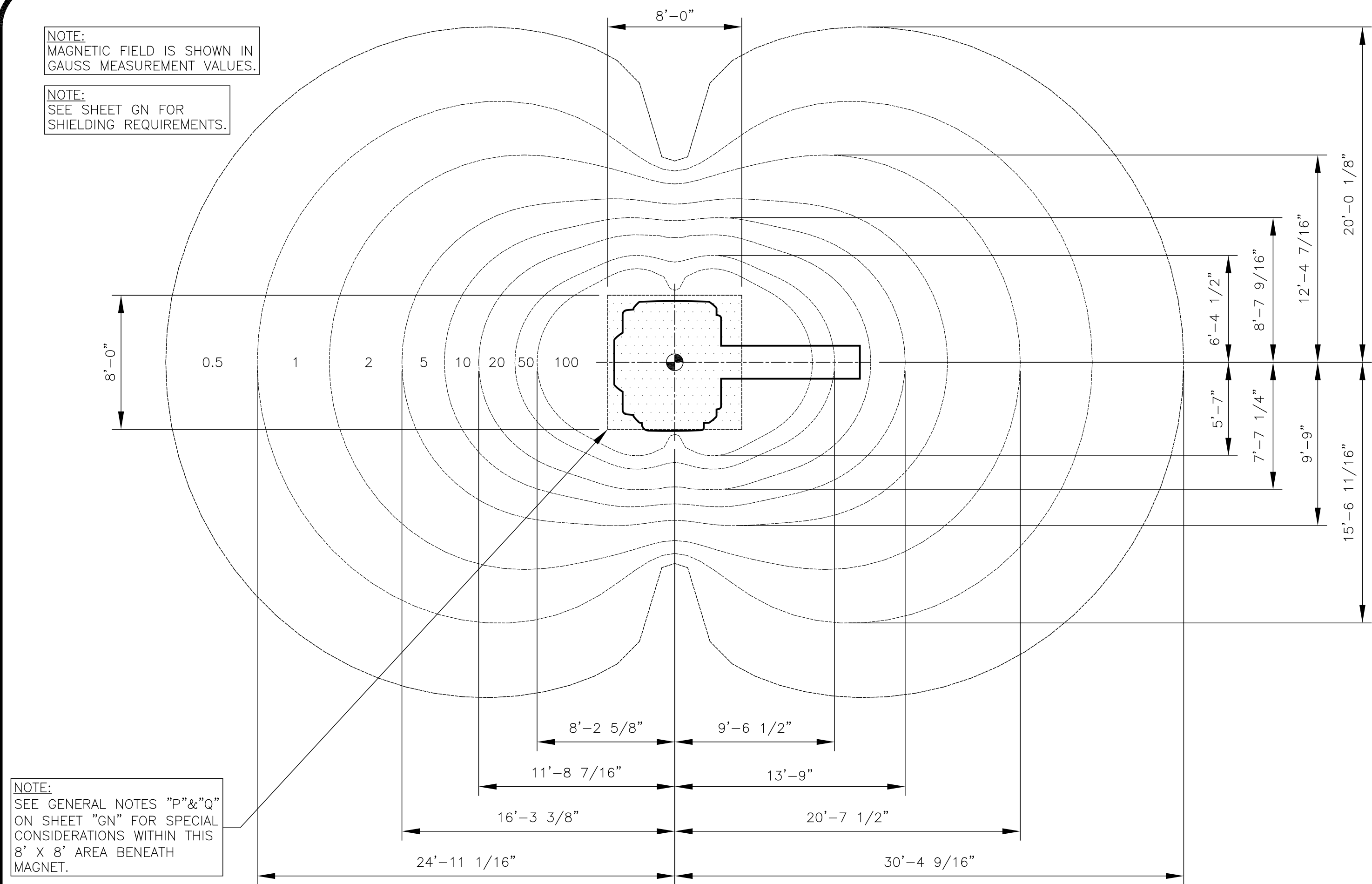
NOTE:  
IF A CEILING HEIGHT OF 8'-10 5/16" IS NOT AVAILABLE, THE SYSTEM  
CAN STILL BE INSTALLED AS LONG AS THE MINIMUM CEILING HEIGHT  
IS 7'-10 1/2" AND A SERVICE OPENING IS PROVIDED IN THE CEILING  
UP TO 8'-10 5/16".

MAGNET LEGS MUST BE INSULATED (ISOLATED) FROM RF ENCLOSURE.

**PINNACLE TRISTAN ASSOCIATES**  
(MR SCAN ROOM - TITAN)  
32 NORTHEAST DRIVE  
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DATE: 11-12-13  
SCALE: 1/4" = 1'-0"  
PLANNER: M.S.  
SID: 30008346  
PROJECT NO.  
**130013741MRF1**



### 1 FRINGE FIELD MEASUREMENTS (PLAN VIEW)

SCALE: 3/16" = 1'-0"

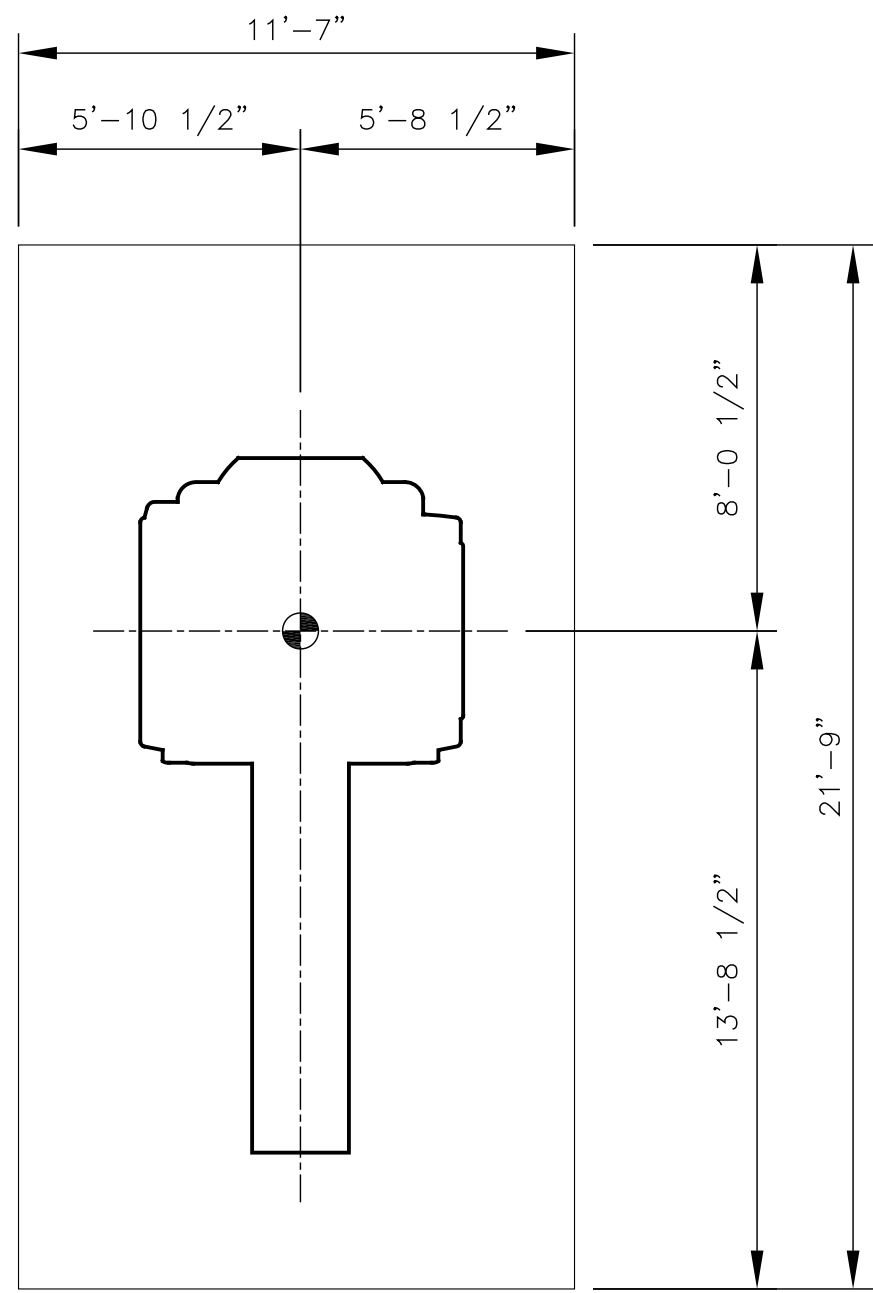
09-05-12

UNIT	EXAMPLE	GAUSS (NOTE A)	DISTANCE (FT.) (NOTE B)
ACCELERATING TUBE	LINEAR ACCELERATORS	0.5	30'-4 9/16"
I.I.	X-RAY SYSTEMS	0.5	30'-4 9/16"
NON-SHIELDED PHOTO-MULTIPLIER TUBE	CT, GAMMA CAMERA, PET SYSTEMS	0.5	30'-4 9/16"
REED RELAY	PACEMAKERS**	5	16'-3 3/8"
X-RAY TUBE	CT, X-RAY SYSTEMS	10	13'-9"
CRT	MONOCHROME MONITORS (SHIELDED)	5	16'-3 3/8"
	MONOCHROME MONITORS (UNSHIELDED)	2	20'-7 1/2"
	COLOR MONITORS (SHIELDED)	1	24'-11 1/16"
	COLOR MONITORS (UNSHIELDED)	0.5	30'-4 9/16"
	MULTIFORMAT CAMERAS	10	13'-9"
	ULTRASONIC DIAGNOSTIC SYSTEMS	2	20'-7 1/2"
	ELECTROCARDIOGRAPHS	2	20'-7 1/2"
	ELECTROENCEPHALOGRAPHS	2	20'-7 1/2"
OXYGEN MONITOR	INCLUDED IN THE MRI SYSTEM	20	11'-8 7/16"
SUPERVISORY UNIT	INCLUDED IN THE MRI SYSTEM	20	11'-8 7/16"
FILTER PANEL	INCLUDED IN THE MRI SYSTEM	100	8'-7"
GRADIENT POWER SUPPLY	INCLUDED IN THE MRI SYSTEM	5	16'-3 3/8"
TRANSFORMER CABINET (WITH VACUUM PUMP UNIT)	INCLUDED IN THE MRI SYSTEM	5	16'-3 3/8"
ECO CABINET	INCLUDED IN THE MRI SYSTEM	5	16'-3 3/8"
HOST CABINET	INCLUDED IN THE MRI SYSTEM	5	16'-3 3/8"
MAGNETIC RECORDING MEDIA	MAGNETIC TAPES, FLOPPY DISKS	10	13'-9"
MAGNETIC RECORDING MEDIA	BANK, CREDIT CARDS	20	11'-8 7/16"
OTHERS	WATCHES	30	10'-9 15/16"

NOTE:  
THE DEVICES LISTED ABOVE ARE AFFECTED BY MAGNETIC FIELDS AND MAY NOT OPERATE PROPERLY NEAR THE GANTRY.

- A. MAXIMUM MAGNETIC FIELD INTENSITY AT WHICH THE UNIT OPERATES NORMALLY. THESE VALUES INCLUDE THE EARTH'S MAGNETIC FIELD (APPROXIMATELY 0.4 GAUSS). IF THE DIRECTION IN WHICH THE GANTRY IS INSTALLED IS CLOSE TO THAT OF THE EARTH'S MAGNETIC FIELD, THE MAXIMUM MAGNETIC INTENSITY (INCLUDING THE EARTH'S MAGNETIC FIELD) OF EACH UNIT MAY EXCEED THE LIMIT. IN THIS SITUATION, THE INSTALLED DIRECTION MUST BE CHANGED. OTHERWISE, DO NOT ALLOW ANY EQUIPMENT TO BE SET UP BEYOND ALLOWABLE LIMIT OR PERSONS TO ENTER THIS AREA.
- B. MINIMUM DISTANCE FROM THE CENTER OF THE MAGNET FOR NORMAL OPERATION.
- C. SPECIAL CAUTION IS REQUIRED FOR ELECTRON MICROSCOPES BECAUSE THEY CAN BE AFFECTED BY MAGNETIC FIELD VARIATIONS AS SMALL A FEW MILLIGAUSS.

NOTE:  
EXISTING/PROPOSED STRUCTURAL STEEL SHIELDING LOCATIONS WERE NOT SPECIFIED AT THE TIME THESE SITE PLANS WERE GENERATED. THE EXISTING AND PROPOSED STRUCTURAL/ENVIRONMENTAL STEEL INFORMATION WITH RELATIONSHIP TO MAGNET MUST BE PROVIDED TO SITE PLANNING FOR REVIEW (FOR ALL WALLS, CEILING AND FLOOR). ALL STRUCTURAL/ENVIRONMENTAL STEEL SHOULD BE IDENTIFIED INCLUDING, BUT NOT LIMITED TO, REBAR, BEAMS, PIPES, DRAINS, AND ANY STEEL USED FOR MAGNETIC SHIELDING. THE MAGNET ENVIRONMENT IS SENSITIVE TO FERROUS MATERIAL, WHICH CAN AFFECT IMAGE QUALITY. THE MOST SENSITIVE AREA IS WITHIN AN 8' X 8' AREA BENEATH THE MAGNET TO A DEPTH OF 1'-4". THESE SITE PLANS MUST BE CONSIDERED TENTATIVE UNTIL THIS INFORMATION IS PROVIDED. THE FINAL SITING OF THE MAGNET AND EQUIPMENT MAY BE AFFECTED BY ANY EXISTING/PROPOSED STRUCTURAL STEEL OR STEEL SHIELDING. THE CUSTOMER IS RESPONSIBLE FOR ANY ASSOCIATED CONSTRUCTION THAT MAY RESULT.

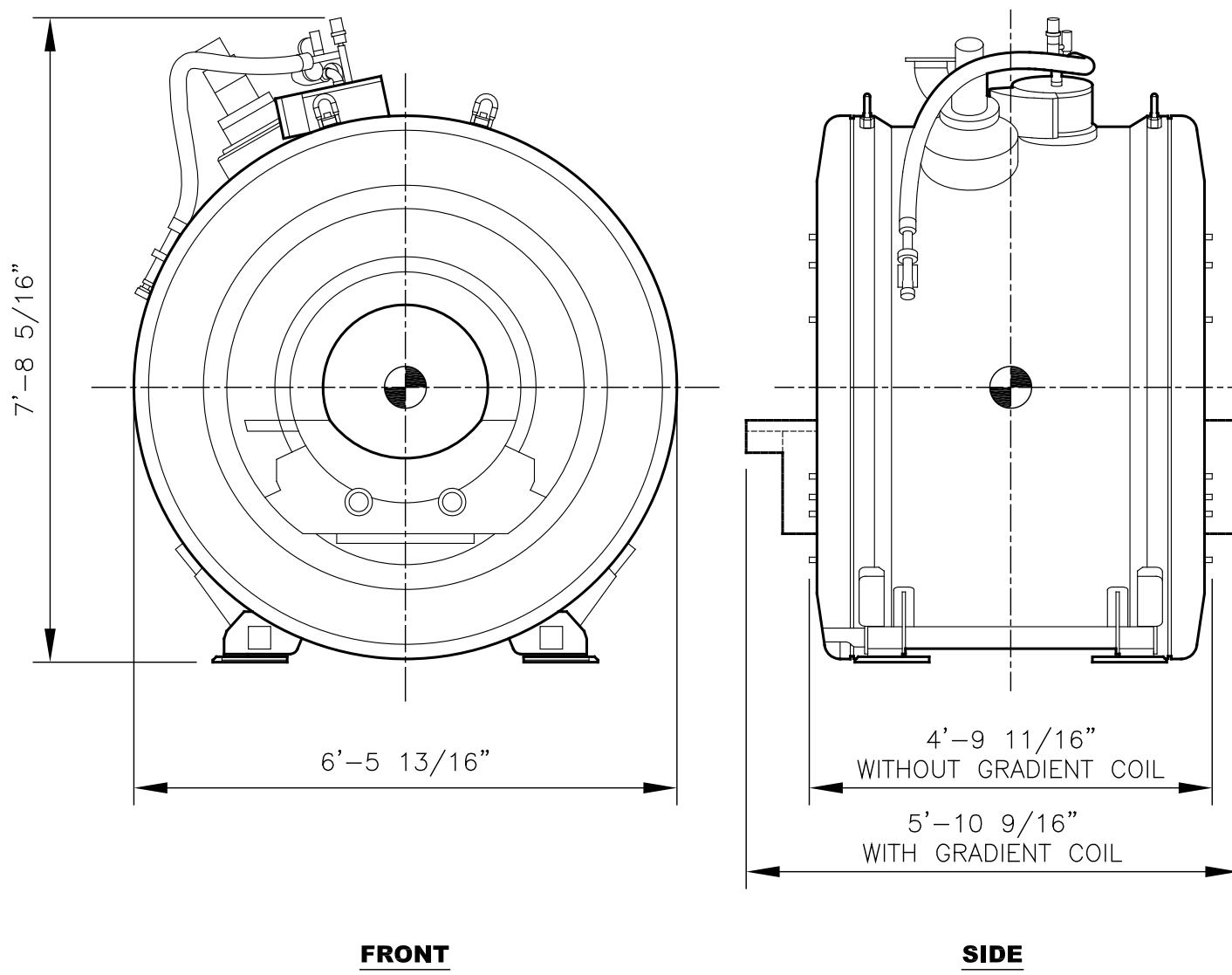


NOTE:  
ALL EXISTING AND PROPOSED MAGNETIC STEEL PLACEMENTS (IN THE WALLS ONLY) MUST BE LOCATED OUTSIDE THIS EXCLUSION AREA (11'-7" X 21'-9").

### 2 FRINGE FIELD MEASUREMENTS (ELEVATION VIEW)

SCALE: 3/16" = 1'-0"

09-05-12

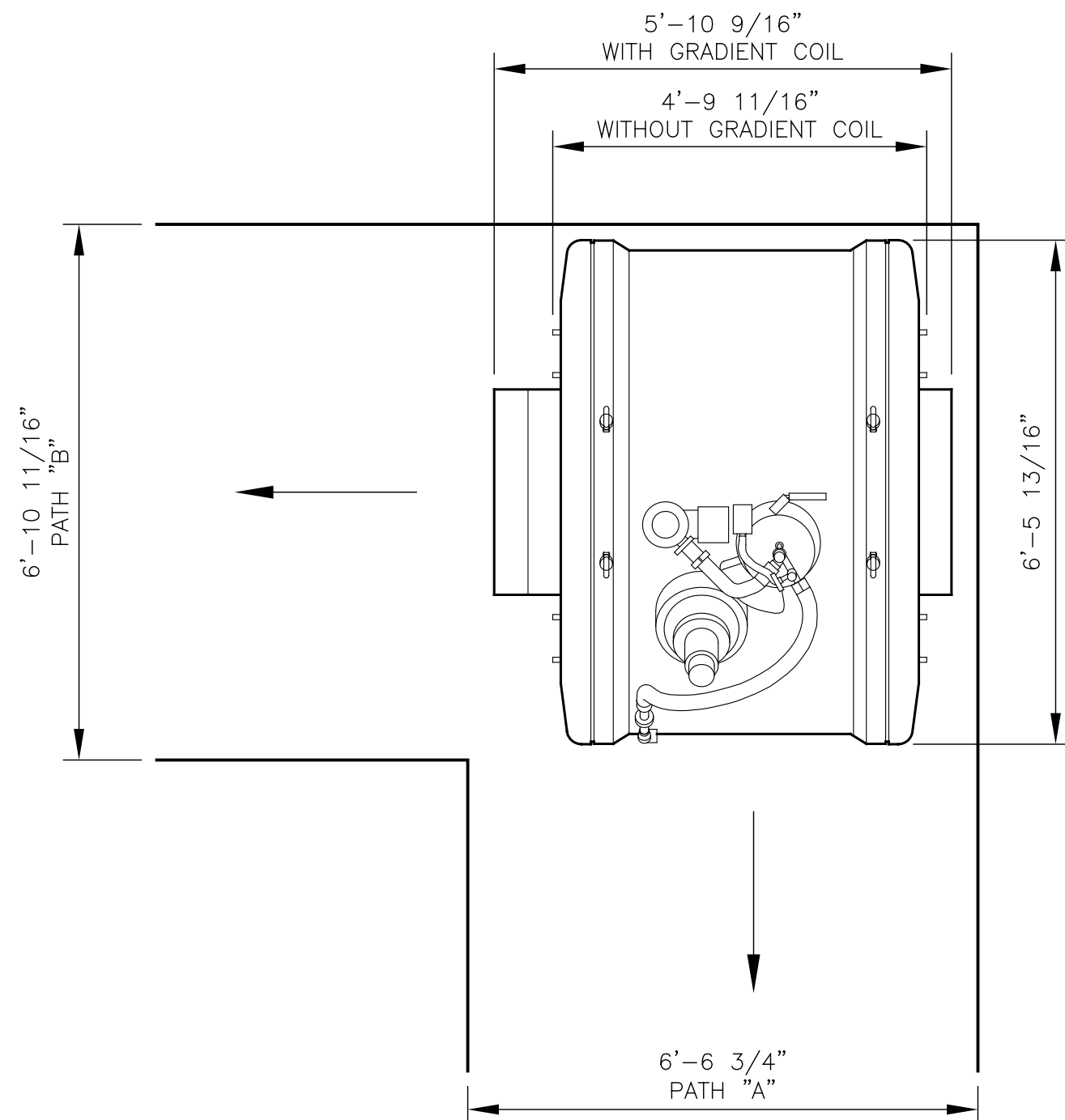


FRONT

SIDE

NOTE:  
FOR DELIVERY: CONSULT RIGGING CONTRACTOR FOR HEIGHT REQUIREMENTS FOR MATERIALS USED TO TRANSPORT MAGNET TO FINAL LOCATION.

- CASTER HEIGHTS WILL VARY.
- CARRYING IN WEIGHT WITHOUT GRADIENT COIL, COVER IS 8,800 LBS (FILLED).



NOTE:  
IF ORIENTATION IS NOT CHANGED AT THE CORNER, 6'-6 3/4" WIDTH IS SUFFICIENT FOR PATH "A" AND 6'-10 11/16" FOR PATH "B".

### 3 EFFECTS OF THE MAGNETIC FIELD

SCALE: NOT TO SCALE

09-05-12

### 4 STEEL EXCLUSION ZONE OF MAGNET

SCALE: 1/4" = 1'-0"

09-05-12

### 5 MAGNET ASSEMBLY FOR CARRYING IN

SCALE: 1/2" = 1'-0"

09-05-12

### 6 MINIMUM CORRIDOR WIDTH FOR MAGNET INGRESS

SCALE: 1/2" = 1'-0"

01-10-11

REV	DATE	DESCRIPTION	INT
Δ	09-04-13	ORIGINAL FINAL DRAWINGS COMPLETED.	MS
Δ	11-12-13	NO CHANGES MADE TO THIS SHEET.	MS

PINNACLE TRISTAN ASSOCIATES

(MR SCAN ROOM – TITAN)

32 NORTHEAST DRIVE  
HERSHEY, PA 17033

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DATE: 11-12-13

SCALE: AS NOTED

PLANNER: M.S.

SID: 30008346

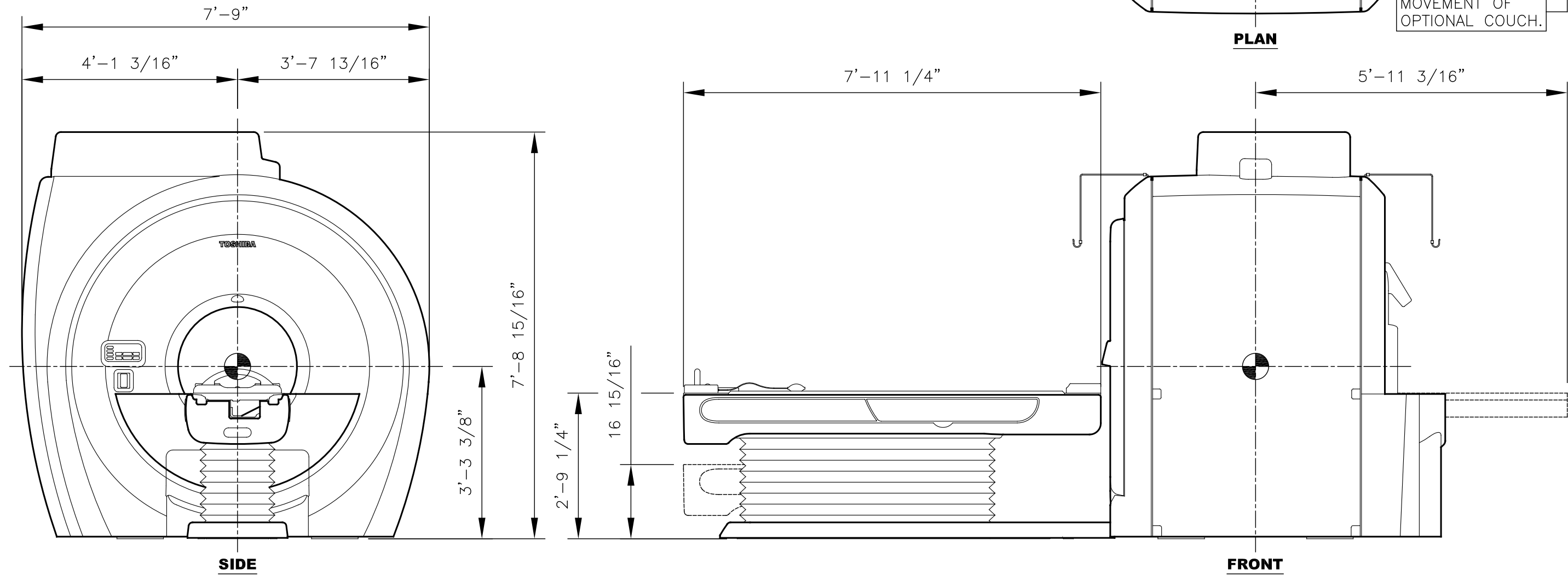
PROJECT NO.  
**130013741MRF1**

**A3**

**TOSHIBA**  
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MAG
HEAT OUTPUT (BTU'S)
4,095
WEIGHT (LBS)
11,905

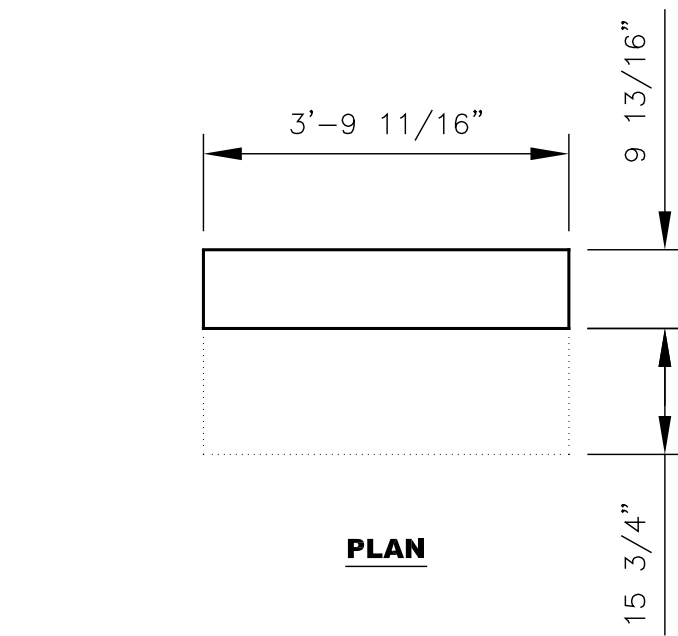
PCH
HEAT OUTPUT (BTU'S)
-
WEIGHT (LBS)
706



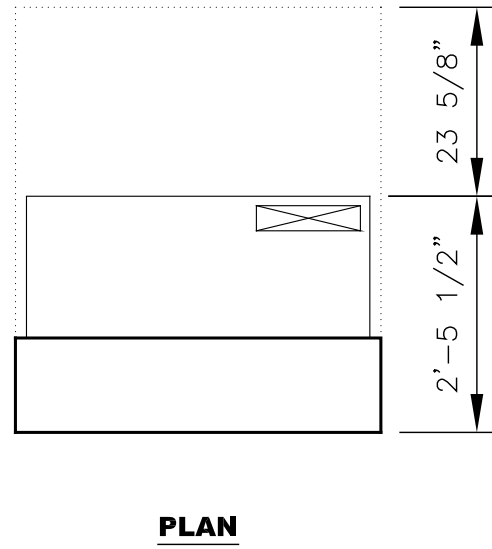
1 TITAN 1.5 TESLA MAGNET AND COUCH

SCALE: 1/2" = 1'-0"

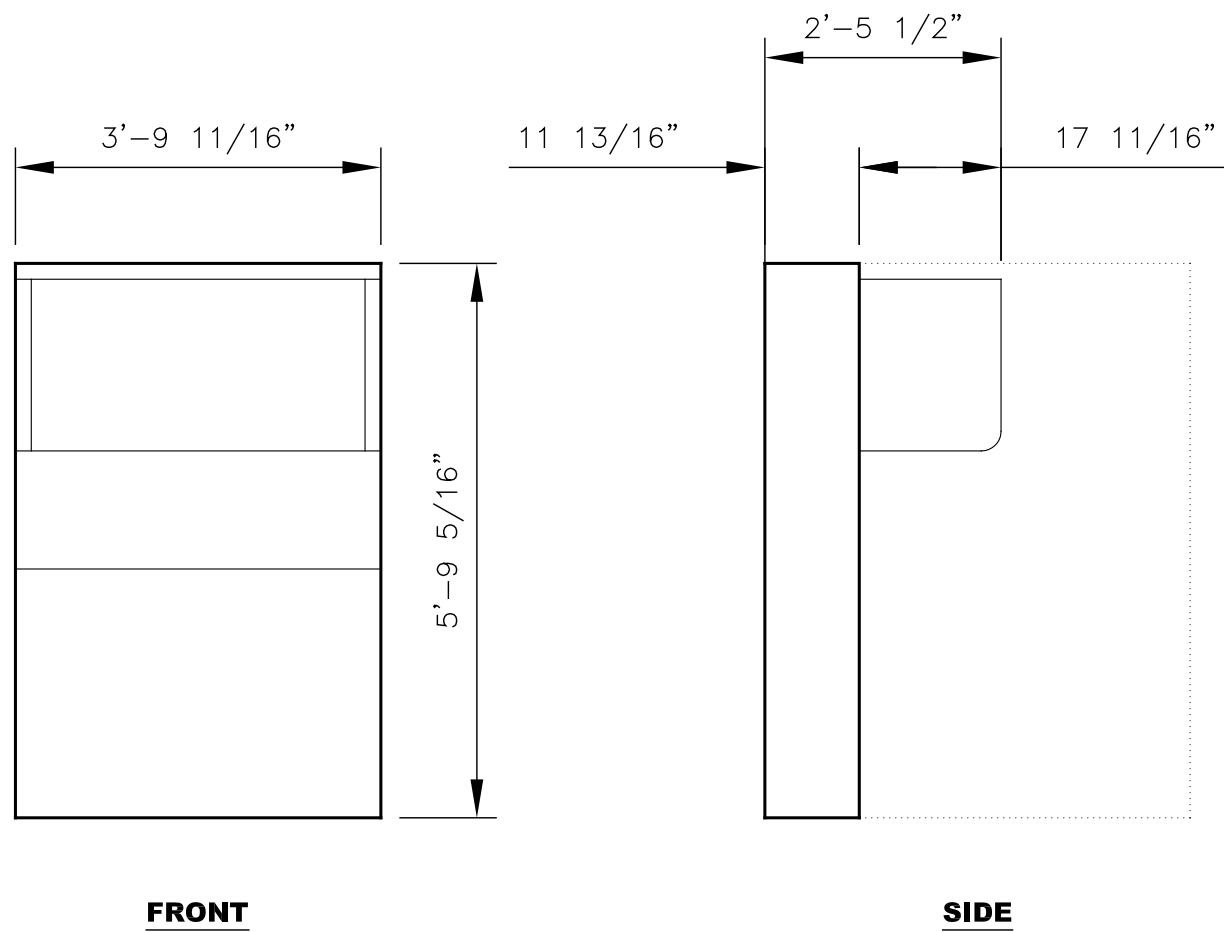
03-12-13



FPC1
HEAT OUTPUT (BTU'S)
-
WEIGHT (LBS)
40



FPC2
HEAT OUTPUT (BTU'S)
-
WEIGHT (LBS)
93



4 FILTER PANEL COVER (SCAN ROOM SIDE)

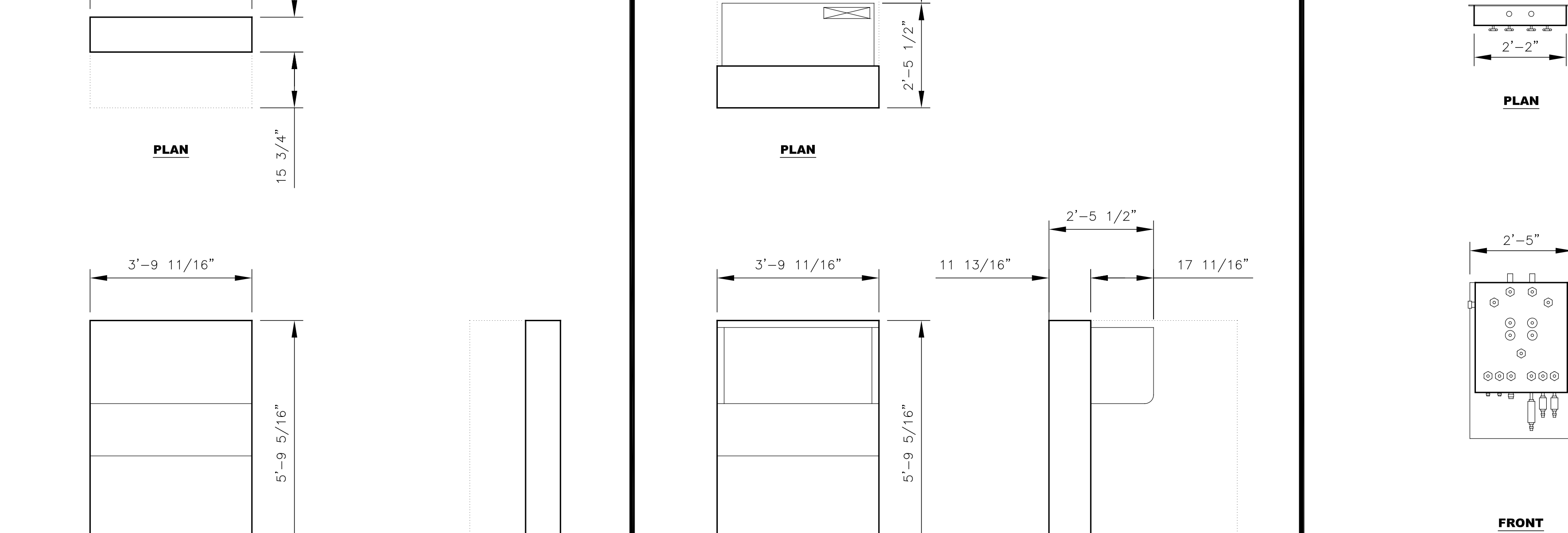
SCALE: 1/2" = 1'-0"

03-12-13

5 FILTER PANEL COVER (EQUIPMENT ROOM SIDE)

SCALE: 1/2" = 1'-0"

03-12-13



GECO
HEAT OUTPUT (BTU'S)
16,379
WEIGHT (LBS)
2,161

2 GRADIENT POWER SUPPLY AND ECO CABINET

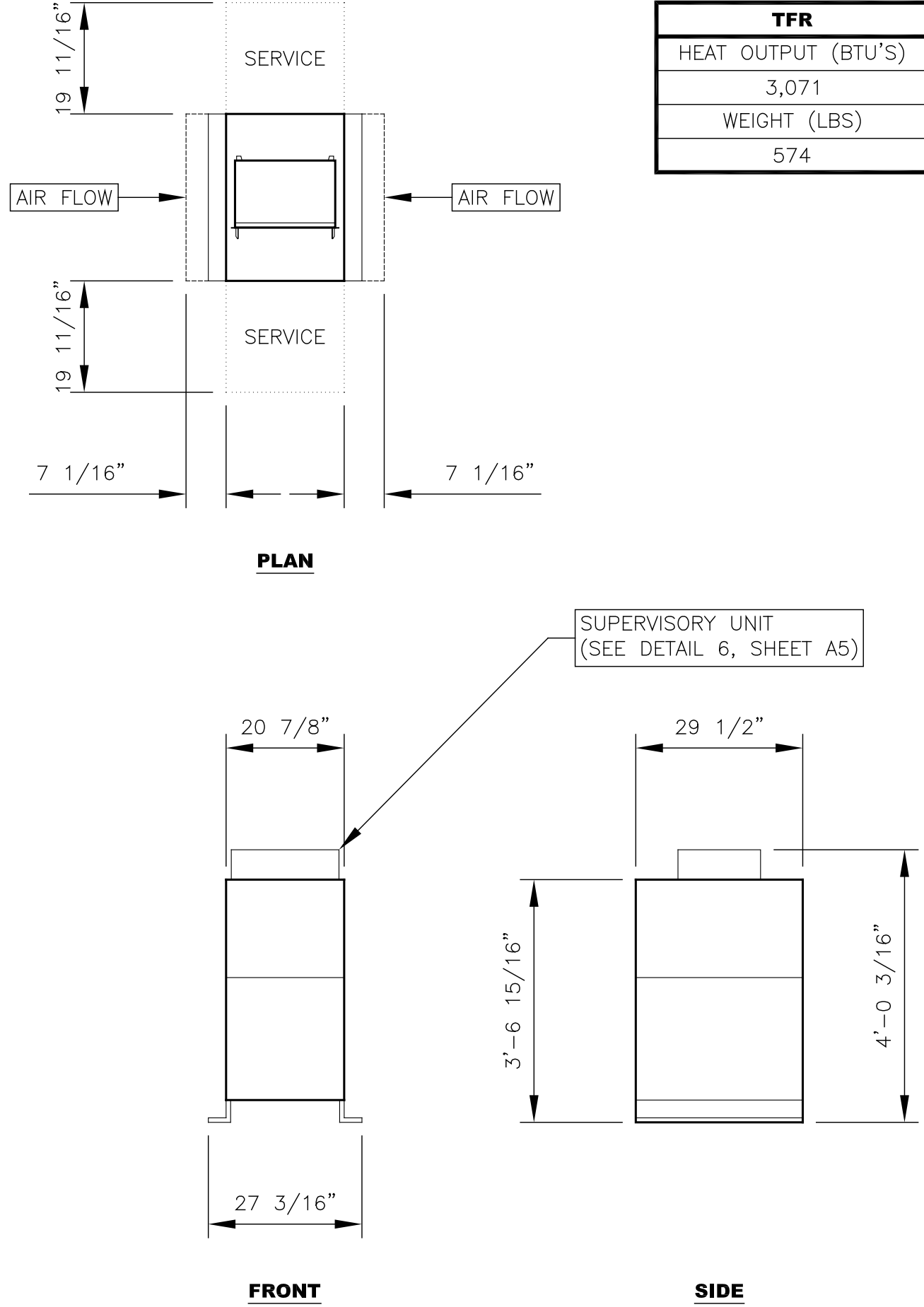
SCALE: 1/2" = 1'-0"

03-12-13

3 TRANSFORMER CABINET

SCALE: 1/2" = 1'-0"

03-12-13



TFR
HEAT OUTPUT (BTU'S)
3,071
WEIGHT (LBS)
574

PINNACLE TRISTAN ASSOCIATES  
(MR SCAN ROOM - TITAN)  
32 NORTHEAST DRIVE  
HERSHEY, PA 17033

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DATE: 11-12-13

SCALE: AS NOTED

PLANNER: M.S.

SID: 30008346

PROJECT NO.  
130013741MRF1



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**6 SUPERVISORY UNIT**  
 SCALE: 1 1/2" = 1'-0" 03-1

**7** **SUPERVISORY UNIT SWITCH**  
 SCALE: 3" = 1'-0" 03-12-13

## 8 VOLTAGE REGULATION DISTRIBUTION UNIT

SCALE: 1/2" = 1'-0"

03-12-13



## 9 MAGNET FAN BOX

SCALE: 1/2" = 1'-0"

03-12-13

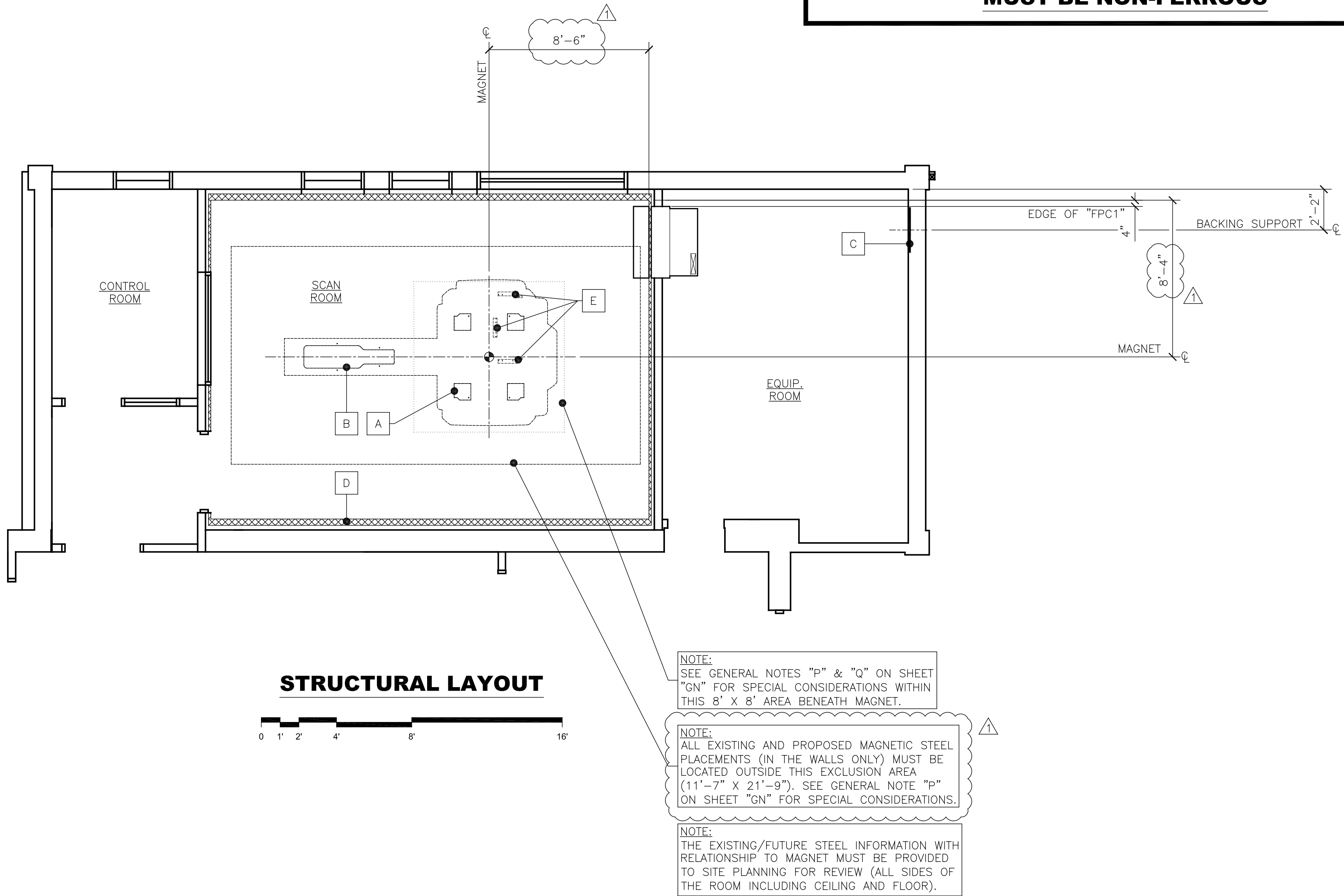
## 5 INNERSHIELD WORKSTATION

SCALE: 1" = 1'-0" 03-12-13

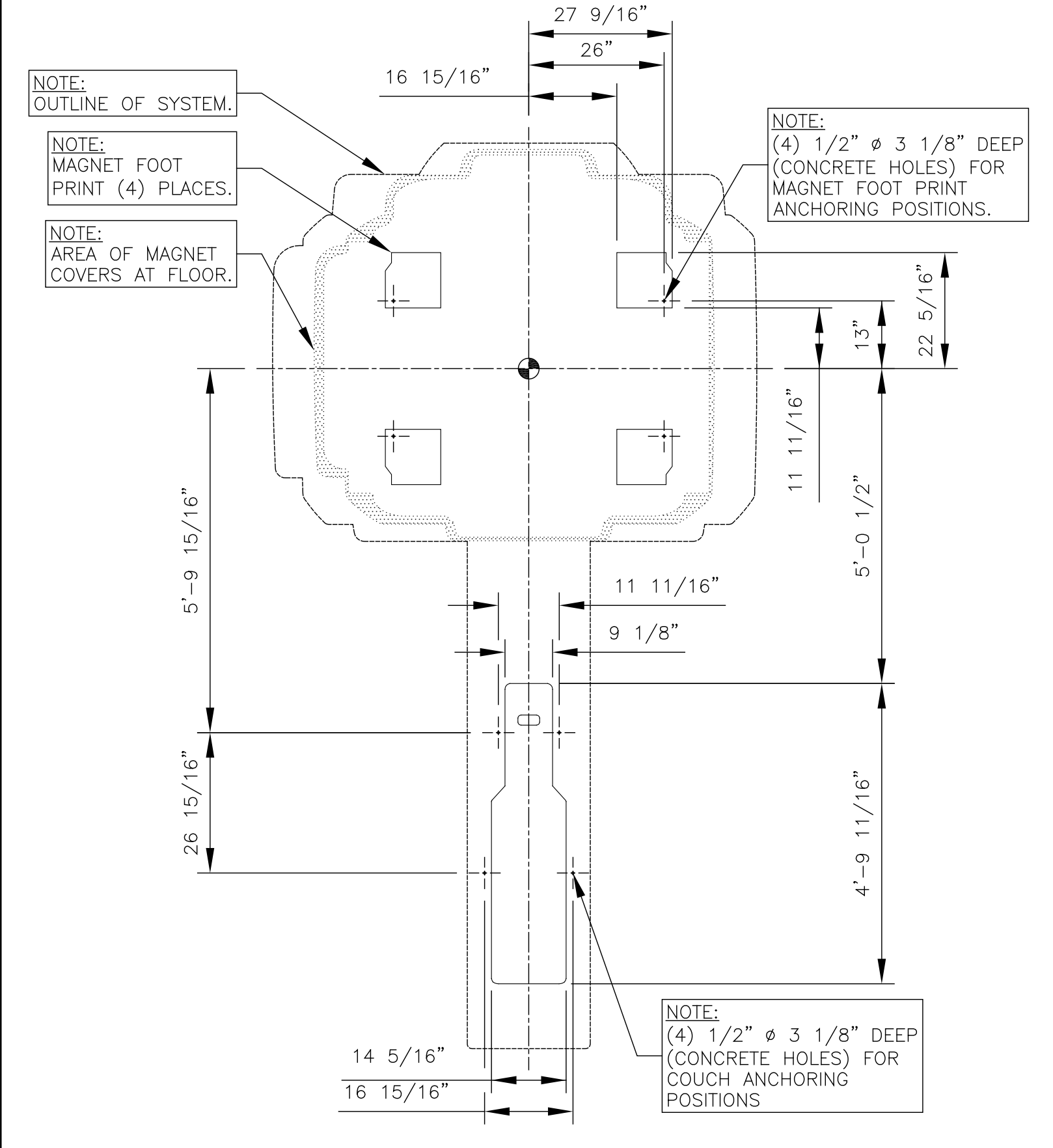
<p><b>PINNACLE TRISTAN ASSOCIATES</b></p> <p>(MR SCAN ROOM – TITAN)</p> <p>32 NORTHEAST DRIVE HERSHEY, PA 17033</p>		REV	DATE	DESCRIPTION	INT
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			11-12-13	NO CHANGES MADE TO THIS SHEET.	MS
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DATE:		11-12-13			
SCALE:		AS NOTED			
PLANNER:		M.S.			
SID:		30008346			
PROJECT NO.					
<b>130013741MRF1</b>					
<b>A5</b>					

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**TOSHIBA**  
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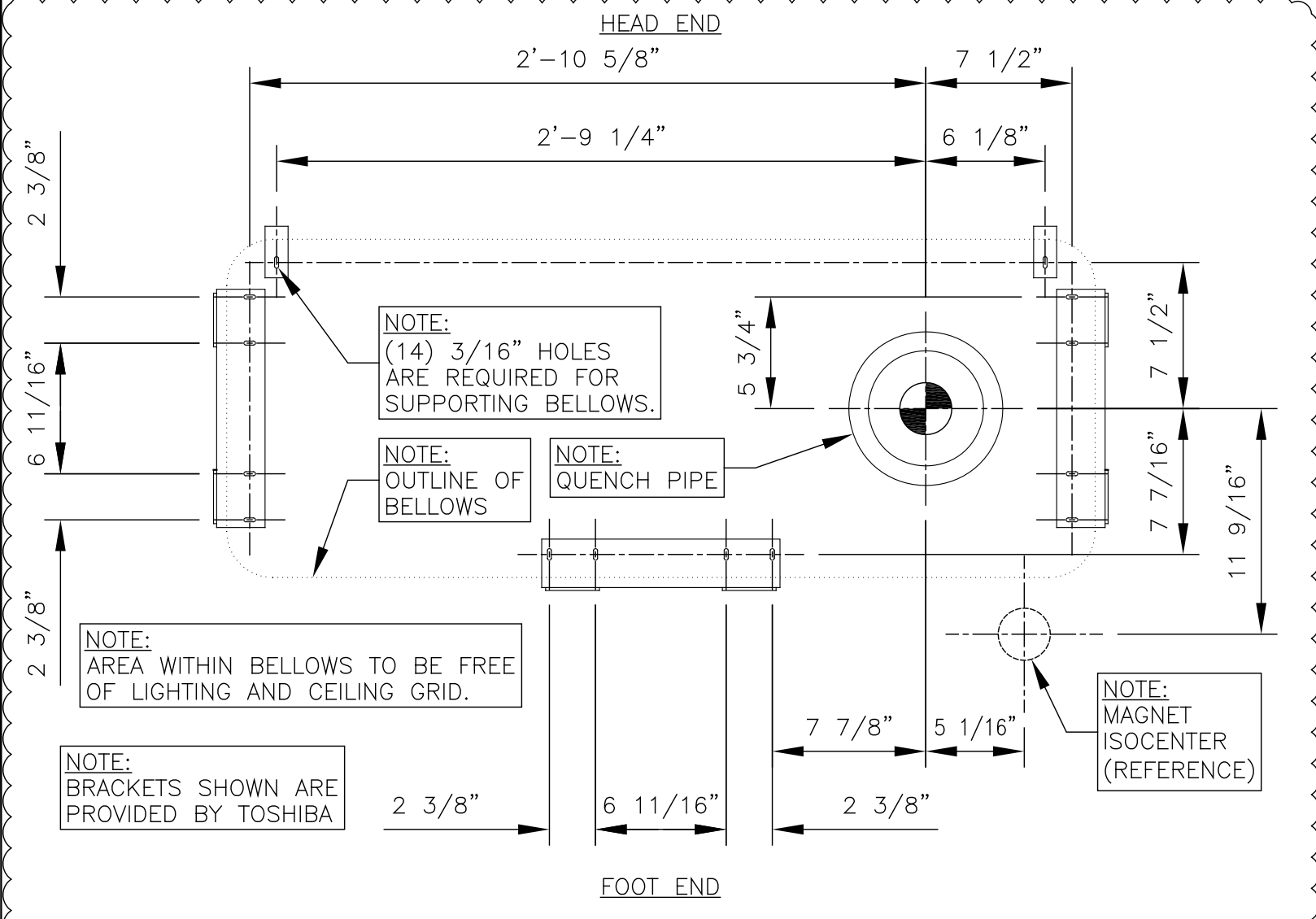
STRUCTURAL LEGEND		
ITEM	ITEM DESCRIPTION SUPPLIED AND INSTALLED BY TOSHIBA	REF.
A	SUPPORT BASE FOR MAGNET	1 S1
B	MAGNET COUCH BASE	1 S1
ITEM	ITEM DESCRIPTION SUPPLIED AND INSTALLED BY CUSTOMER / CONTRACTOR	REF.
C	BACKING SUPPORT FOR MANIFOLD	1 -
D	RF ENCLOSURE	1 -
ITEM	ITEM DESCRIPTION SUPPLIED AND INSTALLED BY CUSTOMER / CONTRACTOR	REF.
E	CEILING BELLOWS SUPPORT PANEL	2 S1
ALL MATERIAL IN SCAN ROOM MUST BE NON-FERROUS		



- NOTE:
- IN CASE OF FIRE, THE FINISH MATERIAL OF THE FLOOR MUST BE NONFLAMMABLE AND HIGHLY FIRE RESISTANT, IN ORDER TO PREVENT THE FIRE FROM SPREADING.
  - THE ENTIRE SCAN ROOM FLOOR TO BE LEVEL WITHIN 1/16".
  - THE FLOOR MUST SUPPORT 11,904.96 LBS. FOR THE MAGNET, INCLUDING THE COVERS AND THE GRADIENT COIL. THE COMPLETE FLOOR MUST WITHSTAND A MAXIMUM CONCENTRATED LOAD OF 3,796.04 LBS. PER SQUARE FOOT (2,976.24 LBS. PER MAGNET FOOT). THE FLOOR MUST BE ABLE TO WITHSTAND BOTH THE MAGNET AND THE WEIGHT OF THE MAGNETIC SHIELDING.
  - IT IS THE R/F VENDOR'S RESPONSIBILITY TO PROVIDE BOLTS AND ANCHOR THE MAGNET.
  - IT IS THE CUSTOMER/CONTRACTOR'S RESPONSIBILITY TO MEET SEISMIC REQUIREMENTS (IF NECESSARY).

## 1 MAGNET FOOTPRINT AND COUCH LAYOUT

SCALE: 1/2" = 1'-0" 05-03-13



- NOTE:  
THE BELLOWS FOR HIDING CABLES WILL BE SECURED TO THE CEILING WITH TOSHIBA SUPPLIED BRACKETS. IT IS THEREFORE NECESSARY TO SUPPORT THE BELLOWS BRACKETS WITH APPROPRIATE STRUCTURAL SUPPORT.
- THE STRUCTURAL SUPPORT IS TO BE SUPPLIED AND INSTALLED BY THE CUSTOMER/CONTRACTOR. STRUCTURAL SUPPORTS ARE FOR MOUNTING BELLOWS BRACKETS. STRUCTURAL SUPPORTS TO BE NON-FERROUS.
- USE THE QUENCH PIPE CENTERLINE AS A REFERENCE POSITION FOR LOCATING THE STRUCTURAL SUPPORT FOR THE BELLOWS.
- MAX BELLOWS EXTENSION FROM STRUCTURAL SUPPORT IS 21 1/2".
- BELLOWS WEIGHT IS 6 LBS.

## 2 CEILING BELLOWS SUPPORT PANEL

SCALE: 1 1/2" = 1'-0" 09-26-13

TOSHIBA

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DATE: 11-12-13

SCALE: 1/4" = 1'-0"

PLANNER: M.S.

SID: 30008346

PROJECT NO. 130013741MRF1

S1

PINNACLE TRISTAN ASSOCIATES

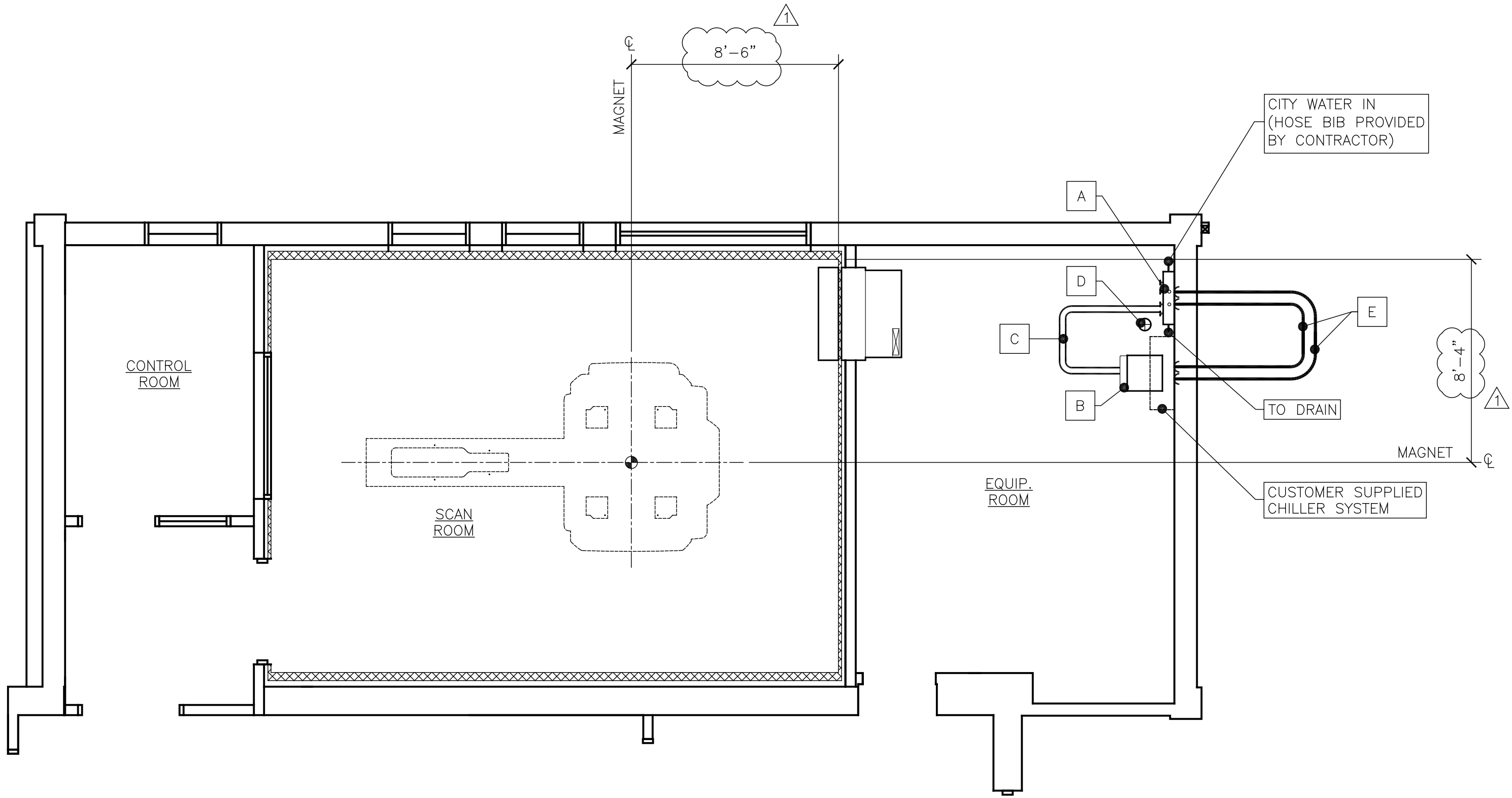
(MR SCAN ROOM - TITAN)

32 NORTHEAST DRIVE  
HERSHEY, PA 17033

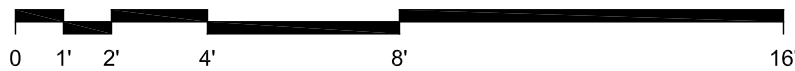
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PLUMBING LAYOUT



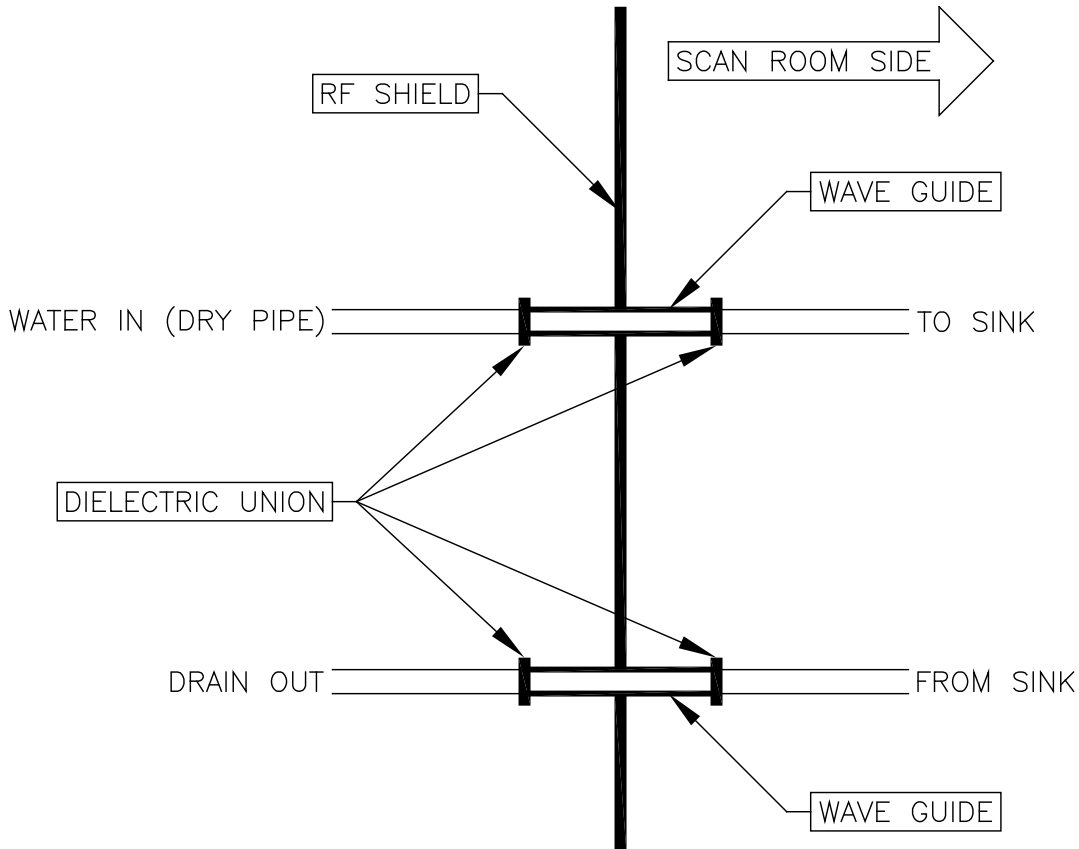
NOTE:  
LONGER HOSES NEED TO BE ORDERED FROM THE MAGNET TO THE REFRIGERATOR.  
LONGER HOSES NEED TO BE ORDERED FROM THE MAGNET TO THE VACUUM PUMP/TRANSFORMER CABINET.

NOTE:  
ONE MALE AND ONE FEMALE HOSE CONNECTOR ARE TO BE PROVIDED BY CUSTOMER / CONTRACTOR FOR CITY WATER BACKUP.

PLUMBING LEGEND

ITEM	ITEM DESCRIPTION SUPPLIED BY TOSHIBA AND INSTALLED BY CUSTOMER / CONTRACTOR	REF.
A	MANIFOLD	1 P2
B	REFRIGERATOR CABINET	1 P2
C	(2) 1/2" FLEXIBLE HOSE FROM MANIFOLD TO REFRIGERATION. FIELD VERIFY WITH TOSHIBA REPRESENTATIVE.	1 P2
ITEM	ITEM DESCRIPTION SUPPLIED AND INSTALLED BY CUSTOMER / CONTRACTOR	REF.
D	DRAIN FOR MANIFOLD & REFRIGERATOR. FIELD VERIFY EXACT LOCATION AT TIME OF INSTALLATION. DRAIN CAPACITY MUST MEET OR EXCEED DISCHARGE CAPACITY. DRAIN MUST BE EQUIPPED WITH AN APPROPRIATE BACK FLOW PREVENTER (BFP).	1 P2
E	SUPPLY AND VENT RETURN LINE FROM MANIFOLD TO CHILLER BY PLUMBING CONTRACTOR. PROVIDE 1" HIGH PRESSURE COPPER PIPE AFTER UNITS ARE SET IN PLACE.	1 P2

ALL MATERIAL IN SCAN ROOM  
MUST BE NON-FERROUS



NOTE:  
A SINK IN THE SCAN ROOM IS NOT RECOMMENDED. IT WILL ONLY BE ACCEPTED IF A "DRY FILL" SYSTEM IS USED AND PLUMBING INTO AND OUT OF THE SCAN ROOM MUST BE VIA WAVE GUIDES WITH DIELECTRIC UNIONS ON BOTH SIDES. THIS WILL PROVIDE BOTH RF FREQUENCY AND ELECTRICAL ISOLATION. PLEASE REFER TO ABOVE DETAIL.

1 SCAN ROOM SINK

SCALE: NOT TO SCALE

01-10-11

PINNACLE TRISTAN  
ASSOCIATES

(MR SCAN ROOM – TITAN)  
32 NORTHEAST DRIVE  
HERSHEY, PA 17033

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DATE: 11-12-13

SCALE: 1/4" = 1'-0"

PLANNER: M.S.

SID: 30008346

PROJECT NO.  
130013741MRF1

P1

TOSHIBA

Leading Innovation >>>

IF CUSTOMER IS PURCHASING CHILLED WATER SYSTEM THROUGH TOSHIBA AS A PASS THROUGH TO DRAKE, PLEASE REFER TO THE DRAKE PASS THROUGH DOCUMENT FOR ADDITIONAL INFORMATION.

IF CUSTOMER IS SUPPLYING CHILLER WATER SYSTEM, PLEASE REFER TO SPECIFICATIONS BELOW:

REQUIREMENTS FOR COOLING WATER - TITAN

- (1) SUPPLY FLOW RATE : 12.70 GAL. OR MORE/MIN (48 L) (24-HOUR CONTINUOUS SUPPLY)
- GRADIENT POWER SUPPLY : 7.95 GAL. OR MORE/MIN (30 L)  
GRADIENT COIL : 3.20 GAL. OR MORE/MIN (12 L)  
REFRIGERATOR : 1.60 GAL. OR MORE/MIN (6 L)
- (2) PRESSURE LOSS IN THE SYSTEM
- GRADIENT POWER SUPPLY : 0.28 MPa @ 7.95 GAL./MIN, WITHOUT HOSE (30 L/MIN)  
GRADIENT COIL : 0.38 MPa @ 3.20 GAL./MIN, WITH HOSE (12 L/MIN)  
REFRIGERATOR : 0.10 MPa @ 1.60 GAL./MIN, WITHOUT HOSE (6 L/MIN)
- (3) MAXIMUM ALLOWABLE INPUT PRESSURE
- GRADIENT POWER SUPPLY : 0.60 MPa  
GRADIENT COIL : 0.50 MPa  
REFRIGERATOR : 0.80 MPa
- NOTE:  
IF THE HEAD LOSS IN THE PIPING FROM THE HEAT EXCHANGER UNIT IS 65'-7" OR MORE, CONSULT THE TOSHIBA INSTALLATION PROJECT MANAGER AND TAKE MEASURES TO ENSURE THAT THE MAXIMUM ALLOWABLE INPUT PRESSURE FOR EACH UNIT IS NOT EXCEEDED.
- (4) SUPPLY WATER TEMPERATURE : 64°F TO 71°F (18°C TO 22°C)
- (5) REQUIRED COOLING CAPABILITY
- GRADIENT POWER SUPPLY : 50,545/13,661 BTU/HR (14.8/4.0 kW)  
(MAXIMUM DURING SCANNING/IN STANDBY STATUS)  
GRADIENT COIL : 40,982 BTU/HR (12 kW) (MAXIMUM DURING SCANNING)  
REFRIGERATOR : 14,003/16,734 BTU/HR (4.1/4.9 kW) (50/60 Hz)
- SYSTEM TOTAL  
IN STANDBY STATUS [AT NIGHT ETC.] : 27,663/30,395 BTU/HR (8.1/8.9 kW) (50/60 Hz)  
DURING SCANNING : 105,529/108,261 BTU/HR (30.9/31.7) kW (50/60 Hz)  
WHEN ONLY THE REFRIGERATOR IS POWERED : 14,002/16,734 BTU/HR (4.1/4.9 kW) (50/60 Hz)
- IF THE COOLING WATER IS CIRCULATED USING THE CHILLER, ETC., THE COOLING PERFORMANCE MUST BE 1.2 TIMES THE STANDARD VALUES GIVEN ABOVE.
- (6) WATER QUALITY
- TAP WATER WHICH MEETS THE SPECIFICATIONS GIVEN IN THE TABLE BELOW

WATER QUALITY SPECIFICATIONS			
	ITEM	COOLING WATER	
		NON-CIRCULATING OR CIRCULATING COOLING WATER	COOLING TOWER
REFERENCE VALUE	pH 77°F (25°C)	6.5 TO 8.0	6.0 TO 8.0
	CONDUCTIVITY (77°F μS/CM)	800 MAX.	200 MAX.
	M ALKALI LEVEL (PPM)	100 MAX.	50 MAX.
	HARDNESS (PPM)	200 MAX.	50 MAX.
	CHLORIDE IONS (PPM)	200 MAX.	50 MAX.
	SULPHATE IONS (PPM)	200 MAX.	50 MAX.
	IRON (PPM)	1.0 MAX.	0.3 MAX.
	SULPHIDE IONS (PPM)	UNDETECTABLE	UNDETECTABLE
	AMMONIUM IONS (PPM)	1.0 MAX.	0.2 MAX.
	SILICA (PPM)	50 MAX.	30 MAX.

CAUTION:  
THERE IS NO DEFINITE RATED VALUE FOR FREE CARBON DIOXIDE; HOWEVER, THE VALUE SHOULD BE AS LOW AS POSSIBLE, SINCE SUCH FREE CARBON DIOXIDE IS A CORROSION AGENT.

- (7) OTHER
- IF THE COOLING WATER SUPPLY IS INTERRUPTED, THE SYSTEM CANNOT BE USED. THE COOLING WATER MUST BE CHECKED AND REPLACED ONCE EVERY 6 MONTHS. IN COLD CLIMATES, CARE MUST BE TAKEN TO PREVENT THE COOLING WATER FROM FREEZING (USE OF ANTIFREEZE IS NOT ALLOWED).

NOTE:  
VANTAGE/TITAN SYSTEMS CAN ONLY USE DISTILLED WATER (NO GLYCOL ALLOWED) IN THE SYSTEM COMPONENTS.

IF THE CUSTOMER'S CHILLER CONTAINS GLYCOL, THEN WE SUGGEST THE USE OF A HEAT EXCHANGER. THE FUNCTION OF THE HEAT EXCHANGER IS TO SEPARATE THE GLYCOL FROM THE WATER IN THE VANTAGE/TITAN SYSTEM COMPONENTS.

IF A HEAT EXCHANGER IS USED, COLDER WATER MAY BE REQUIRED. REQUIRED TEMPERATURE WILL VARY DEPENDING ON THE HEAT EXCHANGER SELECTED.

CARE SHOULD BE TAKING NOT TO EXCEED MAXIMUM ALLOWABLE INPUT PRESSURE AS STATED ABOVE.

CITY WATER IS ONLY FOR SERVICE / MAINTENANCE OF WATER COOLING.

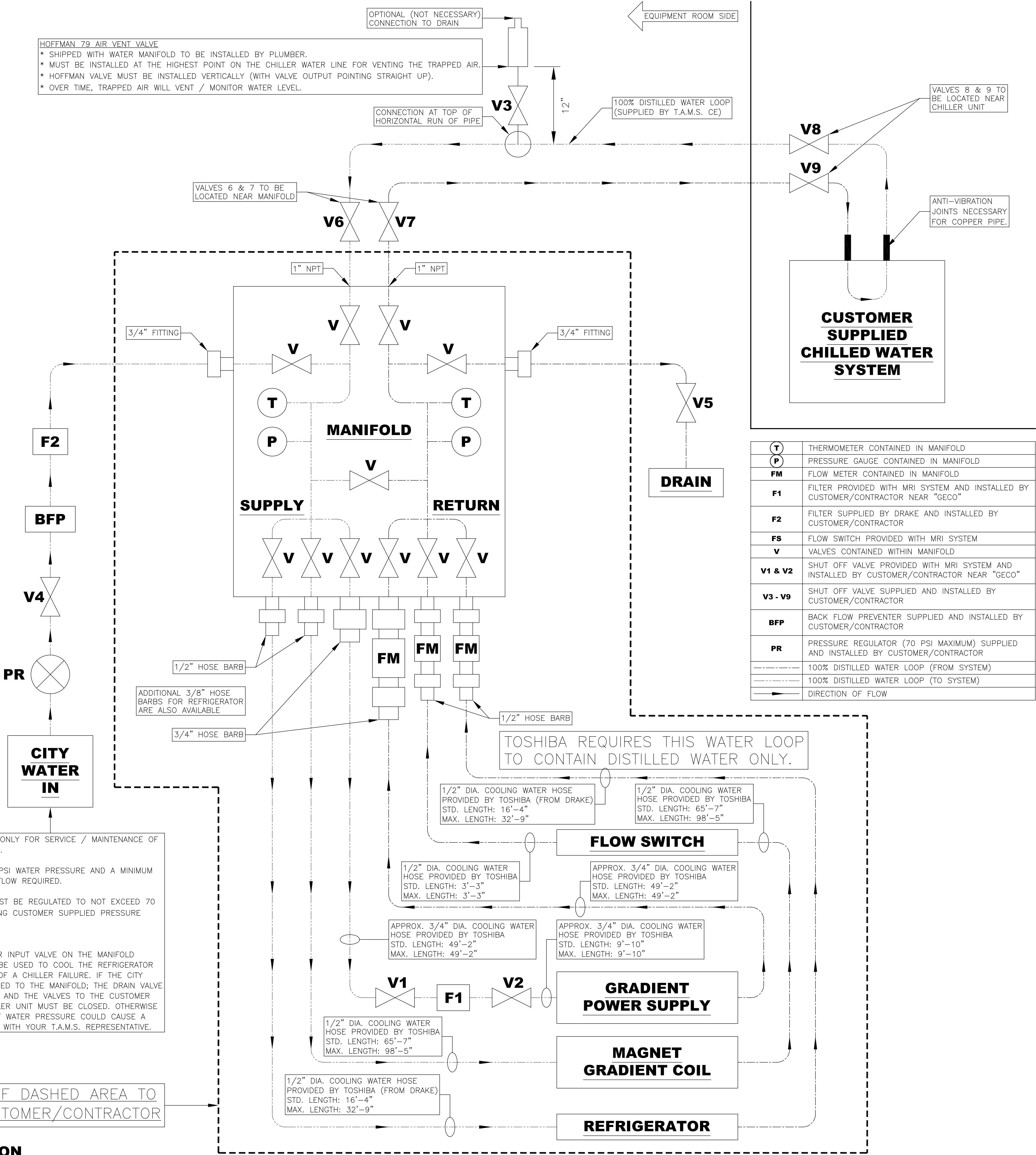
A MAX OF 70 PSI WATER PRESSURE AND A MINIMUM OF 13.8 GPM FLOW REQUIRED.

CITY WATER MUST BE REGULATED TO NOT EXCEED 70 PSI (MAX.) USING CUSTOMER SUPPLIED PRESSURE REGULATOR.

WARNING:  
THE CITY WATER INPUT VALVE ON THE MANIFOLD SHOULD ONLY BE USED TO COOL THE REFRIGERATOR IN THE EVENT OF A CHILLER FAILURE. IF THE CITY WATER IS APPLIED TO THE MANIFOLD; THE DRAIN VALVE MUST BE OPEN AND THE VALVES TO THE CUSTOMER SUPPLIED CHILLER UNIT MUST BE CLOSED. OTHERWISE A BUILD UP OF WATER PRESSURE COULD CAUSE A LEAK. CONSULT WITH YOUR T.A.M.S. REPRESENTATIVE.

ALL ITEMS OUTSIDE OF DASHED AREA TO BE PROVIDED BY CUSTOMER/CONTRACTOR

WATER COOLING FACILITIES CONFIGURATION



TOSHIBA  
Leading Innovation >>>

REV	DATE	DESCRIPTION	INT	MS	MS
1	09-04-13	ORIGINAL FINAL DRAWINGS COMPLETED.			
2	11-12-13	NO CHANGES MADE TO THIS SHEET.			

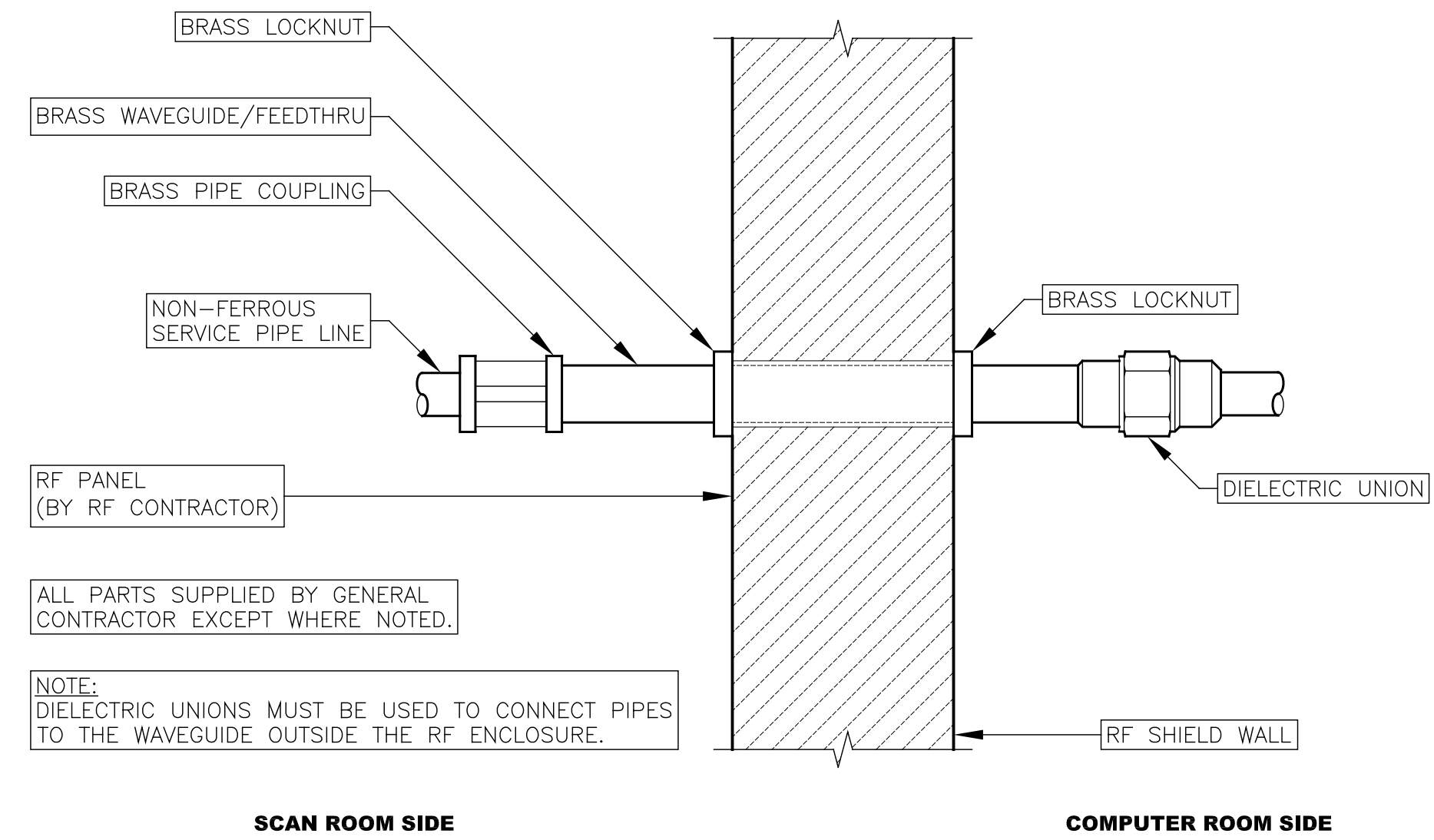
PINNACLE TRISTAN ASSOCIATES  
(MR SCAN ROOM - TITAN)  
32 NORTHEAST DRIVE  
HERSHEY, PA 17033

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DATE: 11-12-13  
SCALE: NOT TO SCALE  
PLANNER: M.S.  
SID: 30008346  
PROJECT NO. 130013741MRF1

P2

TOSHIBA RECOMMENDS THAT A PRE-ACTION PROTECTION SYSTEM (DRY PIPE SPRINKLER SYSTEM) BE INSTALLED BY THE CUSTOMER/CONTRACTOR. TOSHIBA RECOMMENDS THE PRE-ACTION PROTECTION SYSTEM TO MINIMIZE GROUNDING ISSUES THAT CAN ARISE UTILIZING WET TYPE SPRINKLER SYSTEMS. A WET TYPE SPRINKLER SYSTEM CAN BE UTILIZED PROVIDED THE CUSTOMER ASSUMES RESPONSIBILITY OF ALL GROUNDING AND IMAGE ARTIFACT ISSUES THAT MAY RESULT FROM THE USE OF WET SYSTEM. IF A WET-TYPE SPRINKLER SYSTEM IS USED, THE LOCATION OF THE PIPE PENETRATION, MATERIAL AND CONSTRUCTION IS STRICTLY LIMITED AS SHOWN BELOW.



STANDING WATER WITHIN THE SPRINKLER PIPES IN THE RF ENCLOSURE HAS BEEN KNOWN TO ACT AS A GROUND AND A CAUSE OF IMAGE ARTIFACTS. THESE ISSUES CAN DEVELOP OVER TIME.

WAVE GUIDES ARE REQUIRED FOR SPRINKLER LINES. THE REQUIRED LENGTH OF THE WAVE GUIDE DEPENDS ON THE DIAMETER OF THE SPRINKLER LINE.

EXCEPT FOR THE BLAZE MASTER PVC PIPE FIRE SPRINKLER SYSTEM, WHICH CANNOT BE USED AS PART OF A WET PIPE SYSTEM, ALL SPRINKLER LINES ARE CONDUCTIVE. THEY ARE ALSO MECHANICALLY ATTACHED TO THE BUILDING, WHICH MAKES THEM GROUNDED. THUS IF A SPRINKLER LINE IS ATTACHED TO THE RF ENCLOSURE, THE RF ENCLOSURE ALSO BECOMES GROUNDED TO THE BUILDING.

WET SPRINKLER SYSTEM CAN BE SPECIFIED FOR USE IN THE RF ENCLOSURE. STANDARD STEEL PIPES CAN BE USED OUTSIDE THE RF ENCLOSURE, BUT COPPER, BRASS, OR 304 STAINLESS STEEL PIPES SHOULD BE USED WITHIN THE RF ENCLOSURE. THE WAVE GUIDE FOR THE SPRINKLER PIPE MUST BE LOCATED WITHIN 3' FROM THE EDGE OF THE FILTER PANEL.

IF A BRASS OR OTHER APPROPRIATE FEED-THROUGH WAVE GUIDE IS INSTALLED ABOVE THE FILTER PANEL AREA, THE SPRINKLER PIPE OUTSIDE THE RF ENCLOSURE MUST BE CONNECTED TO THE WAVE GUIDE VIA A DIELECTRIC UNION TO ISOLATE THE GROUNDED SPRINKLER PIPE FROM THE RF ENCLOSURE.

THE SPRINKLER LINE INSIDE THE RF ENCLOSURE MUST BE CONNECTED DIRECTLY TO THE WAVE GUIDE, WHICH IS GROUNDED TO THE RF ENCLOSURE. ALL SPRINKLER HEADS WITHIN THE RF ENCLOSURE MUST ORIGINATE FROM THIS PRIMARY LINE.

INSTALLATION OF A DEDICATED SHUT-OFF VALVE FOR THE SPRINKLER SYSTEM FOR THE RF ENCLOSURE IS STRONGLY RECOMMENDED.

THE LOCATION OF THE PENETRATION MUST BE WITHIN 30" ABOVE THE GROUND BUS BAR, WHICH IS THE CENTRAL REFERENCE GROUND.

DIELECTRIC UNIONS MUST BE USED TO CONNECT PIPES TO THE WAVE GUIDE OUTSIDE THE RF ENCLOSURE. ALL WET PIPE SYSTEMS MUST ENTER THE RF ENCLOSURE DIRECTLY ABOVE THE FILTER PANEL.

ONLY BRASS AND COPPER COMPONENTS CAN BE USED IN THE SCAN ROOM. ALL SPRINKLER DROPS THAT PENETRATE THE SCAN ROOM MUST BE ELECTRICALLY BONDED TO THE SCAN ROOM CEILING, AND MUST BE ELECTRICALLY DETACHED FROM THE MAIN SPRINKLER PIPE BY A NONCONDUCTIVE SLEEVE.

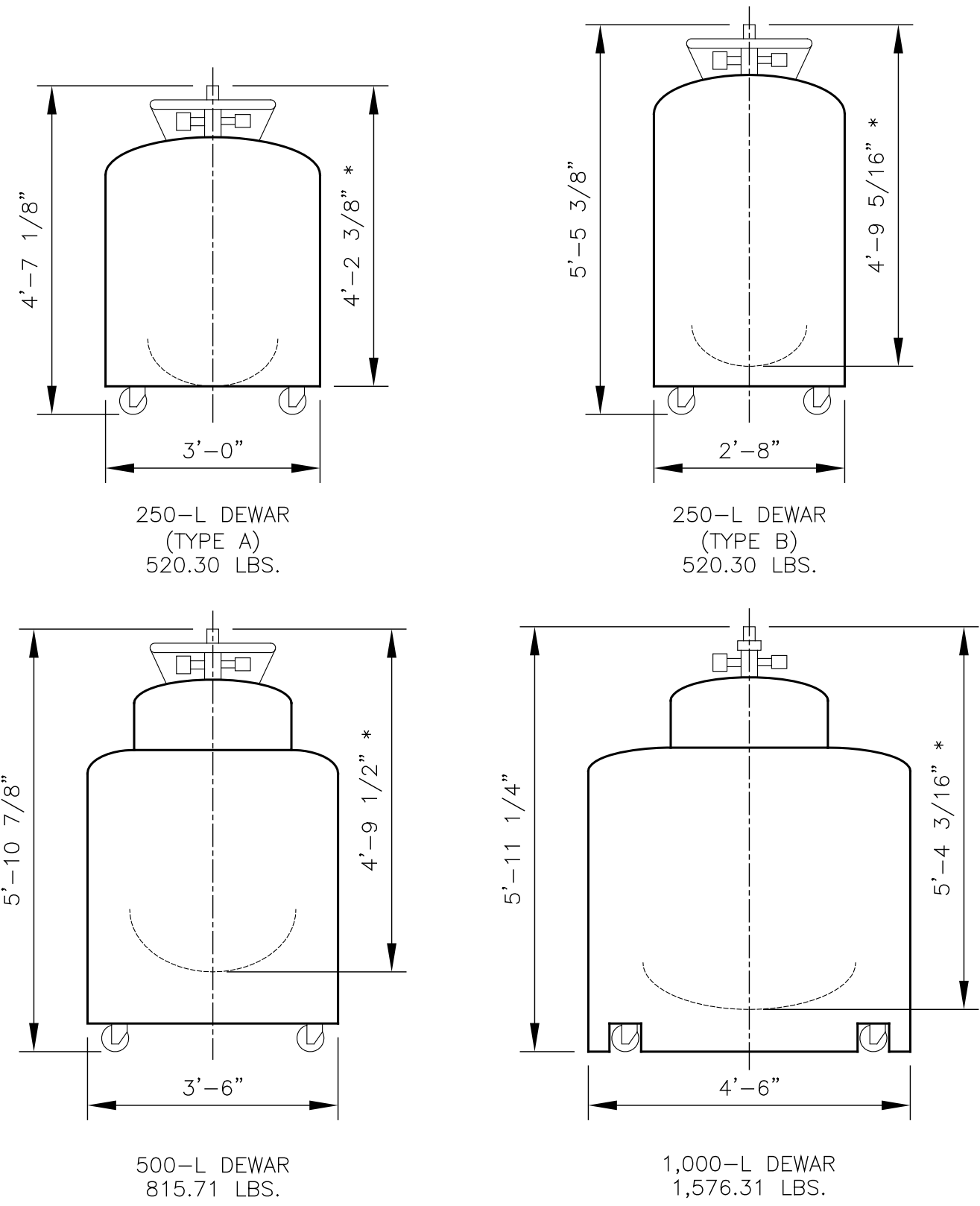
IF A SMOKE DETECTOR SYSTEM IS REQUIRED, DO NOT USE A CALL/RECEIVE SYSTEM.

**IT IS INSTALLATION PROJECT MANAGER'S RESPONSIBILITY TO GET CUSTOMER'S SIGNATURE ON DRY PIPE SPRINKLER SYSTEM SIGN OFF FORM IF DRY SPRINKLER SYSTEM IS NOT PROVIDED.**

## 1 TYPICAL SPRINKLER PENETRATION

SCALE: NOT TO SCALE

SIZES MARKED WITH (\*) INDICATED DEPTH. MASS INCLUDES THE LHe IN THE DEWAR. LHe DEWAR MANUFACTURER: CRYOFAB.



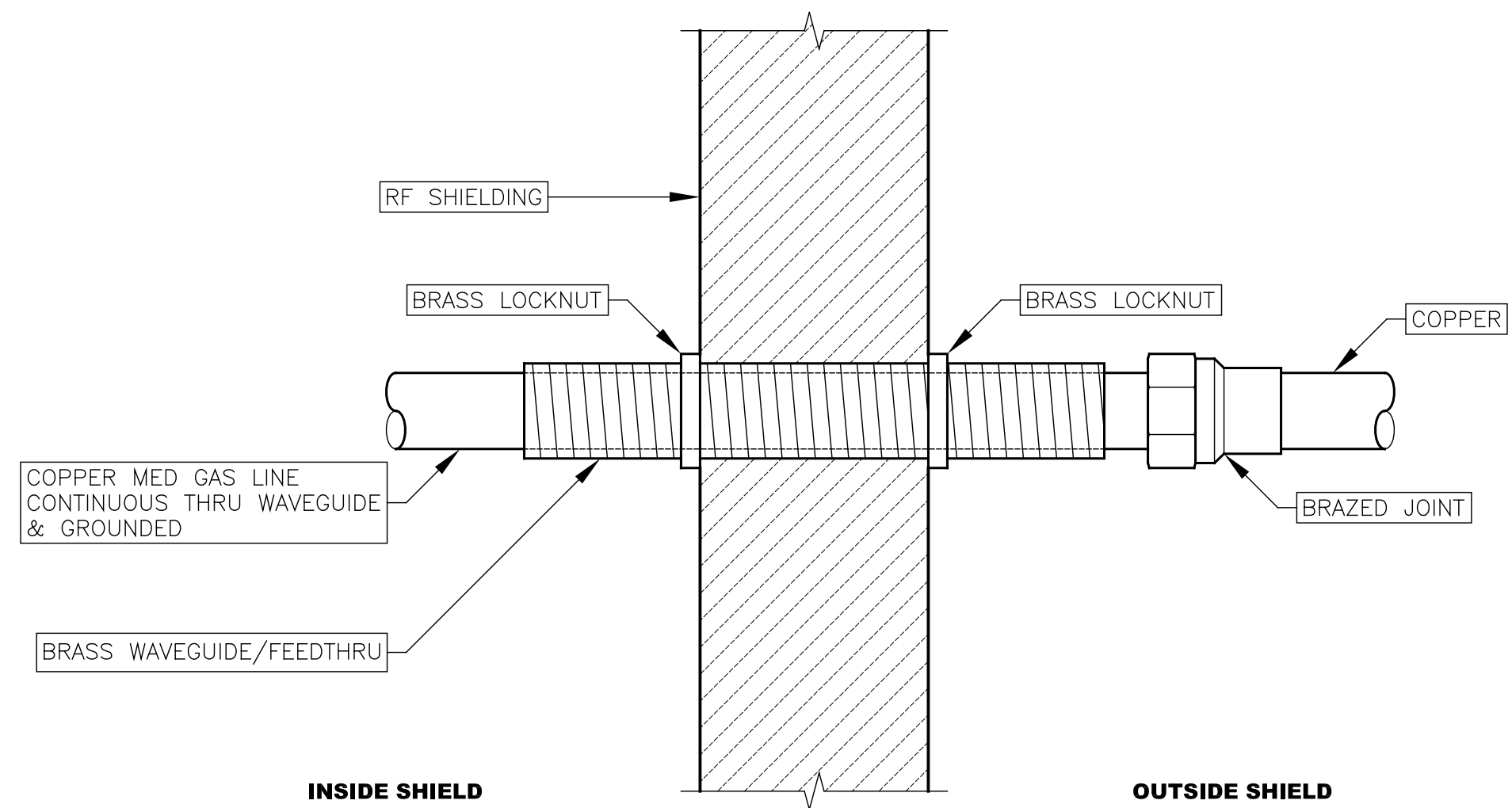
1. THE SIZE OF A LHe DEWAR DIFFERS ACCORDING TO SUPPLIER. BE SURE TO CHECK THE SHAPE OF THE DEWAR IN ADVANCE.
2. BE SURE TO USE A NON-MAGNETIC DEWAR (STAINLESS STEEL, ALUMINUM).
3. 11"-9 3/4" CLEARANCE IS REQUIRED TO INSERT THE TRANSFER TUBE INTO THE HELIUM CONTAINER.
4. ENSURE THE DEWARs HAVE A CLEAR DELIVERY PATH TO MAGNET (CONSIDER DOORS, HALLWAYS, ELEVATORS, ETC.).
5. SET ASIDE AREA FOR HELIUM DEWAR STORAGE DURING INSTALLATION.

## 2 DEWAR - LHe REPLENISHMENT

SCALE: 1/2" = 1'-0"

01-10-11

EXAMPLE OF MEDICAL GAS THROUGH DUCT (PER CODE)

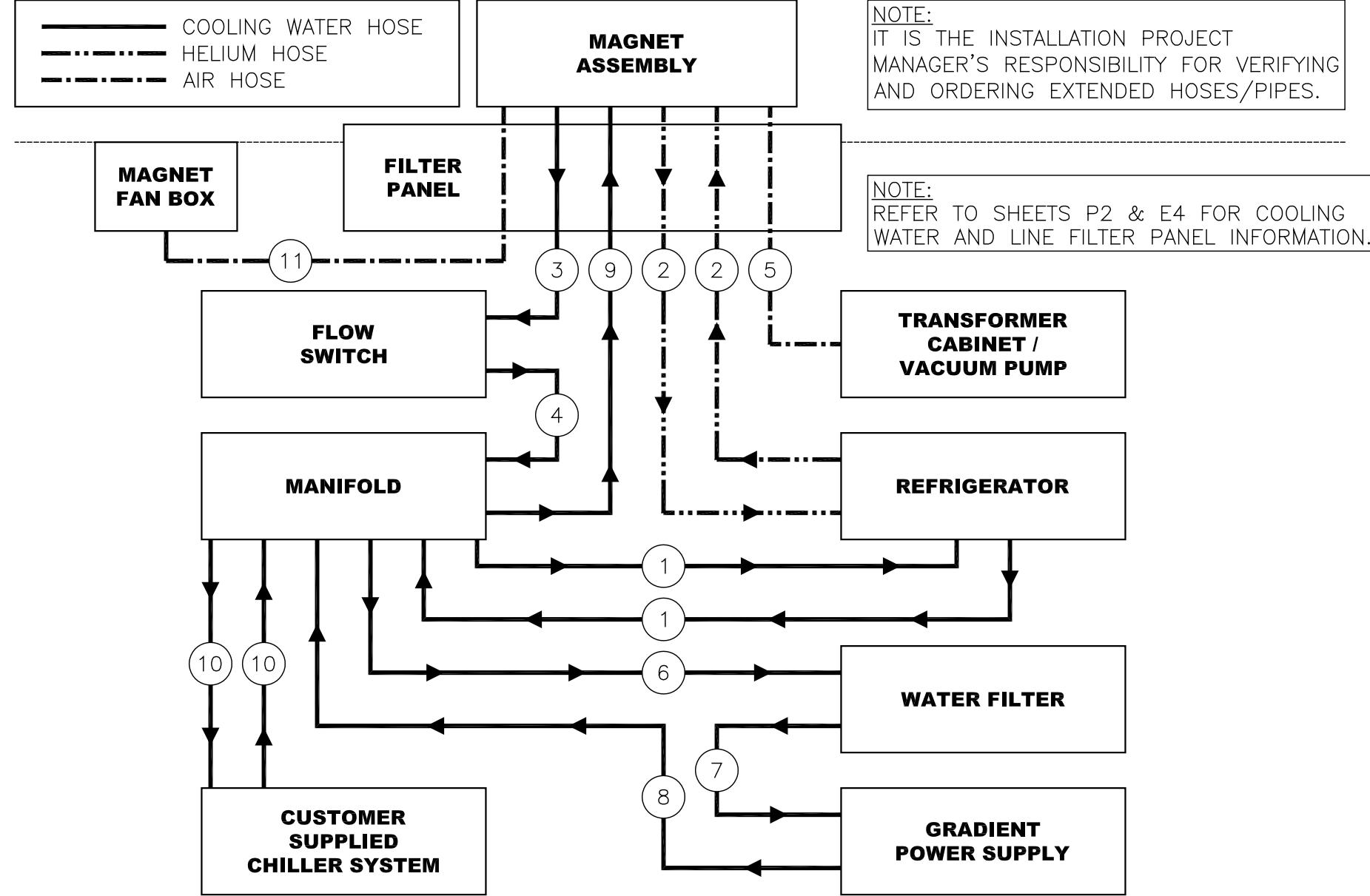


- NOTE:
1. THE THROUGH DUCT OF THE MEDICAL GAS PIPE MUST BE WITHIN APPROXIMATELY 2'-0" OF THE LINE FILTER PANEL.
  2. THE FINAL MEDICAL GAS CONNECTION TO THE WAVEGUIDE CANNOT BE MADE UNTIL GROUND ISOLATION MONITORING IS COMPLETE.
  3. THE MEDICAL GAS MUST BE GROUNDED TO THE WAVEGUIDE & RF SHIELDING.
  4. MOUNT AS CLOSE AS POSSIBLE TO LINE FILTER PANEL.

## 4 TYPICAL MEDICAL GASES DETAIL (OPTIONAL)

SCALE: NOT TO SCALE

01-10-11



ROUTE NO.	TYPE	INTERCONNECTION (1)	INTERCONNECTION (2)	STANDARD LENGTH	MAXIMUM LENGTH
1	COOLING WATER HOSES (IN-HOUSE)	MANIFOLD	REFRIGERATOR	16'-4"	32'-9"
2	HELIUM HOSES	REFRIGERATOR	MAGNET ASSEMBLY	42'-7"	85'-3"
3	COOLING WATER HOSE	FLOW SWITCH	GRADIENT COIL	98'-5"	98'-5"
4	COOLING WATER HOSE	MANIFOLD	FLOW SWITCH	3'-3"	3'-3"
5	VACUUM HOSE	TRANSFORMER CABINET	MAGNET ASSEMBLY	32'-9"	98'-5"
6	COOLING WATER HOSE	MANIFOLD	WATER FILTER	49'-2"	49'-2"
7	COOLING WATER HOSE	WATER FILTER	GRADIENT POWER SUPPLY	9'-10"	9'-10"
8	COOLING WATER HOSE	GRADIENT POWER SUPPLY	MANIFOLD	49'-2"	49'-2"
9	COOLING WATER HOSE	GRADIENT COIL	MANIFOLD	65'-7"	98'-5"
10	COOLING WATER HOSES	MANIFOLD	CUSTOMER CHILLER SYS.	*	*
11	AIR HOSE	GANTRY	MAGNET FAN BOX	49'-2"	49'-2"

\* PROVIDED BY CUSTOMER/CONTRACTOR. EXACT LENGTH TO BE DETERMINED.

## 3 LIQUID AND GAS HOSE CONNECTIONS

SCALE: NOT TO SCALE

05-03-13

PINNACLE TRISTAN ASSOCIATES

(MR SCAN ROOM - TITAN)

32 NORTHEAST DRIVE  
HERSHEY, PA 17033

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PLANNER: M.S.

SID: 30008346

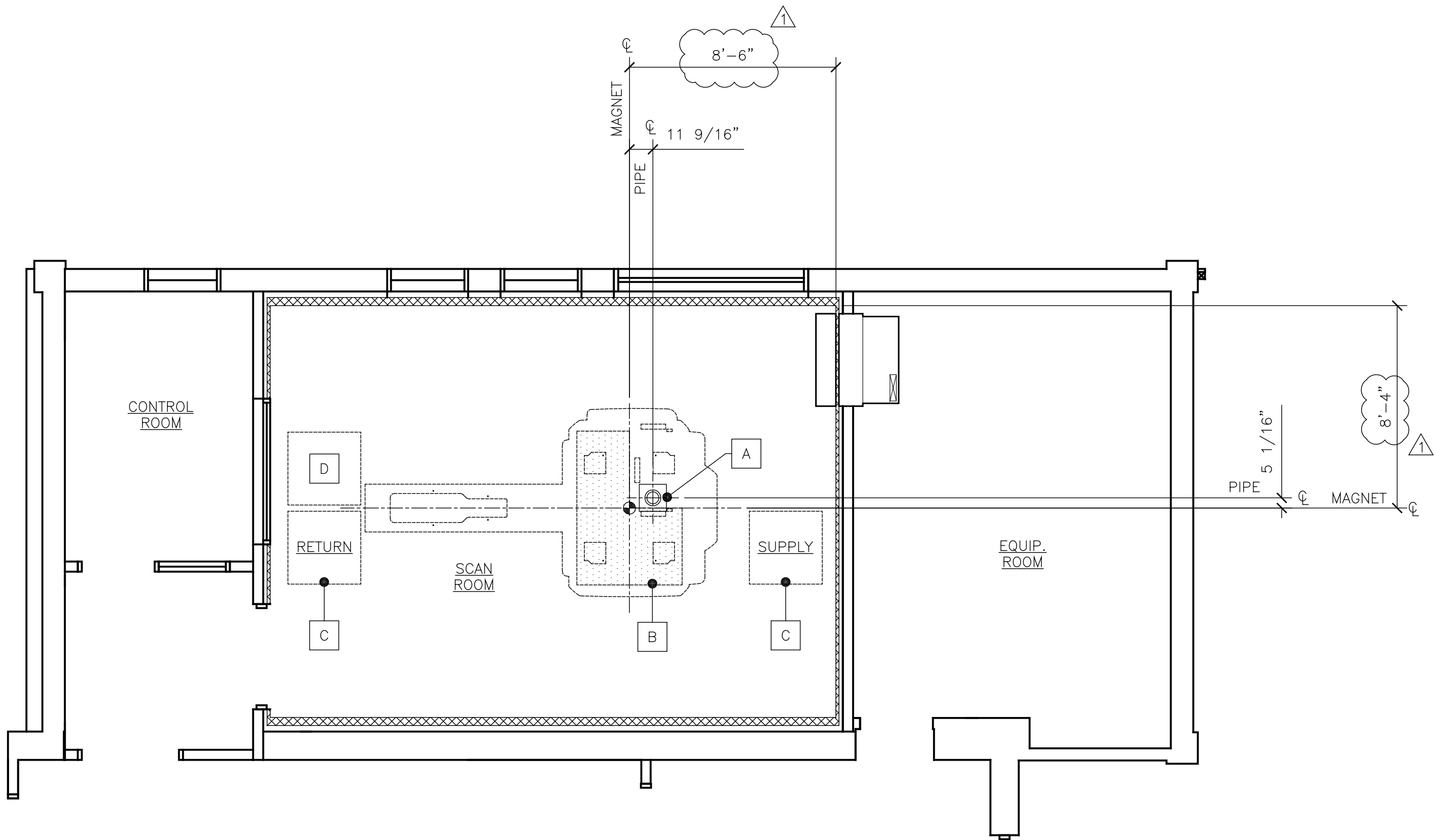
PROJECT NO.  
**130013741MRF1**

**P3**

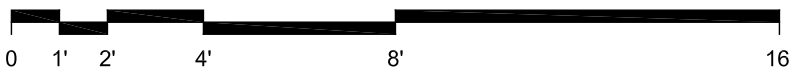
**TOSHIBA**  
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MECHANICAL LAYOUT



MECHANICAL LEGEND

ITEM	ITEM DESCRIPTION SUPPLIED AND INSTALLED BY CUSTOMER / CONTRACTOR	REF.
A	EMERGENCY GHe DISCHARGE PIPE & RF SHIELDING OPENING	ALL W2-4
B	AREA FOR EMERGENCY VENTILATION DUCT WORK (1,060 CUBIC FEET PER MINUTE)	-
C	RECOMMENDED SUPPLY / RETURN LOCATION OF AIR CONDITIONING	-
D	RECOMMENDED PASS-THRU WAVE GUIDE FOR PRESSURE EQUALIZATION	-

ALL MATERIAL IN SCAN ROOM  
MUST BE NON-FERROUS

ENTIRE EMERGENCY GHe DISCHARGE PIPE MUST  
BE MADE FROM STAINLESS STEEL OR ALUMINUM

NOTE:  
THE DIMENSION FROM PARENT WALL TO FINISHED WALL WILL VARY FROM SITE TO SITE. IT IS THE RF VENDOR'S RESPONSIBILITY TO PROVIDE THIS DIMENSION AND ENSURE THE QUENCH PIPE WAVE GUIDE IS PLACED IN THE CORRECT LOCATION (AS SHOWN ON SHEET M1 OF THE FINAL DRAWING PACKAGE). IF THE WAVE GUIDE IS NOT PLACED IN THE CORRECT LOCATION, IT IS THE RF VENDOR'S RESPONSIBILITY TO MAKE THE REQUIRED ADJUSTMENT.

TOSHIBA  
Leading Innovation >>>

REV	DATE	DESCRIPTION	INT
1	09-04-13	ORIGINAL FINAL DRAWINGS COMPLETED.	MS
2	11-12-13	UPDATED ARCH. BACKGROUND. MOVED MAGNET.	MS
3			
4			
5			
6			

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PLANNER: M.S.

SID: 30008346

PROJECT NO.  
130013741MRF1

M1

GENERAL

07–18–12

THIS DOCUMENT COVERS THE DESIGN OF QUENCH LINES USED IN CONJUNCTION WITH TOSHIBA MAGNET TECHNOLOGY 1.5T AND 3T MAGNETS. FOR CALCULATING THE PRESSURE DROPS, **QUENCH LINE CALCULATION** TOOLS ARE AVAILABLE AND MUST ALWAYS BE USED.

IN THE EVENT OF A QUENCH, THE THERMAL ENERGY DISSIPATED CAUSES AN EXTREMELY RAPID BOIL OFF OF THE LIQUID HELIUM. THE SYSTEM MUST BE CAPABLE OF VENTING THE LARGE VOLUME OF GAS GENERATED AT THE APPROXIMATE EXPANSION RATIO OF 1:700 FROM LIQUID AT 4.2 K TO ROOM TEMPERATURE GAS. THE EXHAUST SYSTEM IS CRITICAL FOR THE SAFE OPERATION OF THE MAGNET, AND THE GUIDELINES SET OUT IN THIS SECTION MUST BE FOLLOWED. SINCE HELIUM VENTED IN A QUENCH IS AN ASPHYXIANT AND AN EXTREMELY COLD GAS, THE QUENCH LINE MUST ALWAYS END AT A POINT WHERE ACCESS BY PEOPLE IS NOT POSSIBLE.

IT IS THE RESPONSIBILITY OF THE OPERATOR OF THE MRI SYSTEM IS TO ENSURE THAT THE QUENCH LINE IS MAINTAINED IN AN OPERABLE STATE.

BELLOWS ARE TO BE PROVIDED BY CUSTOMER/CONTRACTOR.

SAFETY NOTES

01–10–11

**WARNING:** **RISK OF ASPHYXIATION**  
**FAILURE TO OBSERVE THE FOLLOWING MAY RESULT IN DIZZINESS AND LOSS OF CONSCIOUSNESS.**  
-> **DO NOT VENT HELIUM GAS DIRECTLY INTO THE MAGNET ROOM.**  
-> **DO NOT VENT EXHAUST GAS FROM THE QUENCH LINE INTO AN ENCLOSED SPACE.**

**NOTE:** **THE OPERATOR OF THE MRI SYSTEM MUST PREPARE AN "EMERGENCY PLAN".**

**NOTE:** **ONLY THE EXAMPLES OF THE TUBE IN THIS GUIDE MAY BE USED.**

**NOTE:** **PLANNING AND INSTALLATION OF QUENCH LINES MUST BE CONDUCTED BY QUALIFIED PERSONNEL, AS APPOINTED BY THE PROJECT MANAGER.**

**NOTE:** **COMPONENTS USED FOR OTHER TUBING, E.G., IN AIR CONDITIONING OR ROOM VENTING, ARE GENERALLY NOT SUITABLE FOR QUENCH LINE CONSTRUCTION.**

**NOTE:** **THE QUENCH LINE MUST BE IDENTIFIED WITH A MARKER TAPE ALONG THE COMPLETE LENGTH OF THE QUENCH LINE. THE CONTENT COULD BE, E.G.: "DO NOT CUT, QUENCH LINE EXHAUST LINE".**

**NOTE:** **NEW CUSTOMER SITES MUST HAVE THE QUENCH LINE INSTALLED AND AVAILABLE FOR IMMEDIATE USE BEFORE THE MAGNET SYSTEM ARRIVES TO ALLOW SUITABLE VENTING FOR THE MAGNET DURING INSTALLATION.**

QUENCH LINE DESIGN RULES

07–13–12

THE FOLLOWING SPECIFIC DESIGN RULES APPLY TO THE COMPONENTS MAKING UP THE QUENCH LINE:

- THE MAXIMUM INTERNAL PRESSURE ALLOWED ON THE LINE IN THE **DESIGN CALCULATIONS** IS **100 MBAR**. HOWEVER, THE QUENCH LINE AND ALL ITS ELEMENTS MUST BE DESIGNED TO WITHSTAND A PRESSURE OF **450 MBAR**. THE LINE MUST BE CONSTRUCTED IN ACCORDANCE WITH SOUND ENGINEERING PRACTICE AS DESCRIBED BELOW.
- THE QUENCH LINE WILL COMPRISE STRAIGHT, HYDRAULICALLY SMOOTH LINE SECTIONS, BENDS UP TO 90° (**FIG. 10-12**) AND A DIFFUSER IF REQUIRED (**FIG. 13**).
- THE END OF THE LINE MUST BE TERMINATED IN A WAY TO PREVENT INGRESS OF RAIN, SNOW, AND FOREIGN OBJECTS (**FIG. 4-8**).
- IF A QUENCH LINE IS VERY SHORT AND STRAIGHT, A FLEXIBLE LINE MAY BE USED FOR THE WHOLE OF THE QUENCH LINE. NOTE, HOWEVER, THAT DUE TO THE HIGH PRESSURE DROP, THE MAXIMUM PERMISSIBLE LENGTH OF FLEXIBLE LINES IS VERY SHORT AS COMPARED TO STRAIGHT LINES.
- THE QUENCH LINE MUST BE MADE FROM A **NON-MAGNETIC STAINLESS STEEL OR ALUMINUM**. ONLY STAINLESS STEEL GRADES AISI 304, 309, 316, and 321 [EN 1.4301, 1.4828, 1.4401, AND 1.4878] OR ALUMINUM MAY BE USED.

**NOTE:** **THE QUENCH LINE COMPONENTS OTHER THAN THOSE SUPPLIED WITH THE MRI SYSTEM (I.E. MAGNET ELBOW, HORIZONTAL ADAPTER, AND FLEXIBLE TUBE) MUST ONLY BE MADE OF STAINLESS STEEL OR ALUMINUM.**

- THE WALL THICKNESS OF THE TUBE MUST BE A **MINIMUM OF 0.7mm (22 S.W.G.)**.
- ONLY ROUND SECTION TUBING MAY BE USED. **SQUARE SECTION IS NOT ALLOWED.**
- DUE CONSIDERATION MUST BE GIVEN TO THE THERMAL CONTRACTION (UP TO 3mm/METER FOR STAINLESS STEEL OR ALUMINUM). STAINLESS STEEL OR ALUMINUM BELLOWS MUST BE USED TO ALLOW FOR ADEQUATE CONTRACTION. **BELLOWS ARE TO BE FITTED AT A MINIMUM OF EVERY 10 METERS.** THE MOVEMENT OF THE BELLOWS MUST BE LIMITED SO THAT THE LINE DOES NOT EXPAND EXCESSIVELY UNDER INTERNAL PRESSURE.
- BELLOWS ARE DESCRIBED AS "STRAIGHT FLEXIBLE" IN THE **QUENCH LINE CALCULATION** TOOL.

**NOTE:** **FLEXIBLE LINES AND BELLOWS MAY ONLY BE MADE OF STAINLESS STEEL OR ALUMINUM.**

- THE LENGTH OF THE BELLOWS IN TOTAL MAY NOT EXCEED 2% OF THE ALLOWED MAXIMUM LINE LENGTH, IN ORDER THAT THE LINE PRESSURE DROP DOES NOT INCREASE EXCESSIVELY.
- THE WEIGHT OF THE LINE MUST BE SUPPORTED AGAINST THE BUILDING. IN ORDER THAT THE LINE SUSPENSION IS NOT OVERSTRESSED DUE TO THE THERMAL CONTRACTION, THE SUSPENSION NEEDS TO BE FLEXIBLE ENOUGH TO ACCOMMODATE THE MOVEMENTS. ALSO, THE WALL EXIT IN GENERAL SHOULD NOT BE FIXED HARD TO THE WALL.
- THE FLEXIBLE TUBE SUPPLIED WITH THE MRI SYSTEM MUST BE FITTED AT THE QUENCH VALVE END. ITS MAIN FUNCTION IS TO REDUCE NOISE TRANSMISSION. ITS SECONDARY FUNCTIONS ARE TO EASE THE FITTING OF THE QUENCH LINE AND TO **ENSURE THAT THE QUENCH VALVE DOES NOT CARRY ANY LOAD FROM THE WEIGHT OF THE QUENCH LINE.**
- THE CLEAR BORE IN THE CUSTOMER/CONTRACTOR SUPPLIED BELLOWS FOR 1.5 TESLA SYSTEMS WILL VARY DEPENDING ON THE LENGTH OF QUENCH LINE.

QUENCH LINE DESIGN RULES CONTINUED

**NOTE:** **THE FLEXIBLE TUBE MUST BE INSTALLED NOMINALLY STRAIGHT, I.E., TO ALLOW FOR MINOR MISALIGNMENT.**  
**IT SHOULD TYPICALLY NOT EXCEED ±5mm, AND NEVER EXCEED THE DESIGN LIMIT OF ±20mm.**

- IT MUST NOT BE BENT IN A WAY TO REPLACE AN ELBOW. THE LENGTH OF THE FLEXIBLE TUBE IS INCLUDED IN THE **QUENCH LINE CALCULATION** TOOL.
- JOINTS MAY ONLY BE MADE BY WELDING (BY COMPETENT WELDERS), OR BY BOLTED FLANGES. ROTARY FLANGES ARE PERMITTED TO EASE THE INSTALLATION PROCESS. V-CLAMPED FLANGES MAY NOT BE USED. GASKETS USED TO SEAL SECTION JOINTS HAVE TO BE MADE OF EITHER UHMW-PE [CESTILENE HD1000, HOSTALEN GC579, OR HOSTALEN GUR812], PTFE [BS EN 13000-1:1998, BS EN 13000-2:1998], OR FIBRE [ASTM F36, BS 7531, DIN 3754P]. **NO OTHER MATERIALS ARE PERMITTED.**

**NOTE:** **WELDS MUST BE ONLY BE MADE BY COMPETENT WELDERS.**

- THE END OF THE QUENCH LINE MUST BE PROTECTED FROM WEATHER CONDITIONS SUCH AS RAIN OR SNOW. IT MUST BE FITTED WITH A WIRE MESH. THE MESH SIZE MUST BE 3/8" (10 +2/-1mm) WITH 18 GAUGE (1.0 ±0.3mm) ROUND WIRES, TO PREVENT INGRESS OF FOREIGN BODIES [E.G. BIRDS AND RODENTS].

**NOTE:** **THE AREA OF THE MESH MUST BE AT LEAST 2.5 TIMES THE CROSS-SECTION AREA OF THE QUENCH TUBE (FIG. 4-8).**

- WHERE THE QUENCH LINE EXITS VERTICALLY THROUGH A FLAT ROOF, THE OUTLET MUST BE ABOVE A LEVEL WHERE WATER COULD ENTER IT IN THE EVENT OF THE ROOF DRAINS BECOMING BLOCKED. WHERE THE QUENCH LINE EXISTS VERTICALLY, A RAIN SHIELD MUST BE FITTED (**FIG. 4**).
- A DEFLECTOR PLATE MUST BE WELDED TO THE LINE WHERE IT EXITS THE ROOF TO PREVENT HELIUM FROM RE-ENTERING THE BUILDING. THE DEFLECTOR PLATE MUST BE AT LEAST THE SAME DIAMETER AS THE RAIN GUARD. IT MUST BE LOCATED AT LEAST TWO LINE DIAMETERS ABOVE THE ROOF, AND TWO DIAMETERS BELOW THE BOTTOM OF THE RAIN GUARD (**FIG. 4**).
- IN THE CASE OF A HORIZONTAL EXIT THROUGH A WALL, THE OUTLET MUST BE TURNED DOWN BY NOT LESS THAN THE LINE DIAMETER TO PREVENT RAIN INGRESS (**FIG. 5-8**). THE EXIT MUST BE SITUATED WHERE IT CANNOT BE BLOCKED BY DRIFTING SNOW.

**CAUTION:** **ONLY USE THE QUENCH LINE OUTLET CONFIGURATIONS DESCRIBED IN THIS CHAPTER. IF THE QUENCH LINE IS NOT CONFIGURED CORRECTLY, SAFETY IS COMPROMISED.**

- TO AVOID THE RISK OF INJURY FROM COLD BURNS AND ASPHYXIATION, ACCESS TO THE QUENCH LINE MUST BE RESTRICTED BY 3m EACH SIDE AND BELOW, AND 6m VERTICALLY ABOVE THE OUTLET; WARNING SIGNS MUST BE PUT UP (**FIG. 2, 3, & 9**). THIS MEANS IN PARTICULAR, THAT THE OUTLET SHOULD BE NO LESS THAN 5m ABOVE SIDEWALKS. THE OUTLET MUST NOT BE SITUATED WHERE, IN CASE OF A QUENCH, HELIUM GAS MIGHT BE DRAWN INTO AN AIR INLET, OR WHERE GAS MIGHT ENTER OPEN WINDOWS. THE COLD GAS MUST NOT BE ALLOWED TO BLOW DIRECTLY ONTO A WINDOW.

**NOTE:** **WHERE WINDOWS ARE WITHIN THE RESTRICTED ACCESS AREA, THEY MUST BE SEALED AND PERMANENTLY CLOSED. MEANS OF OPENING THE WINDOWS MUST BE REMOVED.**

- ALL BENDS MUST BE SMOOTH WALLED AND HAVE A CENTERLINE RADIUS TO INTERNAL LINE DIAMETER RATIO IN THE RANGE OF 1.5 TO 5.0. WHERE A ONE-PIECE BEND IS NOT READILY AVAILABLE, A FABRICATED BEND USING STRAIGHT SECTIONS IS PERMISSIBLE (**FIG. 11**).
- EXPANSION FROM A SMALL TO LARGE LINE DIAMETER MUST BE ACCOMPLISHED USING A DIFFUSER. DIFFUSERS MUST CONFORM TO THE GEOMETRIC PARAMETERS SHOWN IN (**FIG.13**).

**CAUTION:** **NEVER REDUCE THE DIAMETER OF A TUBE IN THE DOWNSTREAM DIRECTION. THIS WILL CAUSE SHOCKWAVE REFLECTIONS AND LOCAL PRESSURE PEAKS WHICH MAY DAMAGE THE MAGNET.**

- THE QUENCH LINE MUST BE THERMALLY INSULATED ALONG ITS FULL LENGTH. THIS IS TO AVOID CONDENSATION OF LIQUID AIR IN CASE OF A QUENCH, AS WELL AS WATER CONDENSATION ON THE INSIDE IN HUMID WEATHER CONDITIONS. A DOUBLE-WALLED STRUCTURE IS ALLOWED. MINERAL FIBER INSULATION (BRANDS SUCH AS ROCKWOOL DUCTWRAP OR OTHER) MUST NOT BE LESS THAN 25mm THICK. THE INSULATION MUST CONFORM TO LOCAL REGULATIONS FOR FIBROUS INSULATION MATERIALS.
- WITHIN THE RF ROOM, THE LINE MUST BE INSULATED WITH ONE LAYER OF 25mm THICK CLASS O ARMAFLEX [ARMACELL]. VAPOR BARRIERS MUST NOT MAKE ELECTRICAL CONTACT BETWEEN THE MAGNET LINE WORK AND THE WAVE GUIDE, IN ORDER TO AVOID RF DISTURBANCE TO THE IMAGING SYSTEM. THE OUTSIDE MAY BE COVERED WITH AN AESTHETIC FINISH.
- OUTDOOR LINES MUST BE COVERED IF ACCESS CANNOT BE EXCLUDED AT THE LINE OR BELOW (DRIPPING LIQUID AIR IN CASE OF A QUENCH). OUTSIDE INSULATION MUST BE WEATHERPROOF [E.G., ARMAFINISH FR PAINT, OR ARMA-CHECK INSULATION].

**NOTE:** **THE QUENCH LINE INSULATION MUST EXTEND UP TO THE QUENCH VALVE ON THE MAGNET.**

**NOTE:** **THERE MUST BE CLEARANCE BETWEEN THE FINISHED INSULATION AND THE MAGNET COVERS.**

- THE FULLY INSULATED QUENCH LINE MUST BE MARKED ALONG ITS LENGTH WITH A WARNING TAPE STATING ITS FUNCTION, (**FIG. 2**).

**WARNING**  
**VENT PIPE FOR EXTREMELY COLD HELIUM GAS**  
**ONLY AUTHORIZED PERSONNEL TO WORK ON VENT PIPE**

FIGURE 2: WARNING LABEL - QUENCH LINE

QUENCH LINE DESIGN RULES CONTINUED

- A WARNING LABEL, (**FIG. 3**) MUST BE ADHERED NEXT TO THE EXTERNAL OUTLET.

**WARNING**  
**KEEP AWAY. EXTREMELY COLD GAS**  
**MAY BE EXHAUSTED WITH NO**  
**WARNING.**  
**DO NOT WORK ON THE VENTING IF**  
**THE MAGNET IS AT FIELD.**

FIGURE 3: WARNING LABEL - QUENCH LINE OUTLET

- TO AVOID ELECTRICAL NOISES BEING PICKED UP BY LOOPS BETWEEN THE MAGNET, QUENCH LINE, THE RF ROOM AND THE BUILDING, IT IS NECESSARY TO HAVE GALVANIC SEPARATION AT THE MAGNET END AND AT THE BUILDING END OF THE QUENCH LINE.
- THE GALVANIC SEPARATION AT THE MAGNET IS BETWEEN THE FLEXIBLE TUBE AND MAGNET ELBOW OR HORIZONTAL ADAPTER (WHICH EVER IS FITTED). THIS GALVANIC JOINT IS ACHIEVED BY USING THE GASKET, STAINLESS STEEL OR ALUMINUM BOLTS, INSULATING BUSHES NUTS AND WASHERS SUPPLIED WITH THE MAGNET SYSTEM (**FIG. 16**).
- A SECOND GALVANIC SEPARATION IS REQUIRED AT THE BUILDING END.
- THE QUENCH LINE DESIGN MUST COMPLY WITH THE REQUIREMENTS SPECIFIED IN THIS DOCUMENT. IT IS THE RESPONSIBILITY OF THE PROJECT MANAGER TO ACCEPT THE DESIGN AND INSTALLATION OF THE QUENCH LINE BEFORE THE MAGNET IS CONNECTED!
- A PRINT OFF OF THE COMPLETED "CALCULATOR" SHEET AND A COMPLETED "QUENCH LINE ACCEPTANCE PROTOCOL" FROM THE **QUENCH LINE CALCULATION** TOOL MUST BE PROVIDED WITH ACCEPTANCE DOCUMENTATION.

**NOTE:** **THE DESIGN AND CONSTRUCTION OF THE QUENCH LINE MUST BE DOCUMENTED IN DRAWINGS AND CALCULATIONS, AND KEPT WITH THE "SYSTEM OWNER MANUAL".**

QUENCH LINE OUTLET CONFIGURATIONS

01–10–11

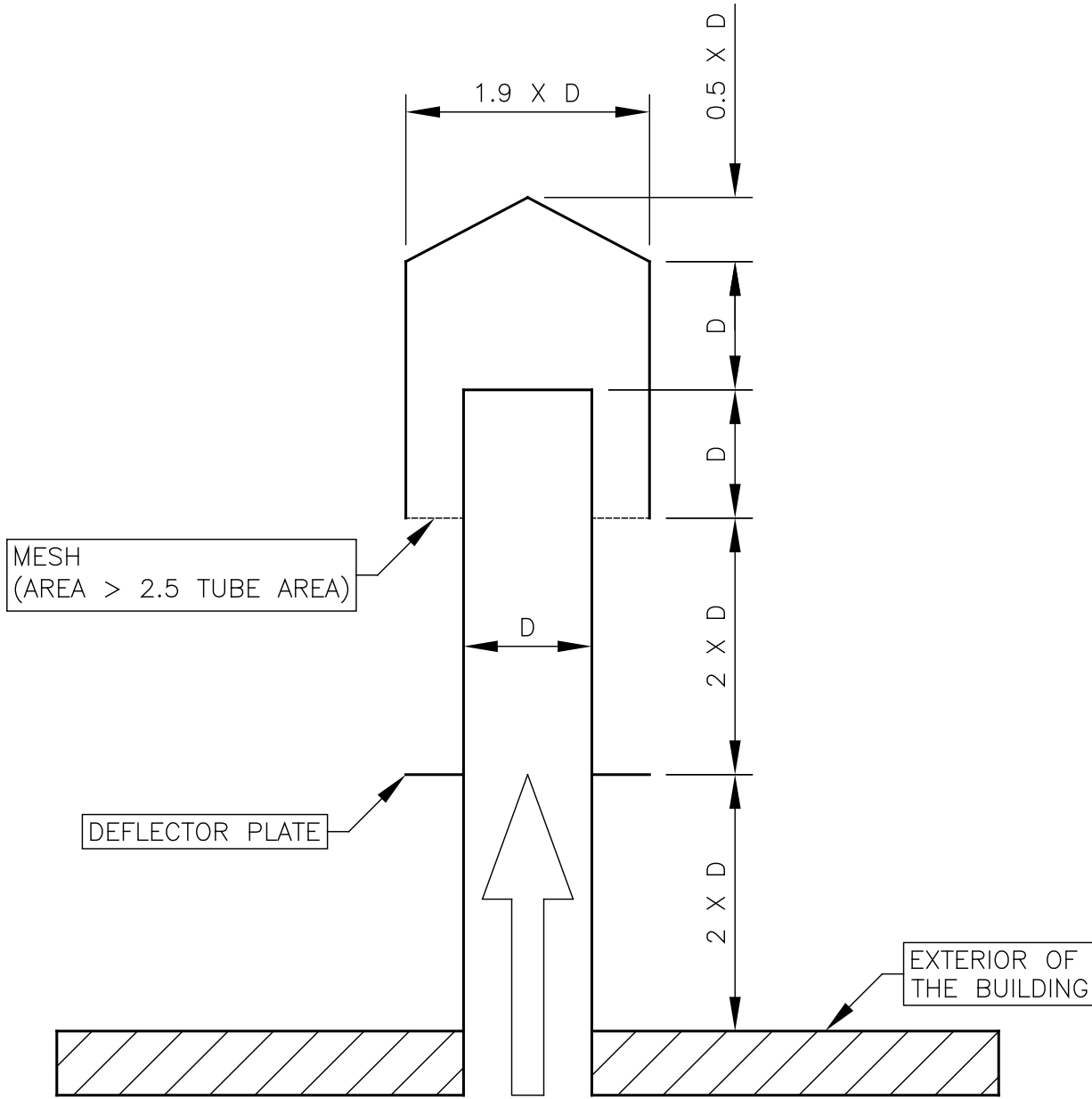


FIGURE 4 - QUENCH LINE OUTLET TO ATMOSPHERE - VERTICAL

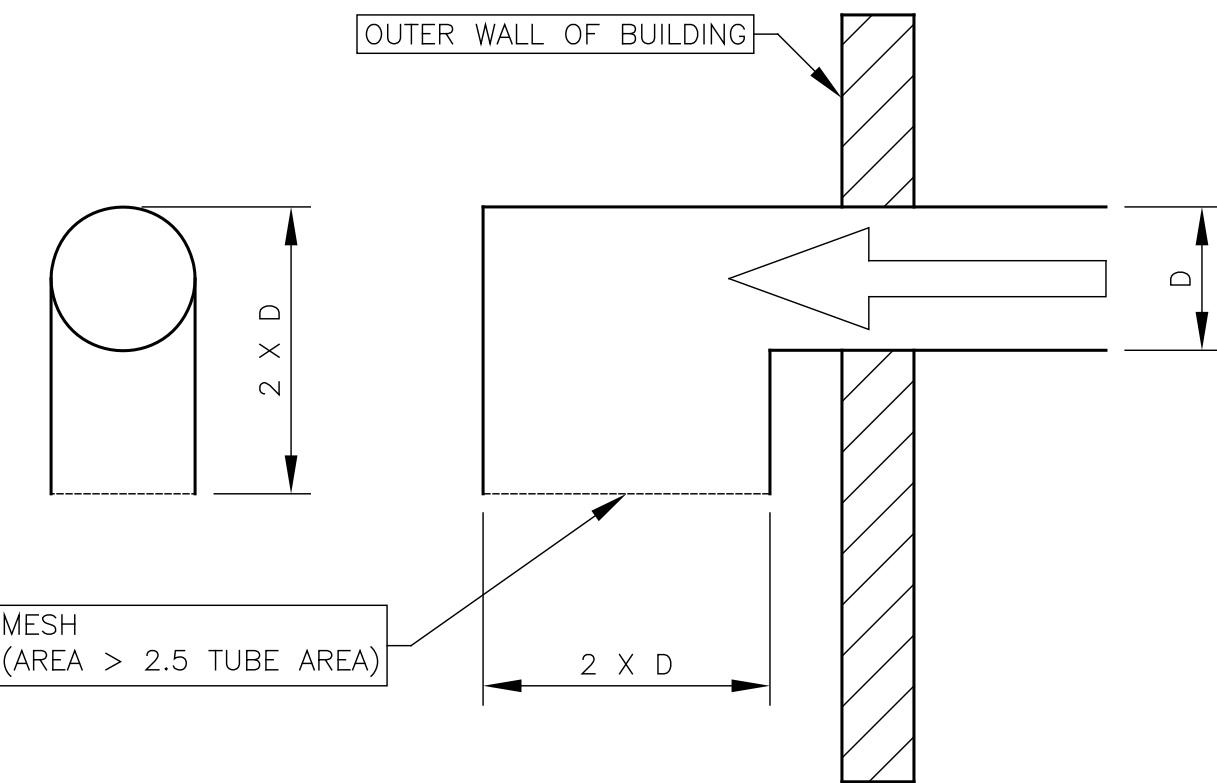


FIGURE 5 - QUENCH LINE OUTLET TO ATMOSPHERE - HORIZONTAL OPTION 1

QUENCH LINE OUTLET CONFIGURATIONS CONT.

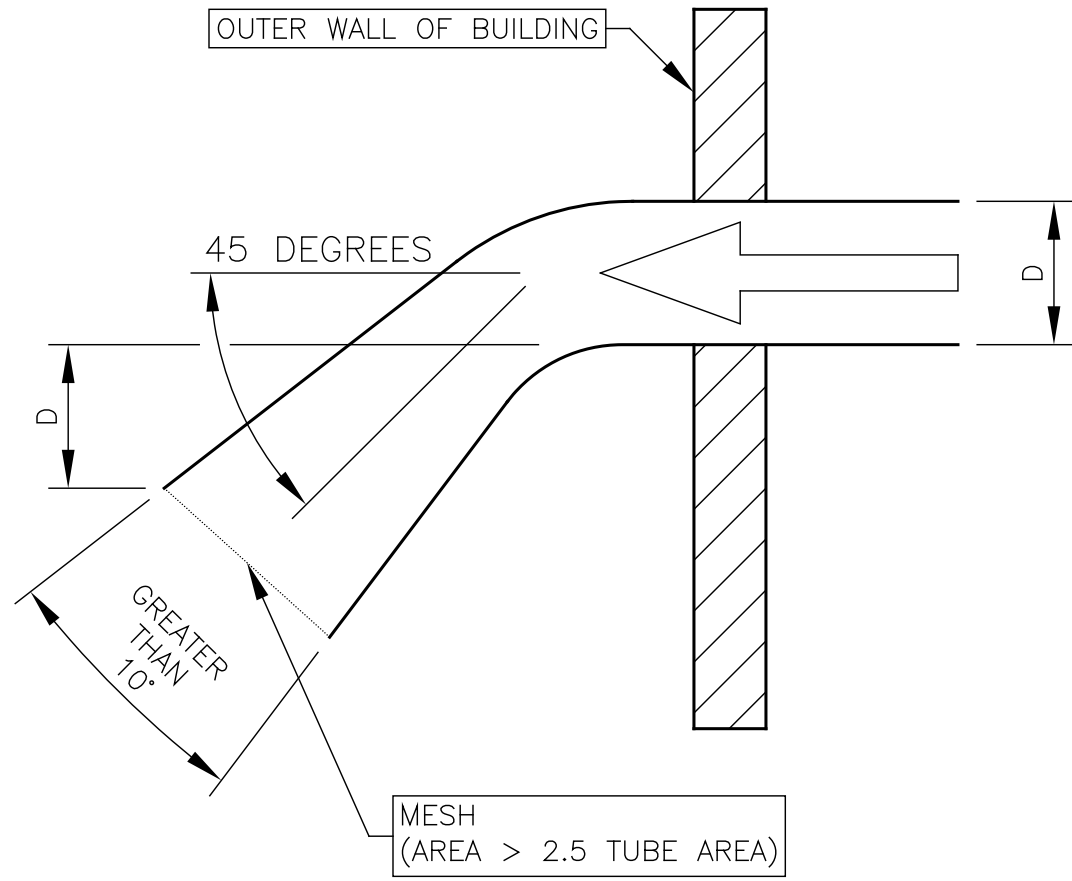


FIGURE 6 - QUENCH LINE OUTLET TO ATMOSPHERE - HORIZONTAL OPTION 2

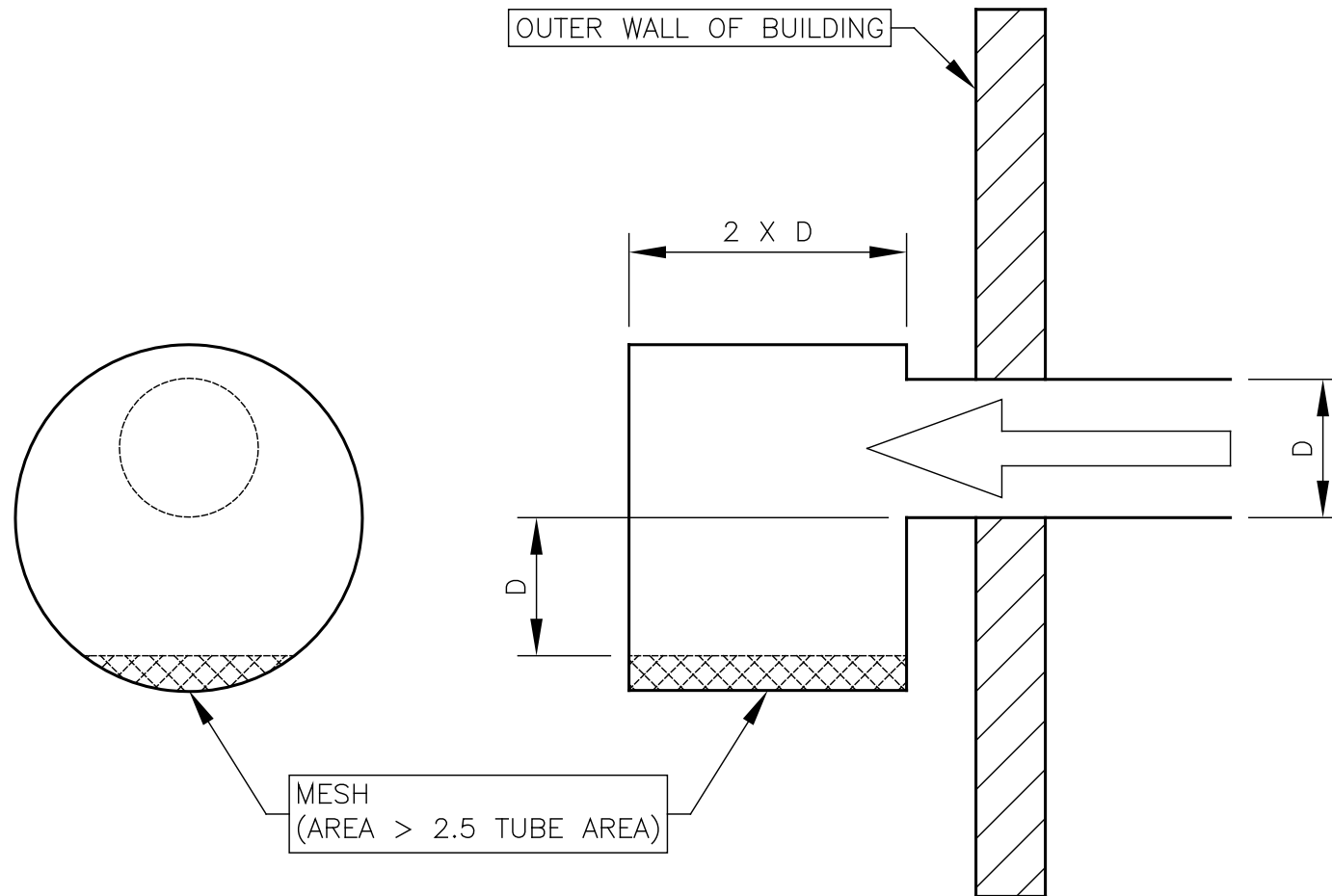


FIGURE 7 - QUENCH LINE OUTLET TO ATMOSPHERE - HORIZONTAL OPTION 3

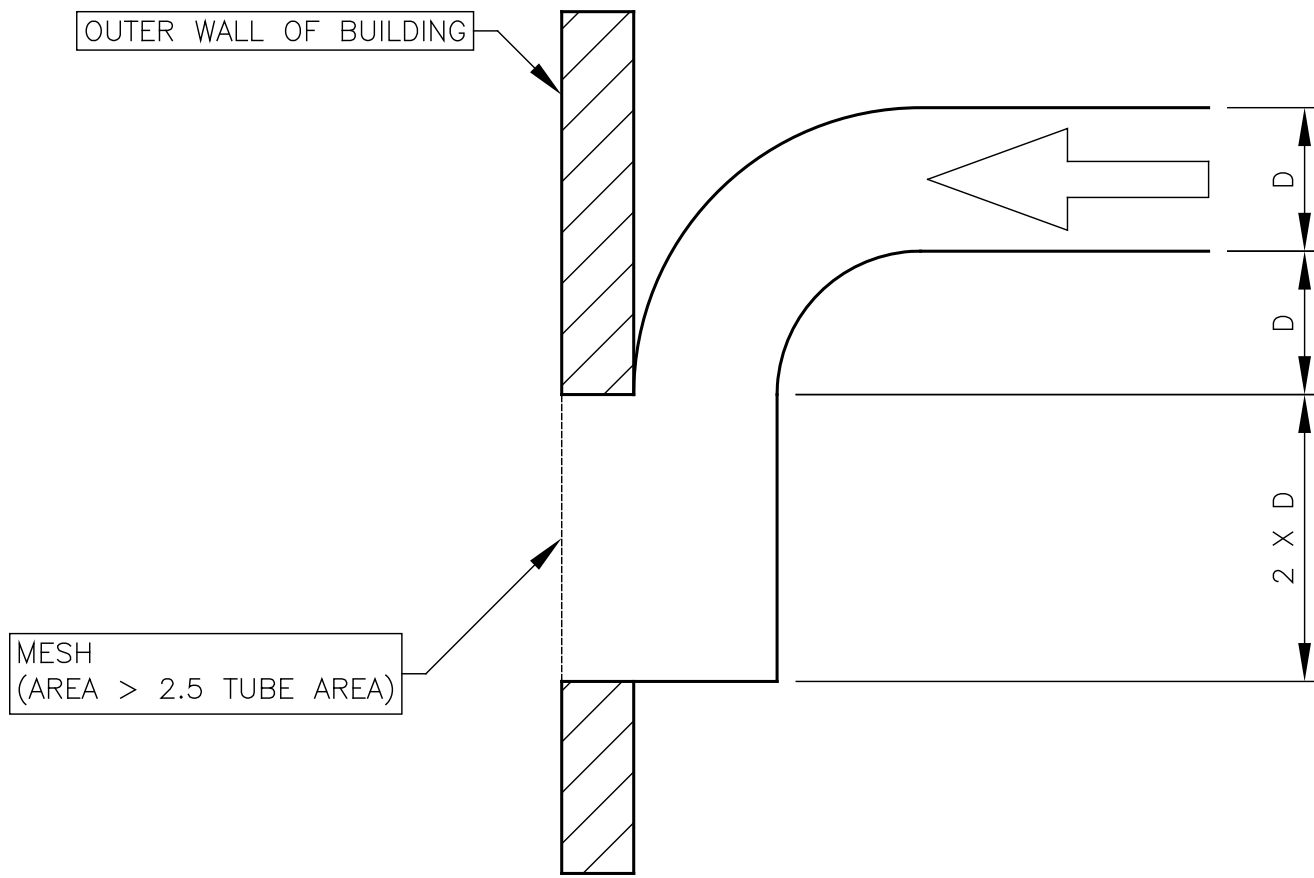


FIGURE 8 - QUENCH LINE OUTLET TO ATMOSPHERE - HORIZONTAL OPTION 4

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REV	DATE	DESCRIPTION	INT	MS	MS
Δ	09-04-13	ORIGINAL FINAL DRAWINGS COMPLETED.			
Δ	11-12-13	NO CHANGES MADE TO THIS SHEET.			

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PROJECT NO.	<b>130013741MRF1</b>

**M2**

QUENCH LINE OUTLET CONFIGURATIONS CONT.

01-10-11

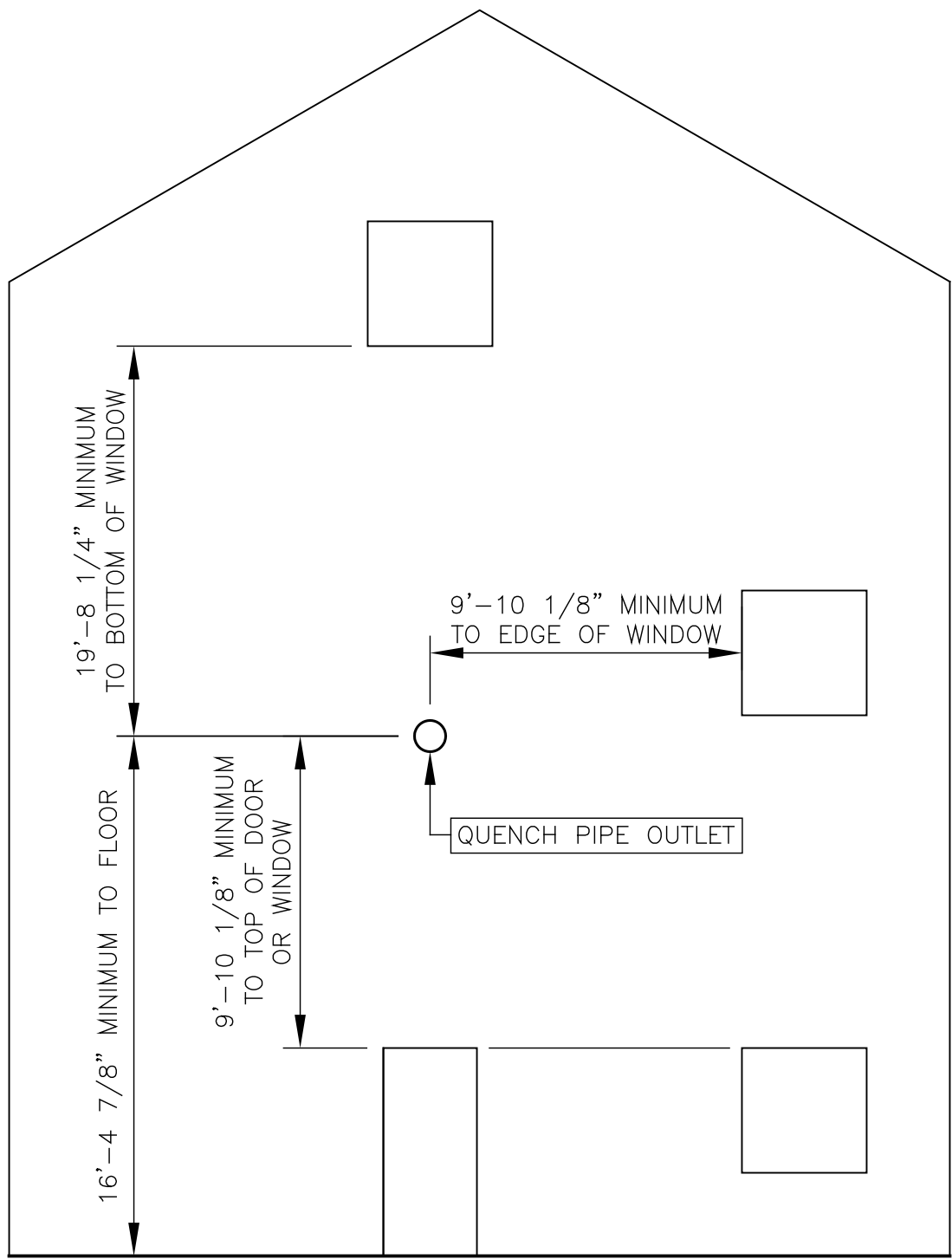


FIGURE 9 - EXAMPLE OF QUENCH LINE OUTLET POSITION REQUIREMENTS TO THE OUTSIDE (NOT TO SCALE)

QUENCH LINE ELBOWS

01-10-11

RECOMMENDED 1 PIECE ELBOW

MINIMUM 4 SECTION ELBOW

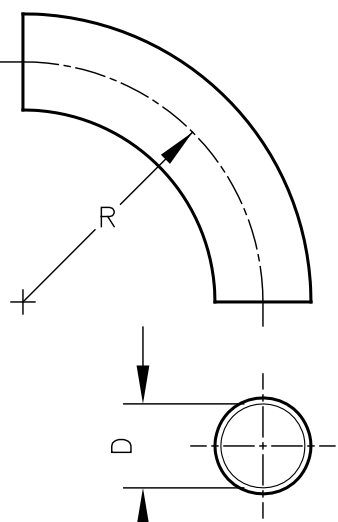


FIGURE 10 - QUENCH LINE SMOOTH ELBOW

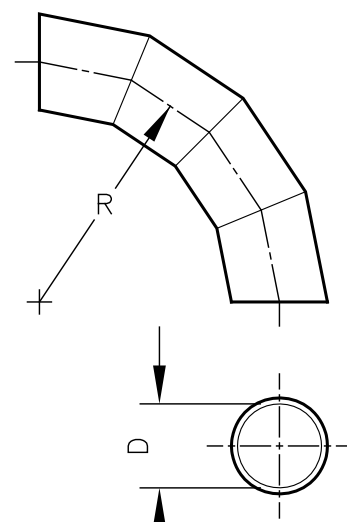
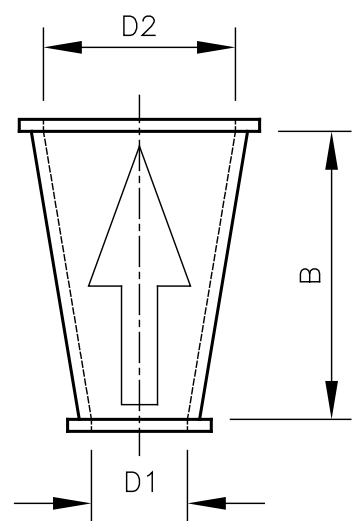


FIGURE 11 - QUENCH LINE SEGMENTED ELBOW

DIFFUSER

07-13-12

THE RECOMMENDED DIFFUSER DESIGN FOR MINIMUM PRESSURE LOSS IS THE RATIO OF:  
 $B > 2.5 \times (D2 - D1)$



D1 = SMALL INSIDE DIAMETER OF TUBE (FLEXIBLE TUBE SIDE)  
D2 = LARGE INSIDE DIAMETER OF TUBE (QUENCH TUBE SIDE)  
B = LENGTH OF DIFFUSER

FIGURE 13 - DIFFUSER

QUENCH LINE WATER DRAINS (AS REQUIRED)

08-05-11

- SECTIONS WHERE WATER MIGHT COLLECT ARE TO BE AVOIDED, BUT IF THEY CANNOT BE AVOIDED, AN AUTOMATIC WATER DRAIN MUST BE FITTED AT THE BOTTOM OF THE SECTION. SEE (FIG. 14 & 15) FOR DIMENSIONS AND THE METHOD OF FITTING TO THE QUENCH PIPE.
- IF THE MAGNET SHOULD QUENCH, THERE WILL BE A VERY SMALL RELEASE OF HELIUM GAS FROM THE DRAINS, WHICH CAN BE TOLERATED EVEN IN SMALL ROOMS [10 L IN 10 MIN]. IF THE EXIT IS RAIN PROTECTED AND THE LINE IS PROPERLY INSULATED, THERE WILL BE NEXT TO NO WATER COMING FROM THE DRAINS. IT IS THEREFORE NOT REQUIRED TO CONNECT THE DRAINS TO A WASTEWATER INSTALLATION. WATER UNDER THE DRAINS WOULD INDICATE A MALFUNCTION.
- THE DRAINS ARE TO BE INSPECTED AND CLEANED FROM DEBRIS ANNUALLY TO ENSURE THAT THEY ARE OPERATING CORRECTLY. ACCESS MUST BE TAKEN INTO CONSIDERATION WHEN DESIGNING THE QUENCH LINE. THIS OPERATION MAY BE DONE WITH THE MAGNETIC AT FIELD, AND AN M8 SCREW SHOULD BE INSERTED INTO THE OPEN ATTACHMENT HOLD TO ENSURE MINIMAL ESCAPE OF GAS IN THE UNLIKELY EVEN THAT THE MAGNET SHOULD QUENCH DURING INSPECTION.

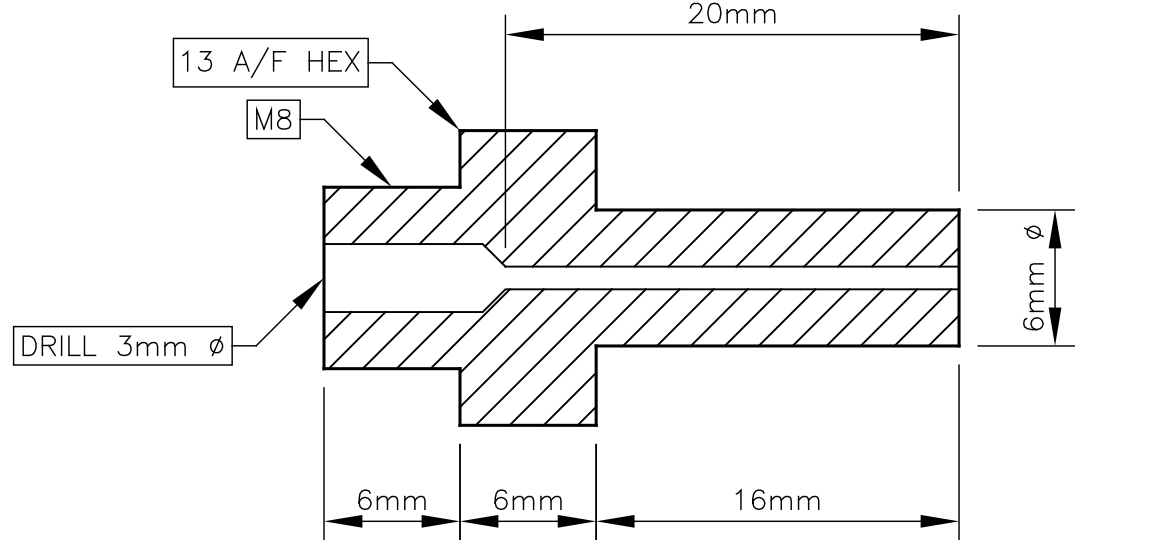


FIGURE 14 - DRAWING OF AUTOMATIC WATER DRAIN (SCALE: 3:1)

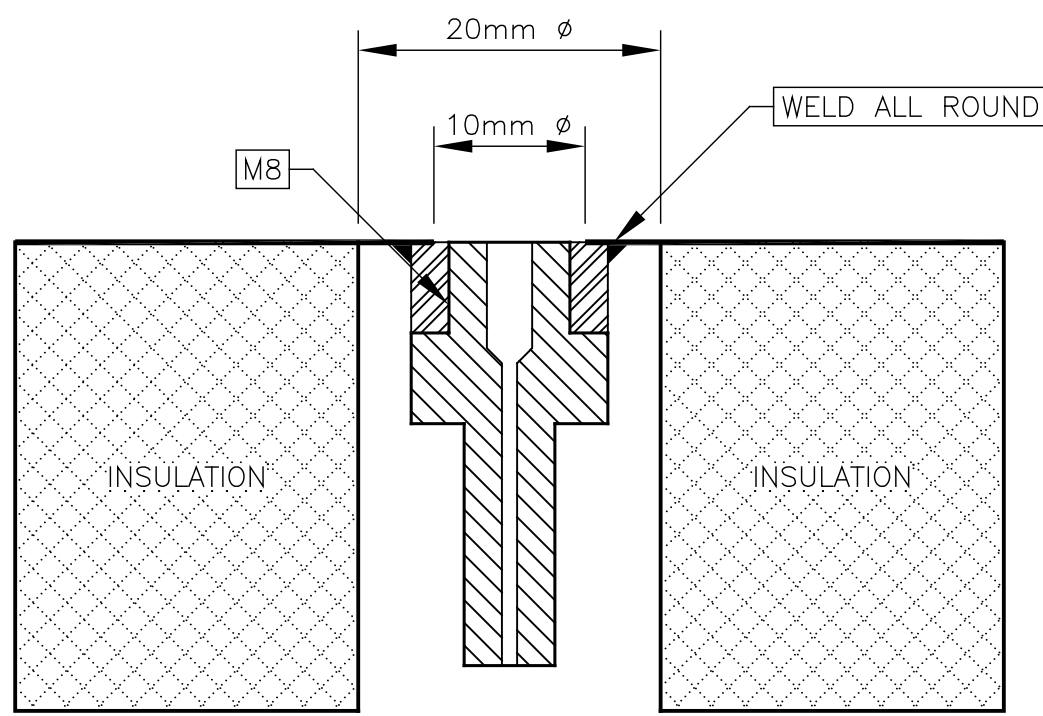


FIGURE 15a - WATER DRAIN INSTALLATION (SCALE: 2:1)

- CUT THROUGH PIPE 10mm  $\phi$
- WELD M8 NUT TO SURFACE OF PIPE
- SCREW IN WATER DRAIN
- WHEN INSULATING PIPE, LEAVE 20mm  $\phi$  CLEARANCE FOR DRAIN

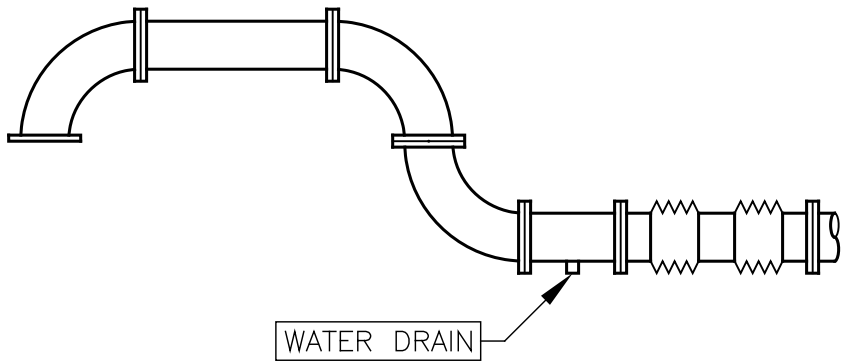
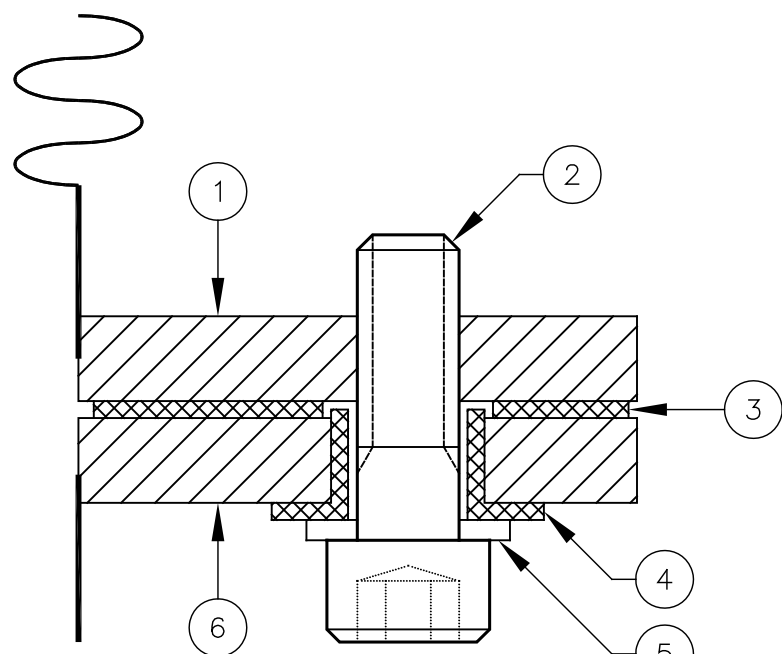


FIGURE 15b - WATER DRAIN INSTALLATION (NOT TO SCALE)

FLEXIBLE TUBE GALVANIC SEPARATION

07-13-12



- FLEXIBLE TUBE FLANGE
- M8 HEX HEAD SCREWS (12 OFF)
- FIBER GASKET
- PTFE INSULATOR (12 OFF)
- NORDLOCK WASHER (12 OFF)
- TURRET FLANGE

FIGURE 16 - GALVANIC JOINT AT FLEXIBLE TUBE (NOT TO SCALE)

RF WAVEGUIDE

01-10-11

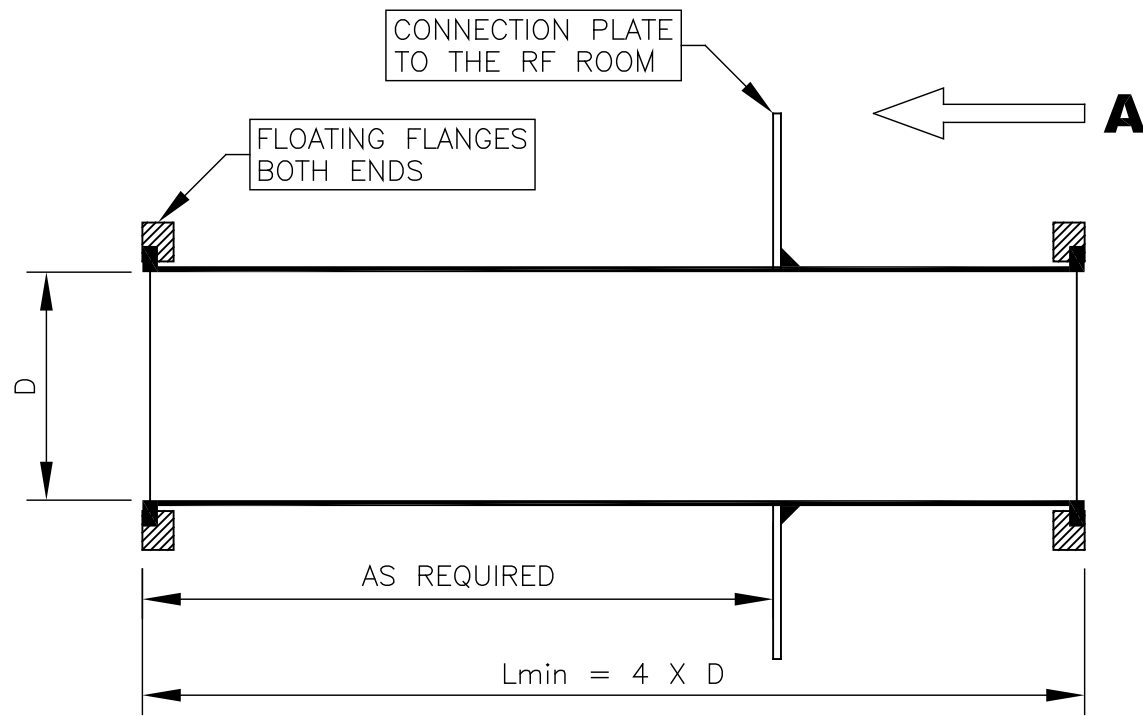
THE RF ROOM FEED-THROUGH NEEDS TO CONFORM TO CERTAIN GEOMETRY CONSTRAINTS IN ORDER TO GUARANTEE THE RF INTEGRITY OF THE RF ROOM (FIG. 17).

AS A FUNCTION OF THE INNER PIPE DIAMETER (D) THE FOLLOWING APPLIES TO THE MINIMUM LINE LENGTH Lmin FOR FREQUENCIES UP TO 128 MHz AND 110 dB ATTENUATION:

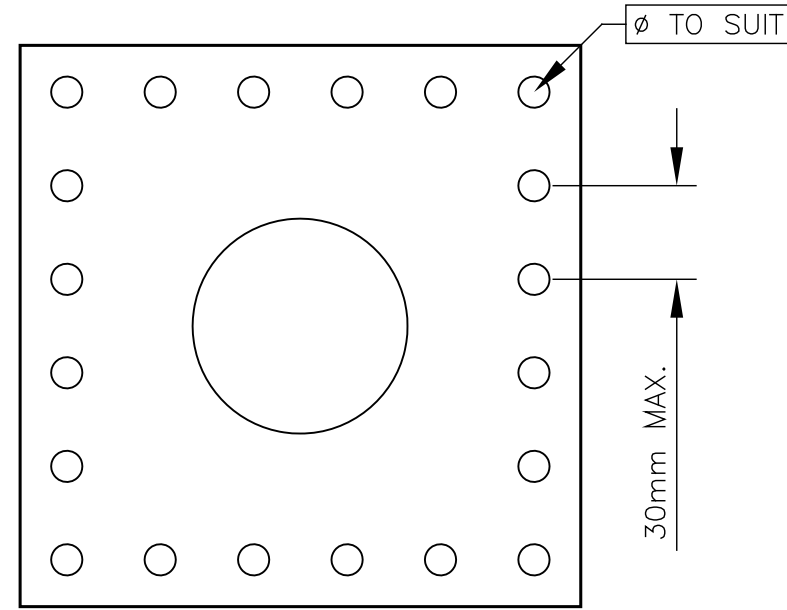
$$L_{min} = 4.0 \times D$$

WHEREBY:  $D \leq 300\text{mm}$

- THE BOLT SPACING IN THE CONNECTOR PLATE TO RF ROOM MUST BE A MAXIMUM OF 30mm APART TO ENSURE RF SHIELDING.
- DEPENDING ON RF ROOM DESIGNS, RF SEALS MAY BE REQUIRED BETWEEN THE MOUNTING FLANGE AND THE RF ROOM.



NOTE:  
INSULATING CONNECTIONS ARE TO BE MADE AT BOTH ENDS OF THE WAVEGUIDE.

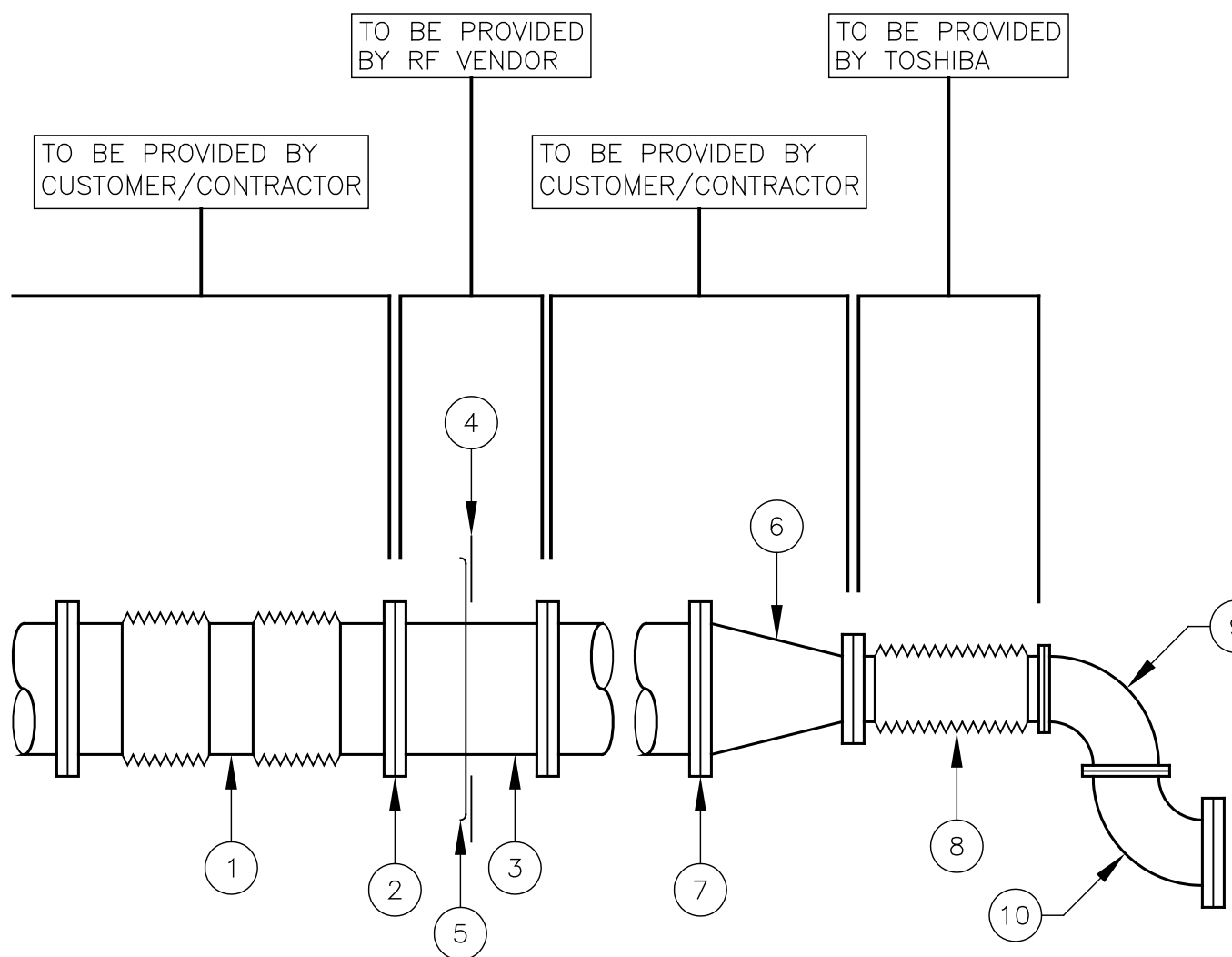


VIEW ON ARROW "A"

FIGURE 17 - RF WAVEGUIDE

QUENCH LINE CONFIGURATIONS

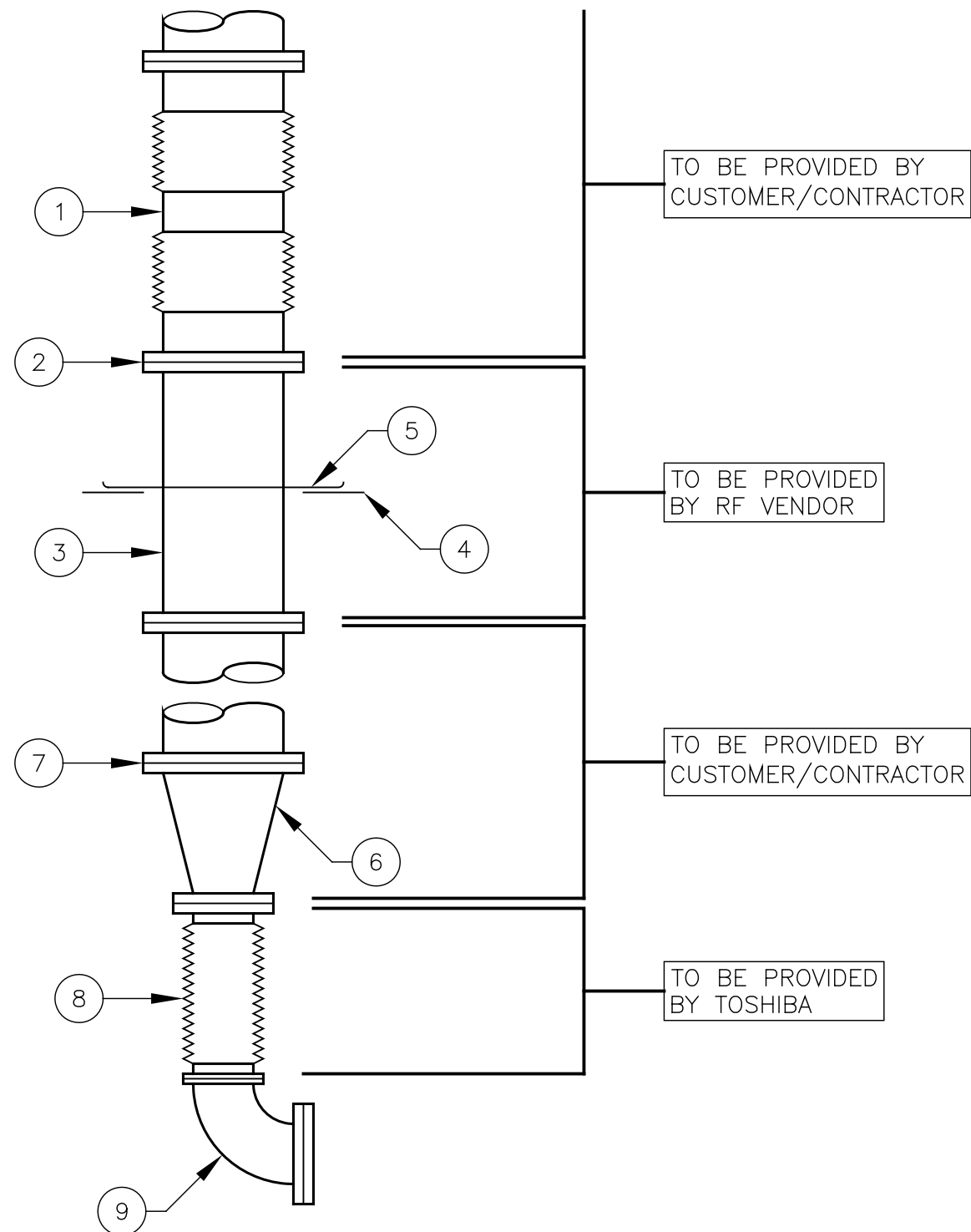
07-13-12



- BELLOWS (SUPPLIED BY CUSTOMER/CONTRACTOR, SEE FIG. 20)
- GALVANIC SEPARATION (2 PLACES)
- RF FEED THROUGH
- RF ROOM
- CONNECTION PLATE TO RF ROOM
- DIFFUSER (OPTIONAL)
- FLANGE (E.G. WELDED, SCREW CONNECTION)
- FLEXIBLE TUBE (SUPPLIED WITH MAGNET, SEE FIG. 22)
- 90° ELBOW (SUPPLIED BY CUSTOMER/CONTRACTOR)
- 90° ELBOW (SUPPLIED WITH MAGNET)

FIGURE 18 - EXAMPLE OF HORIZONTAL BELLOWS AND CABIN FEED-THROUGH

QUENCH LINE CONFIGURATIONS CONTINUED



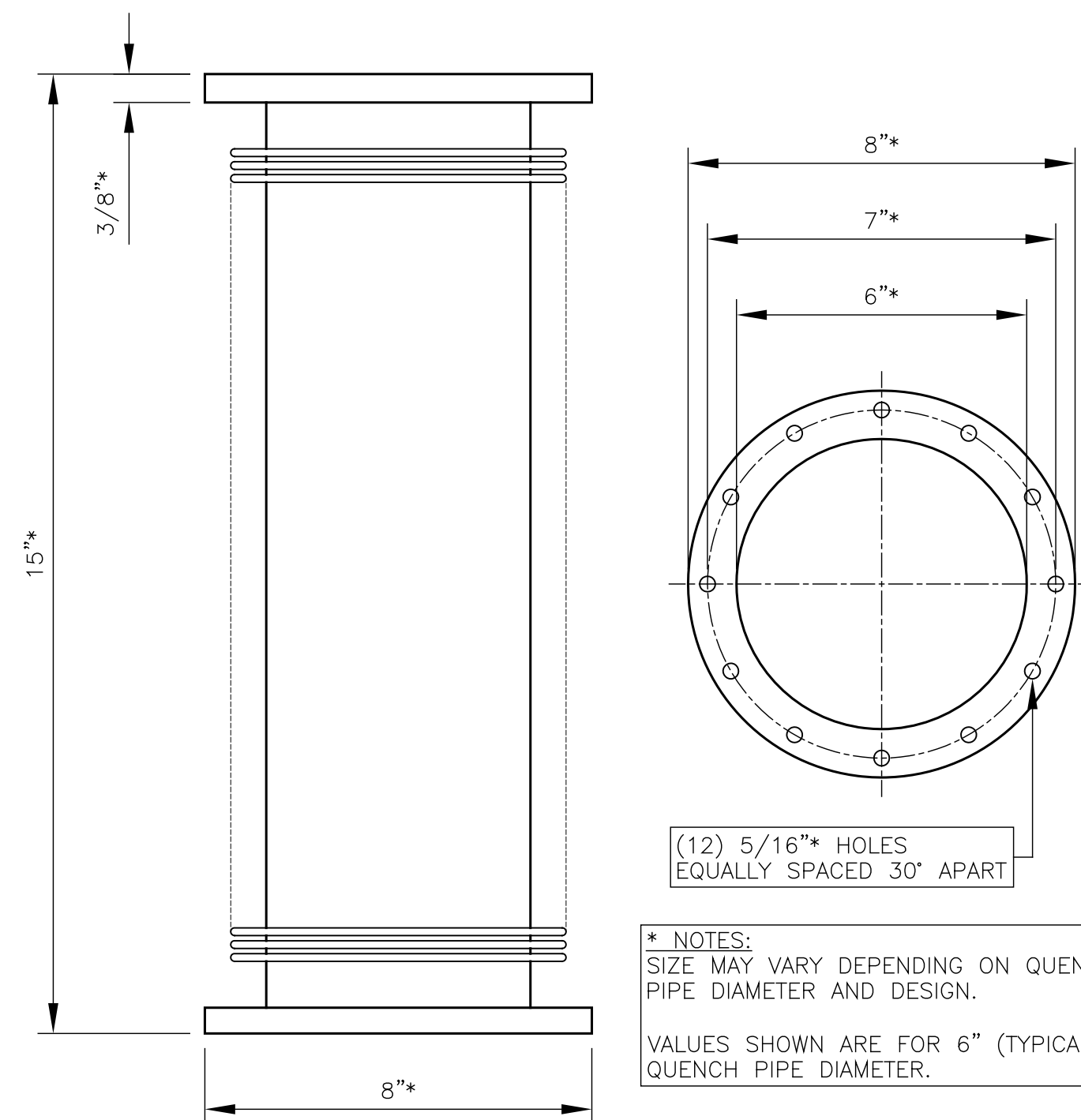
- BELLOWS (SUPPLIED BY CUSTOMER/CONTRACTOR, SEE FIG. 20)
- GALVANIC SEPARATION (2 PLACES)
- RF FEED THROUGH
- RF ROOM
- CONNECTION PLATE TO RF ROOM
- DIFFUSER (OPTIONAL)
- FLANGE (E.G. WELDED, SCREW CONNECTION)
- FLEXIBLE TUBE (SUPPLIED WITH MAGNET, SEE FIG. 22)
- 90° ELBOW (SUPPLIED WITH MAGNET)

FIGURE 19 - EXAMPLE OF VERTICAL BELLOWS AND CABIN FEED-THROUGH

BELLOWS

(SUPPLIED/INSTALLED BY CUSTOMER/CONTRACTOR)

07-13-12



\* NOTES:  
SIZE MAY VARY DEPENDING ON QUENCH PIPE DIAMETER AND DESIGN.  
VALUES SHOWN ARE FOR 6\" (TYPICAL) QUENCH PIPE DIAMETER.

FIGURE 20 - BELLOWS FOR 1.5 TESLA MAGNETS

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FLEXIBLE TUBE

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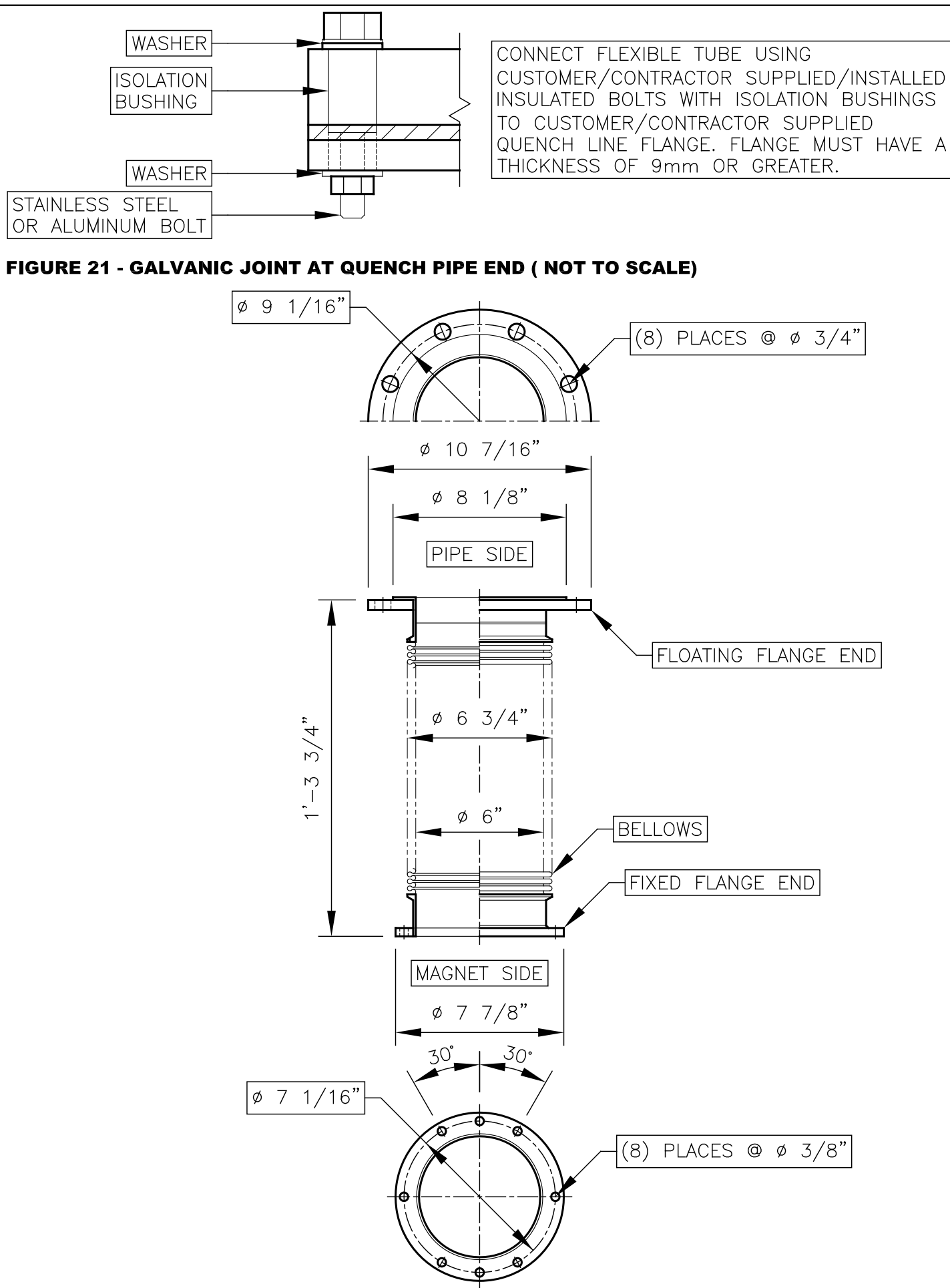


FIGURE 21 - GALVANIC JOINT AT QUENCH PIPE END ( NOT TO SCALE)

FIGURE 22 - FLEXIBLE TUBE FOR 1.5 TESLA MAGNETS

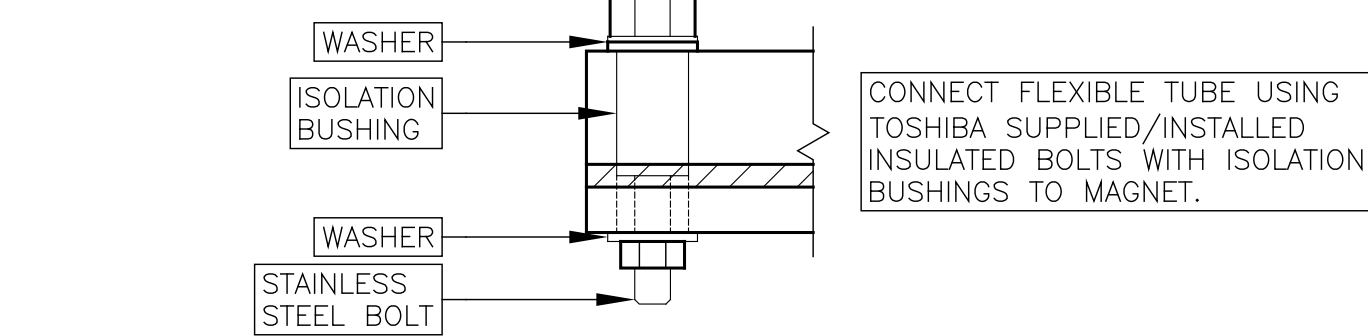
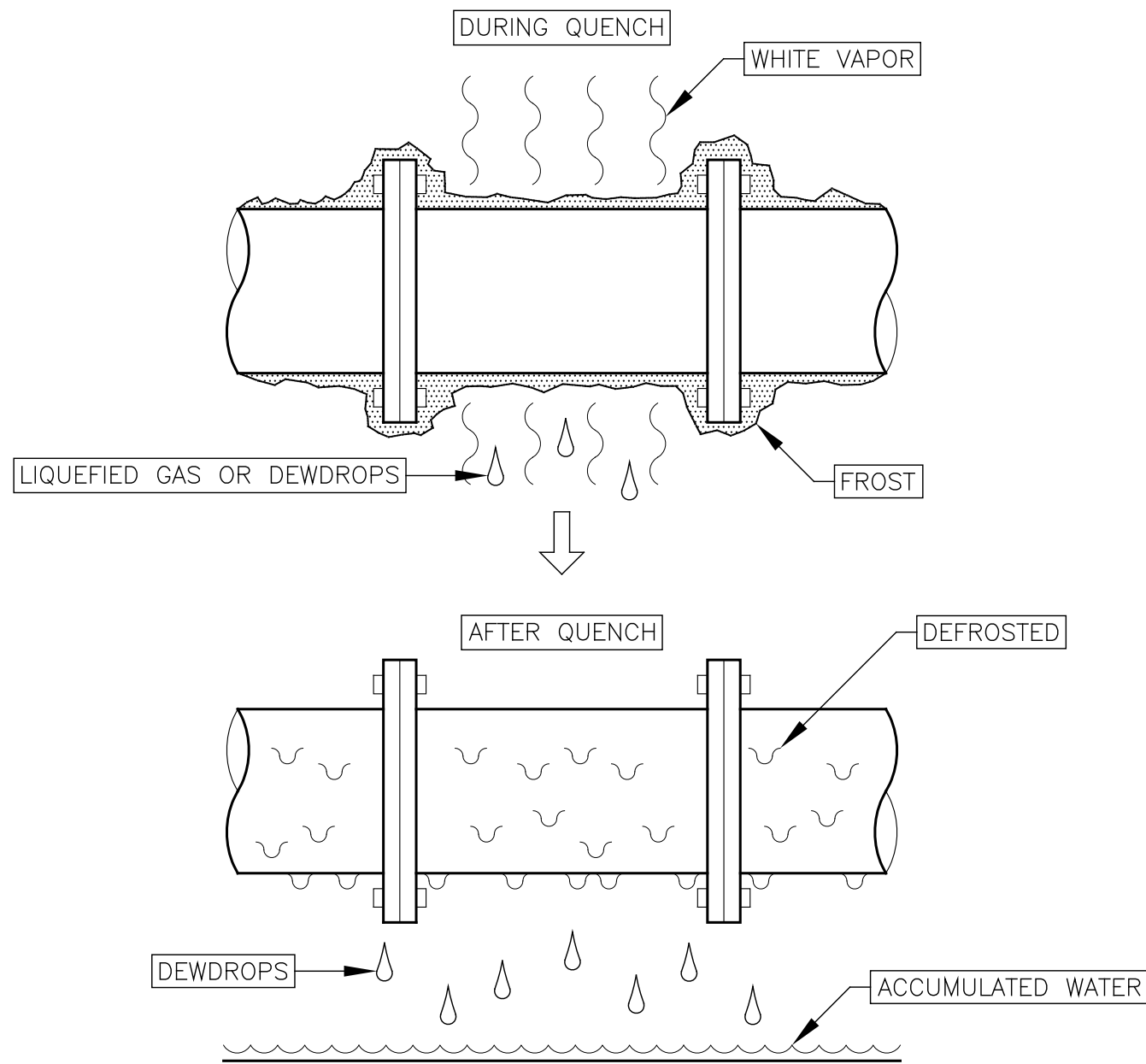


FIGURE 23 - GALVANIC JOINT AT MAGNET END ( NOT TO SCALE)

QUENCH LINE CONDENSATION

07-08-11

[IF THE QUENCH PIPE IS NOT THERMALLY INSULATED, THE FOLLOWING WILL OCCUR:]

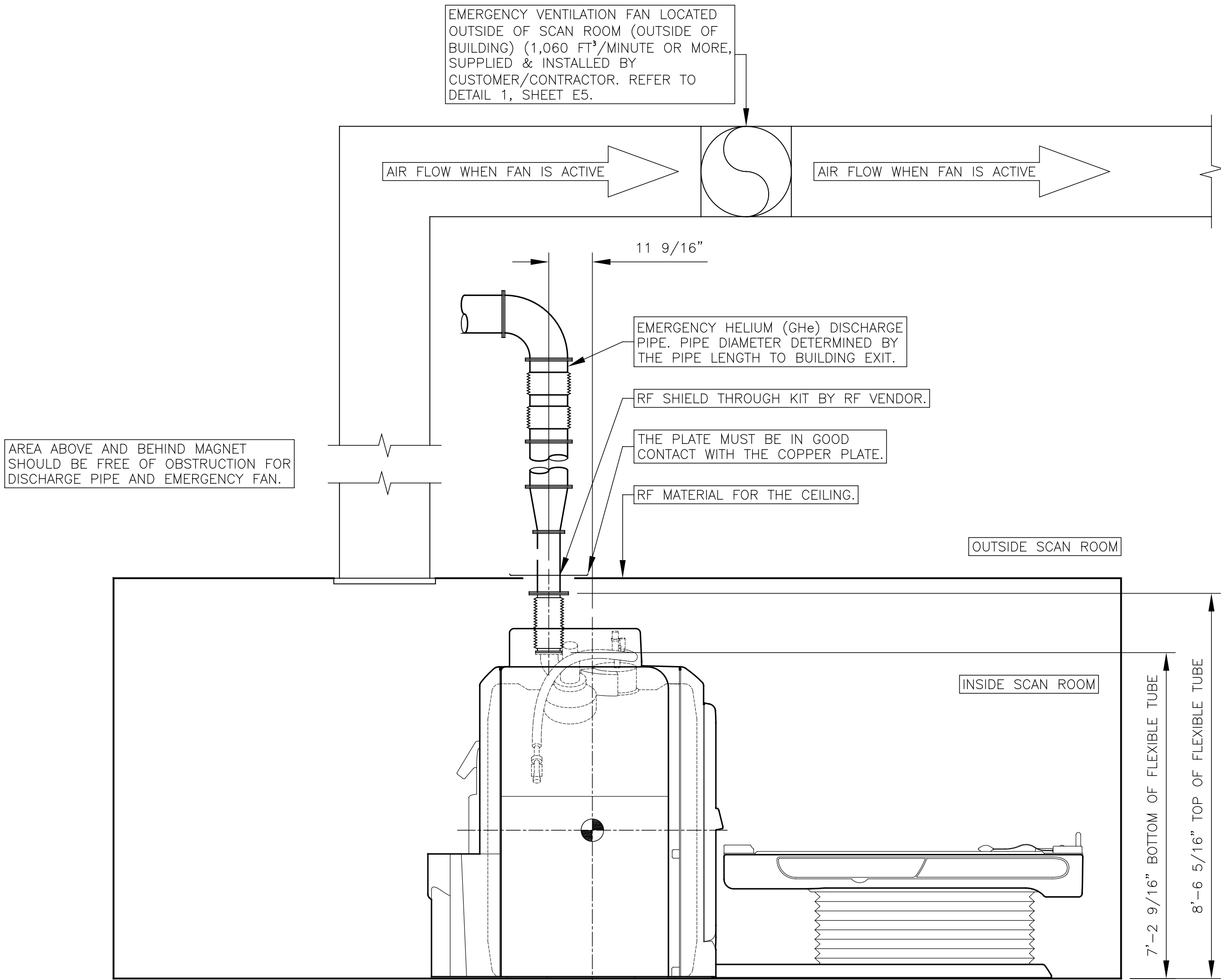


NOTE:  
CONDENSATION MAY OCCUR EVEN IF THE PIPE IS THERMALLY INSULATED.  
THEREFORE, ELECTRICAL WIRING MUST NOT BE LOCATED UNDER THE PIPE.

FIGURE 24 - QUENCH LINE CONDENSATION ( NOT TO SCALE)

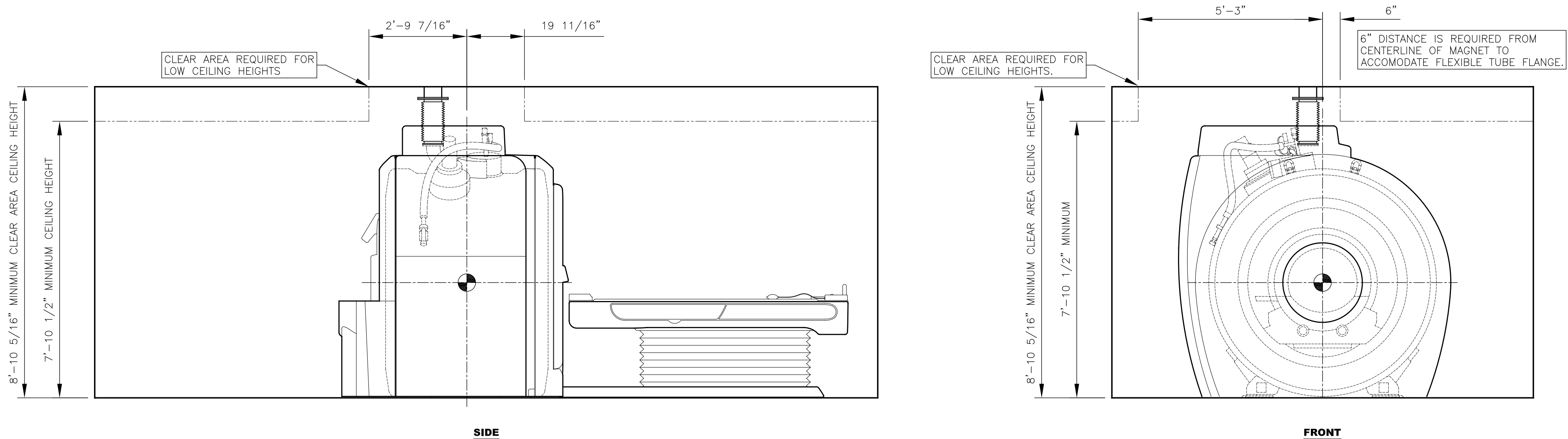
QUENCH LINE AND EMERGENCY VENTILATION FAN

09-05-12



INSTALLATION SPACE FOR THE GANTRY

09-05-12



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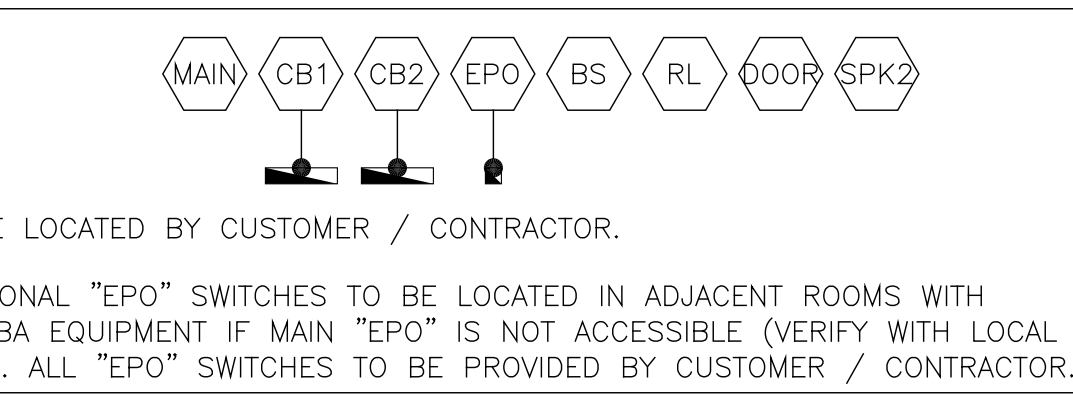
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**NOTE:**  
GROMMETED OPENINGS ARE SHOWN FOR  
REFERENCE ONLY. VERIFY SIZE AND LOCATION  
WITH TOSHIBA REPRESENTATIVE.

JB3	10" W X 10" L X 4" H, J-BOX FLUSH MOUNTED IN FINISHED CEILING. OPEN TO "VR2".
RL	ROOM LIGHTING (BY CUSTOMER/CONTRACTOR).
SPK2	SCAN ROOM SPEAKER.
DOOR	DOOR SWITCH. EXACT LOCATION T.B.D.
	QUAD 110V ELECTRICAL OUTLETS FOR SYSTEM EQUIPMENT AND/OR SERVICE EQUIPMENT. OUTLETS TO BE LOCATED IN EACH ROOM WHERE SYSTEM EQUIPMENT IS LOCATED.
	RJ45 CONNECTOR, CAT5 CABLE TO BE USED FOR DATA CONNECTION FOR NETWORKING.
	DEDICATED PHONE LINE SUPPLIED/INSTALLED BY CUSTOMER/CONTRACTOR.
	CUSTOMER/CONTRACTOR PROVIDED SERVICE ELECTRICAL OUTLETS THAT CONNECTS TO "FPC1".

1

E5

## **SCAN ROOM EMERGENCY LIGHTS**

IF RECHARGEABLE BATTERY LIGHTS ARE TO BE USED IN THE SCAN ROOM, THE CHARGING UNIT MUST BE LOCATED OUTSIDE OF THE RF ROOM. THE CHARGING LEADS MUST BE ROUTED INTO THE RF ROOM VIA APPROPRIATE POWER FILTERS TO THE LIGHT AND THE BATTERY.

## **ALL MATERIAL IN SCAN ROOM**

## **MUST BE NON-FERROUS**

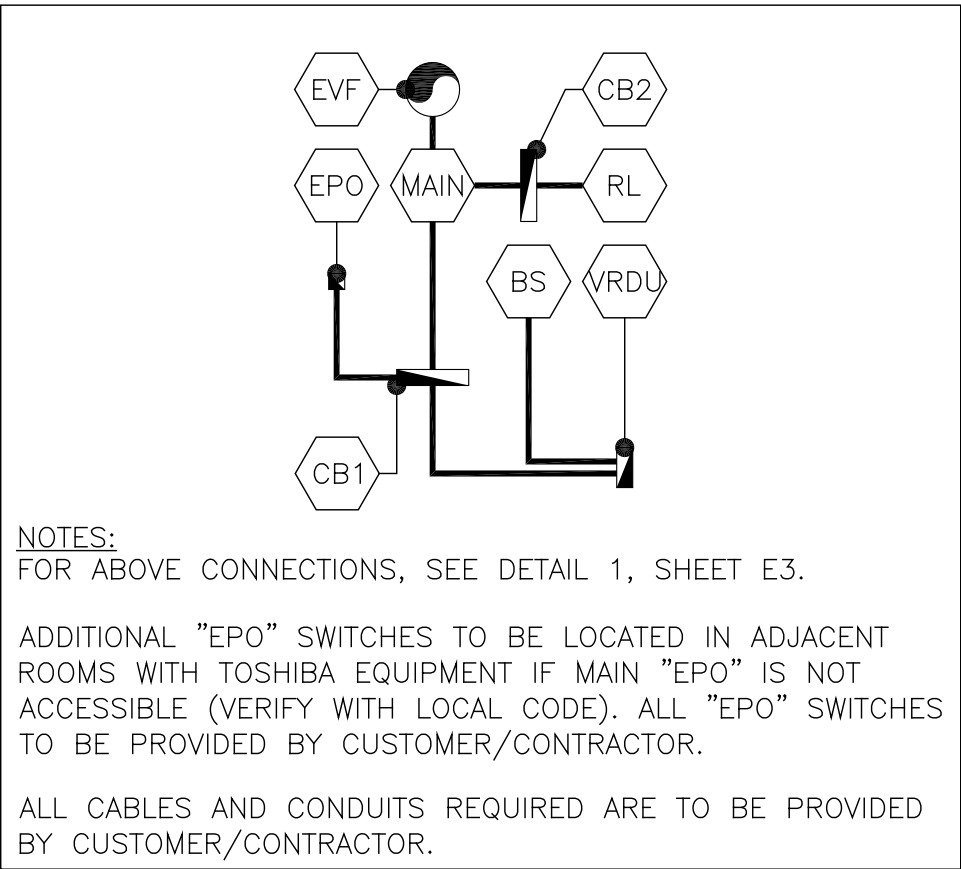
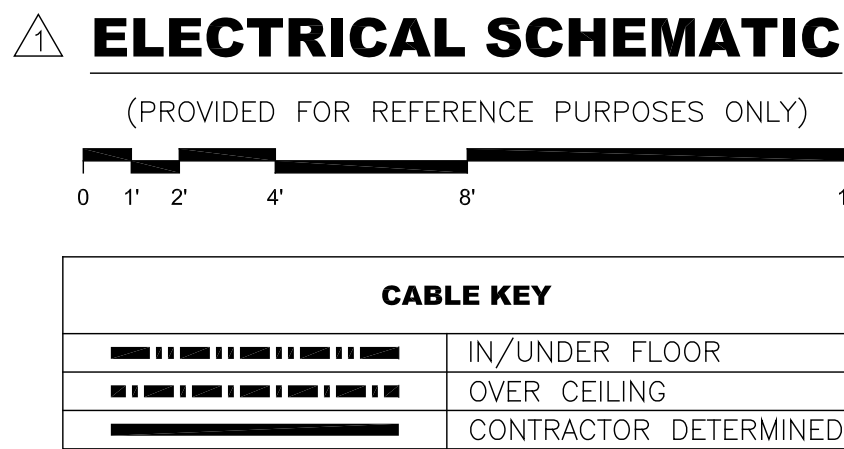
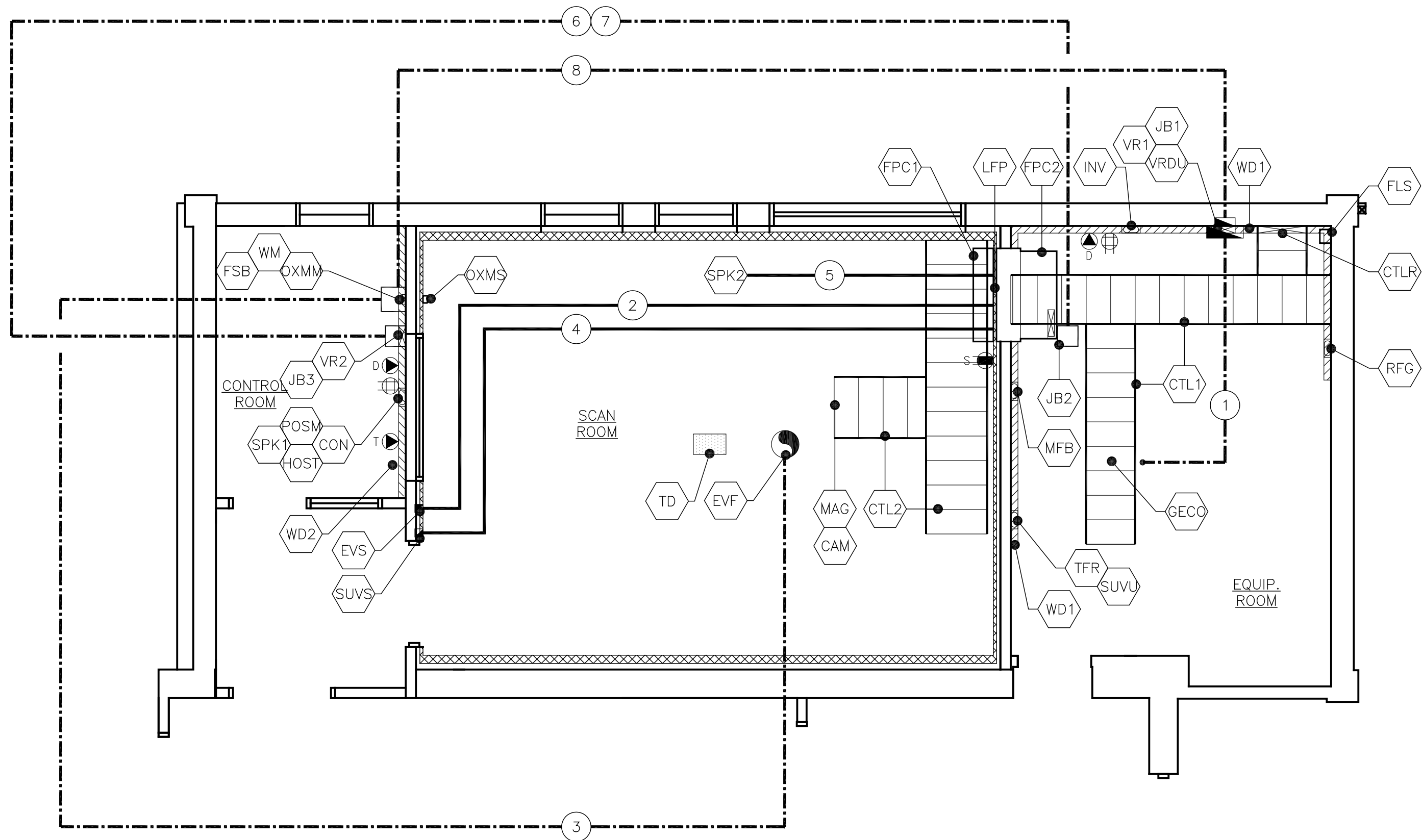
**ALL MATERIAL IN SCAN ROOM**  
**MUST BE NON-FERROUS**

**SCAN ROOM EMERGENCY LIGHTS**

IF RECHARGEABLE BATTERY LIGHTS ARE TO BE USED IN THE SCAN ROOM, THE CHARGING UNIT MUST BE LOCATED OUTSIDE OF THE RF ROOM. THE CHARGING LEADS MUST BE ROUTED INTO THE RF ROOM VIA APPROPRIATE POWER FILTERS TO THE LIGHT AND THE BATTERY.

**ALL MATERIAL IN SCAN ROOM  
MUST BE NON-FERROUS**

# E1



CONDUIT SCHEDULE

CONTRACTOR CONDUIT REFERENCE						CABLE REFERENCE			
RUN NO.	CONDUIT (POINT TO POINT)		CONDUIT (ROUTING)	CONDUIT (DIAMETER)	CONDUIT (MAX. LENGTH)	CABLE (POINT TO POINT)		CABLE LENGTH (USABLE)	CABLES (SUPPLIED BY)
1	VRDL	GECC	OVER CEILING	2 1/2"	TBD*	VRDL	GECC	SEE RUN "N" DETAIL (1/E6)	TOSHIBA
2	LFP	EVS	CONTRACTOR DETERMINED	1"	CONTRACTOR DETERMINED	LFP	EVS	PER CONTRACTOR	CONTRACTOR (IN RF SHIELD)
3	FSB	EVF	OVER CEILING	1"	27'-0"	FSB	EVF	SEE RUN "A" DETAIL (1/E6)	CONTRACTOR (THRU RELAY BOX)
4	LFP	SUVS	CONTRACTOR DETERMINED	1"	CONTRACTOR DETERMINED	LFP	SUVS	SEE RUN "CC" DETAIL (1/E6)	TOSHIBA (SIGNAL) (IN RF SHIELD)
5	LFP	SPK2	CONTRACTOR DETERMINED	1/2"	45'-0"	LFP	SPK2	SEE RUN "DD" DETAIL (1/E6)	TOSHIBA (SIGNAL) (IN RF SHIELD)
6	JB2	JB3	OVER CEILING	3"	TBD*	TFR	CON	SEE RUN "H" DETAIL (1/E6)	TOSHIBA
7	JB2	JB3	OVER CEILING	3"	TBD*	GECC	HOST	SEE RUN "L" DETAIL (1/E6)	TOSHIBA
						GECC	CON	SEE RUN "E" DETAIL (1/E6)	TOSHIBA
						GECC	HOST	SEE RUN "L" DETAIL (1/E6)	TOSHIBA
						GECC	DOOR	SEE RUN "AA" DETAIL (1/E6)	TOSHIBA
8	JB1	FSB	OVER CEILING	PER CODE	TBD*	LFP	CON	SEE RUN "D" DETAIL (1/E6)	TOSHIBA
						VRDL	FSB	SEE RUN "C" DETAIL (1/E6)	TOSHIBA (POWER)

NOTE:  
A. CONDUITS SUPPLIED/INSTALLED BY CUSTOMER/CONTRACTOR.  
B. ALL CONDUIT RUNS MUST TAKE THE SHORTEST MOST DIRECT ROUTE POSSIBLE.  
C. CONDUITS MAY HAVE A MAXIMUM OF (3) 90° BENDS.  
D. CONDUIT IS NOT TO BE RUN IN SUCH A MANNER THAT WILL ALLOW CABLE POINT TO POINT LENGTHS TO BE EXCEEDED AS SHOWN IN CONDUIT LEGEND.  
E. ALL GROUND WIRES NEED TO BE INSULATED/ISOLATED.  
F. CONTRACTOR TO PROVIDE PULL STRINGS IN EACH CONDUIT.

\* FINAL LENGTH OF CONDUIT TO BE DETERMINED IN FIELD BY I.P.M.

ALL MATERIAL IN SCAN ROOM  
MUST BE NON-FERROUS

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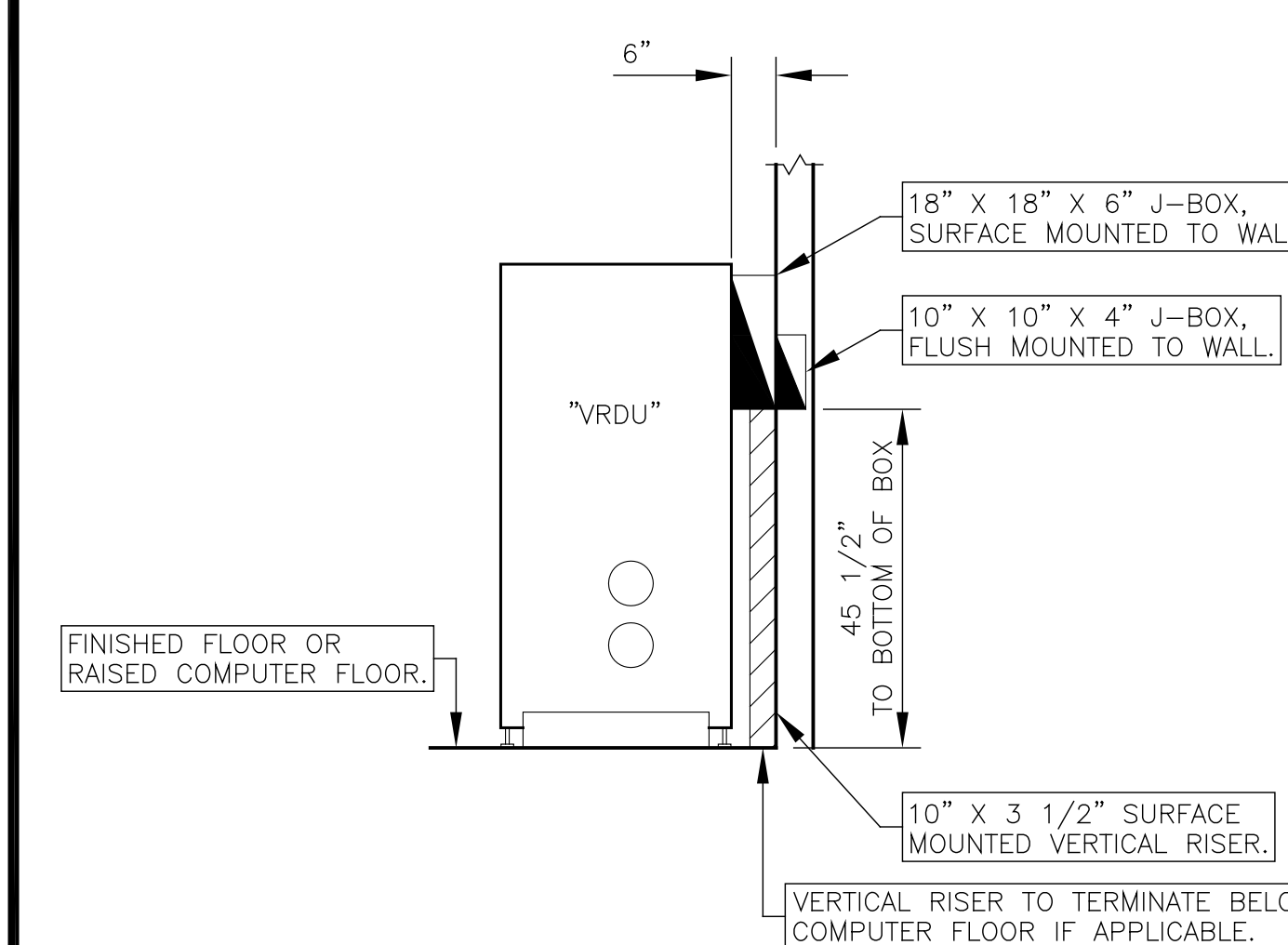
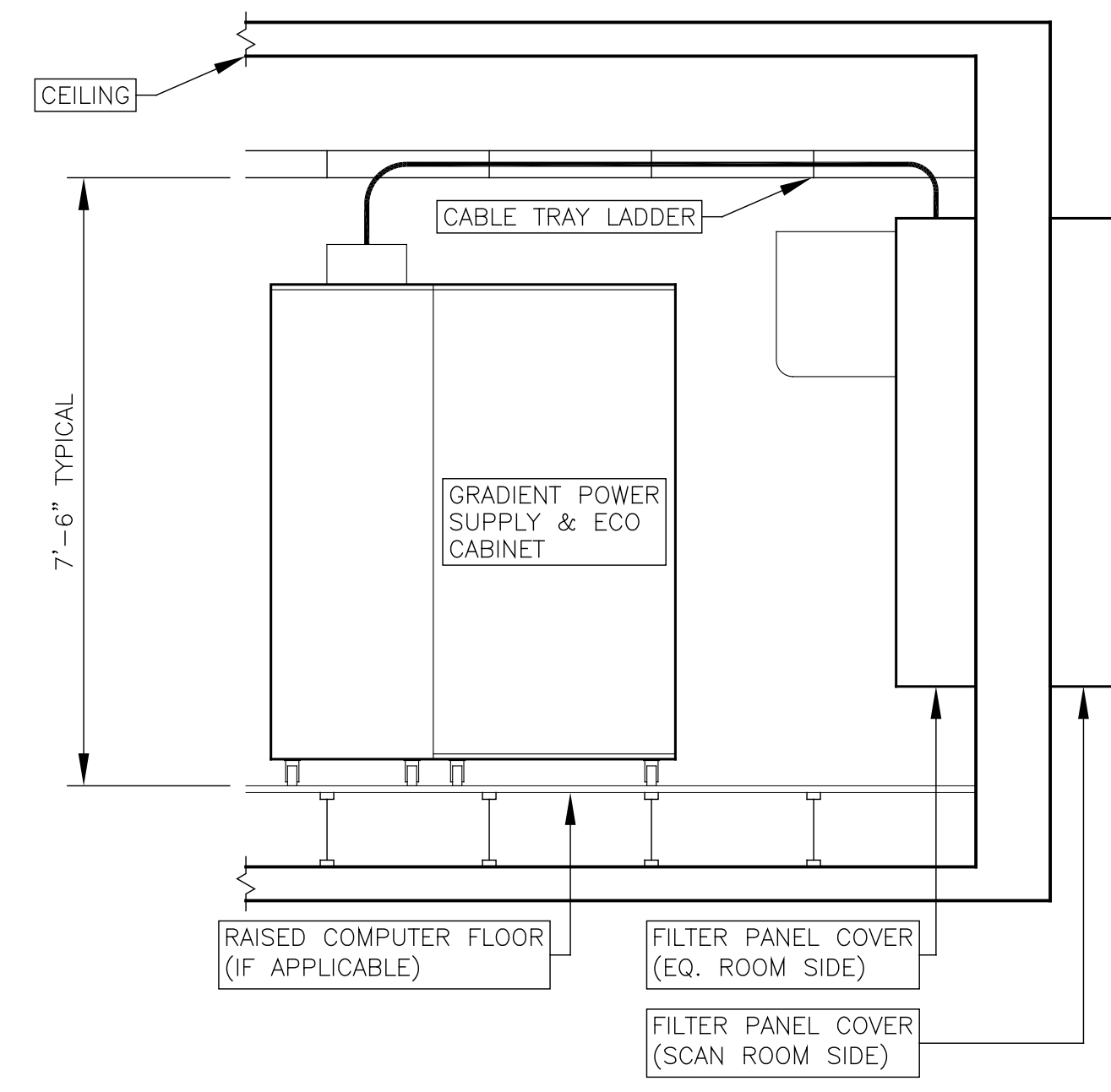
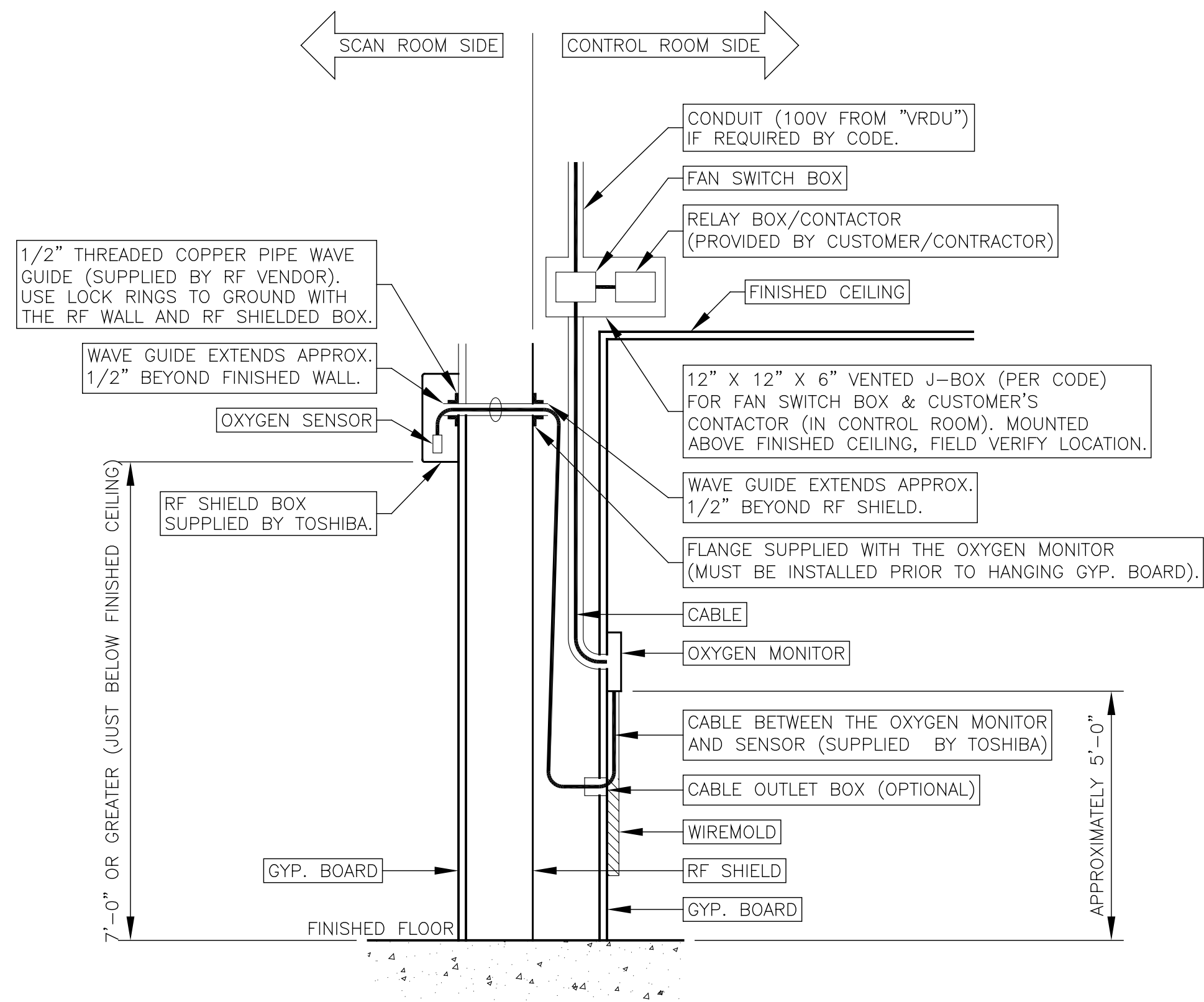
SCALE: 1/4" = 1'-0"

PLANNER: M.S.

SID: 30008346

PROJECT NO.  
130013741MRF1





**1 CONNECTION OF "OXMM" & "OXMS"**  
SCALE: NOT TO SCALE

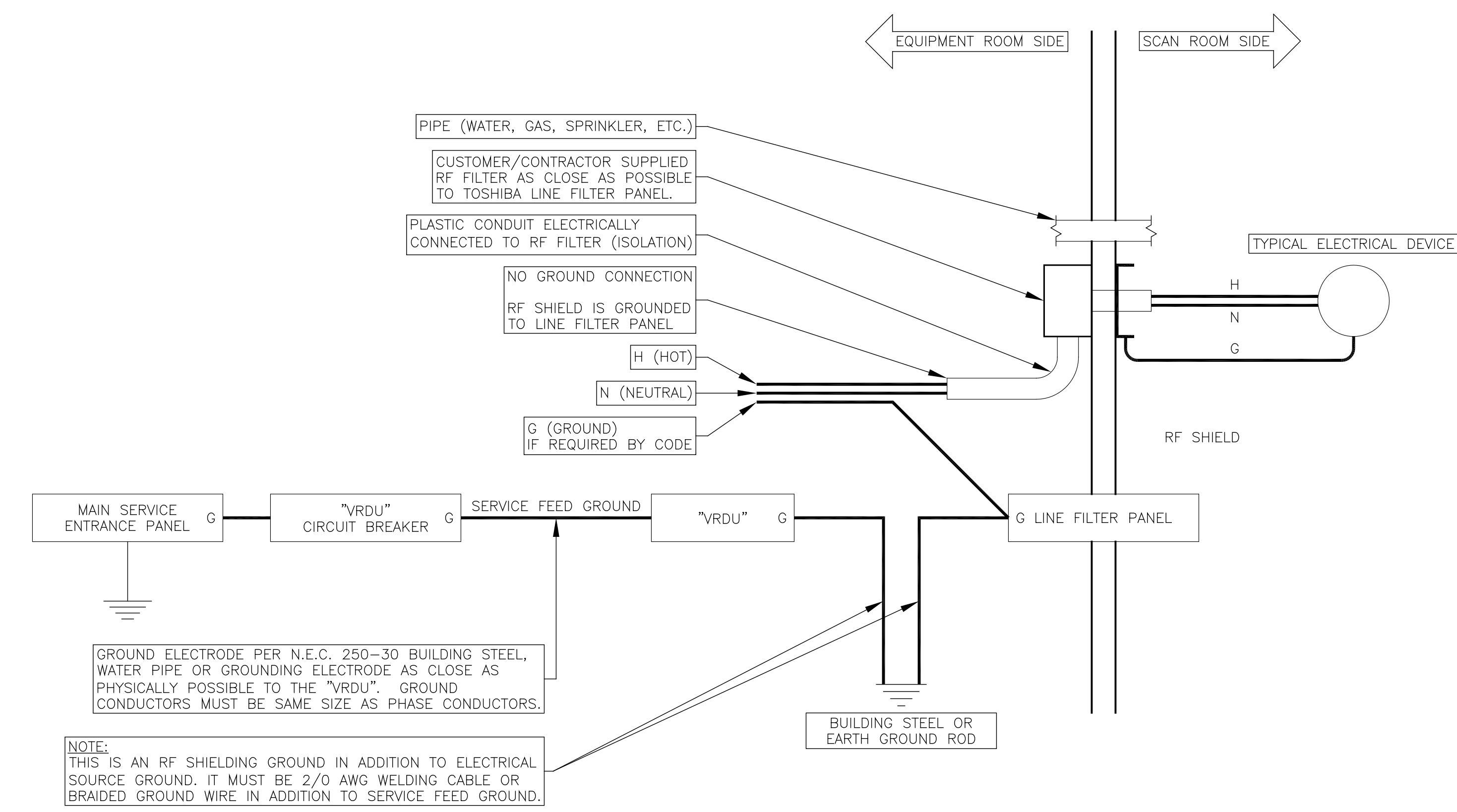
01-10-11

**2 TYPICAL CABLE LADDER ELEVATION**  
1/2" = 1'-0"

09-05-12

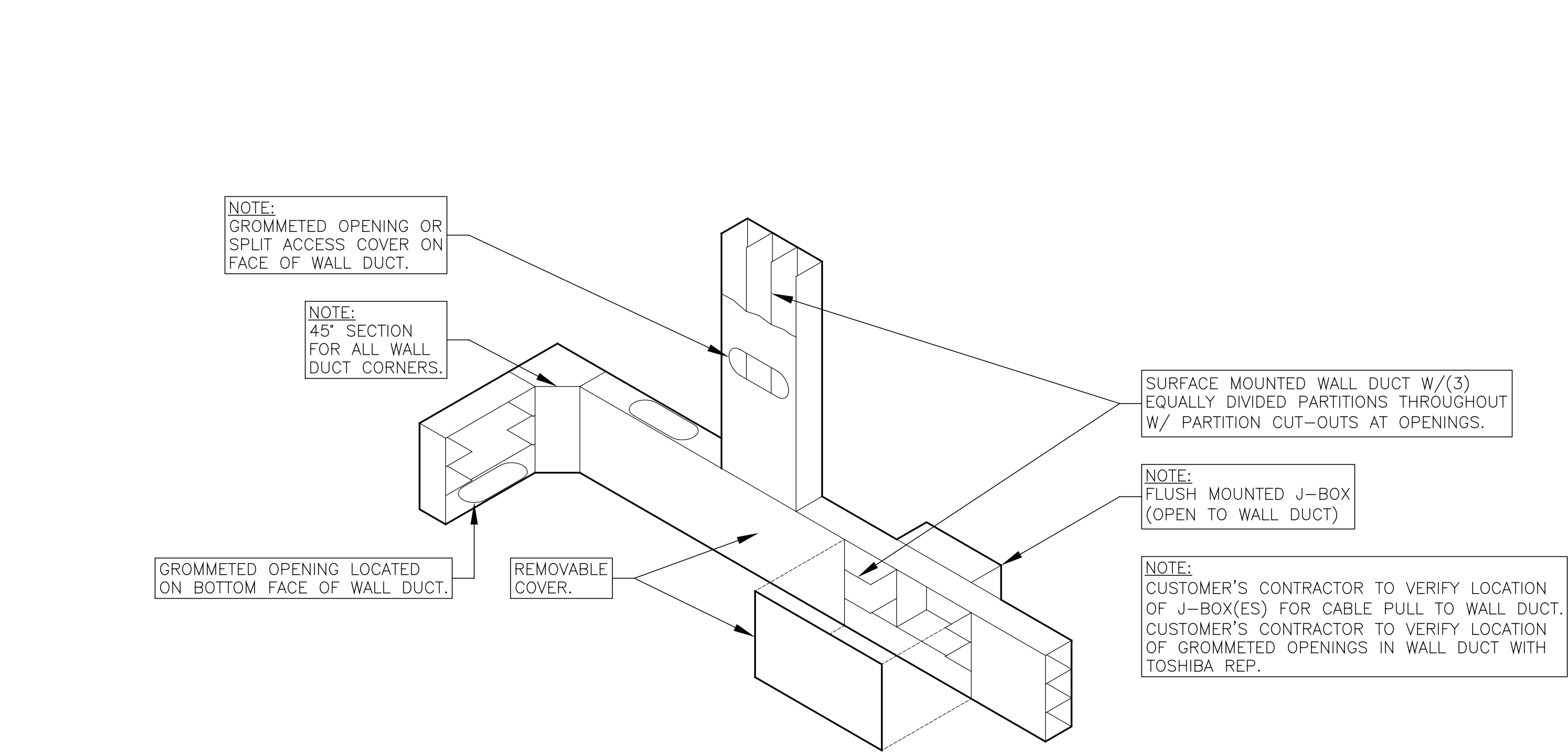
**3 "VRDU" ELECTRICAL ELEVATION**  
SCALE: 1/2" = 1'-0"

01-10-11



**4 TYPICAL SCAN ROOM GROUNDING**  
SCALE: NOT TO SCALE

01-10-11



**5 TYPICAL WALL DUCT DETAIL WITH WALL DUCT / J-BOX / VERTICAL RISER**  
SCALE: NOT TO SCALE

01-10-11

TOSHIBA

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REV	DATE	DESCRIPTION	INT
Δ	09-04-13	ORIGINAL FINAL DRAWINGS COMPLETED.	MS
Δ	11-12-13	NO CHANGES MADE TO THIS SHEET.	MS

PINNACLE TRISTAN ASSOCIATES

(MR SCAN ROOM - TITAN)

32 NORTHEAST DRIVE  
HERSHEY, PA 17033

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DATE: 11-12-13

SCALE: AS NOTED

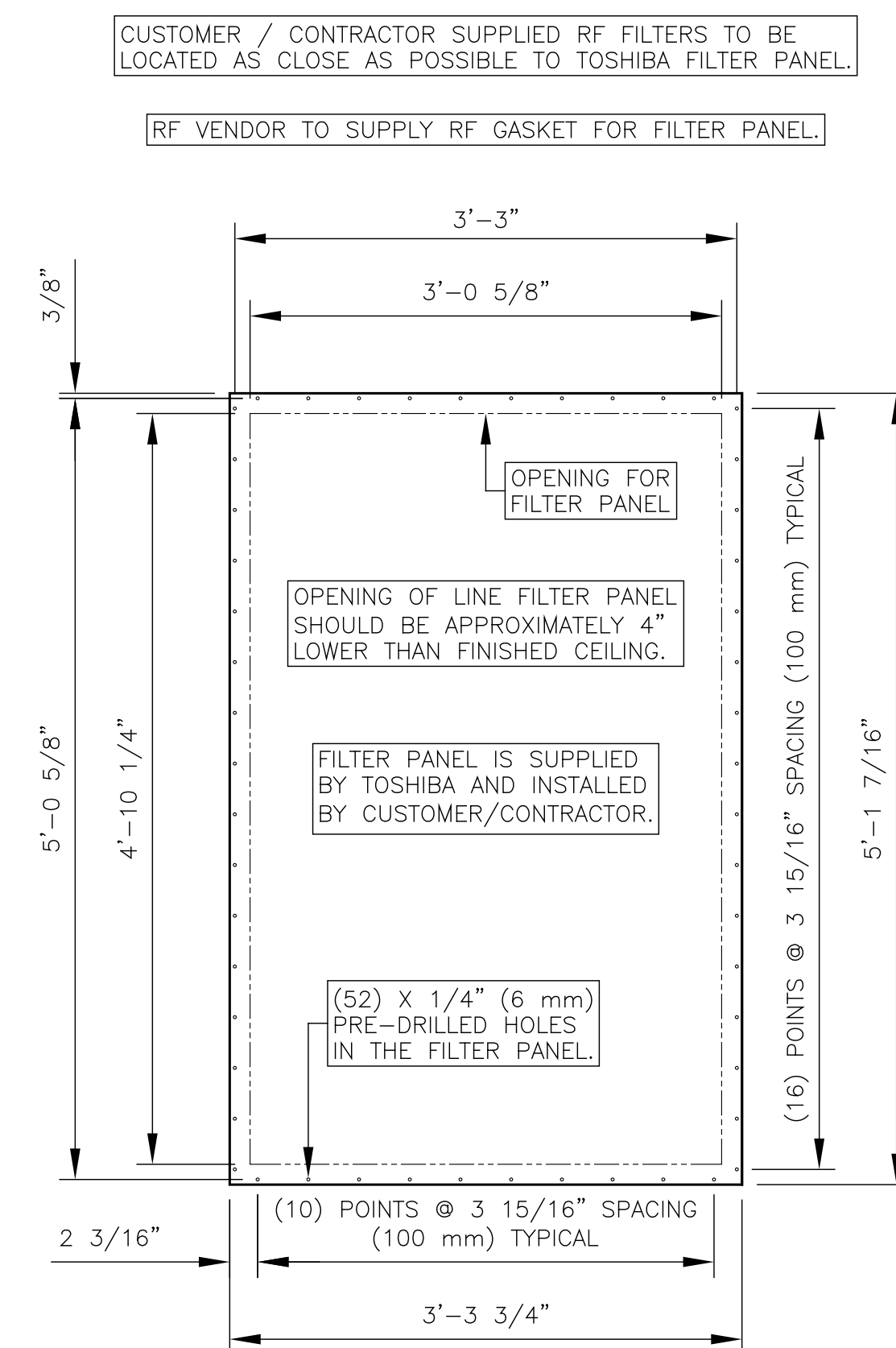
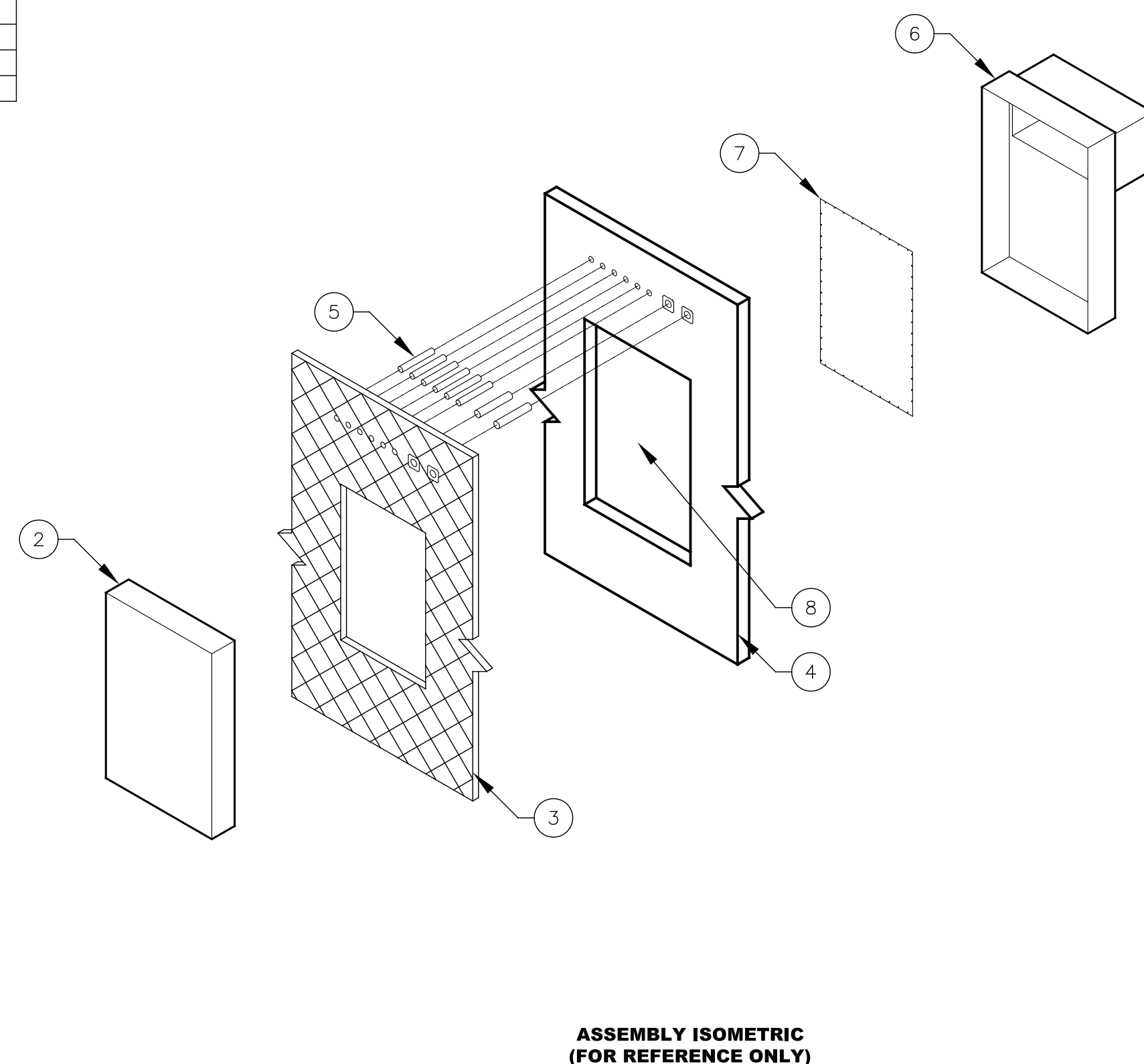
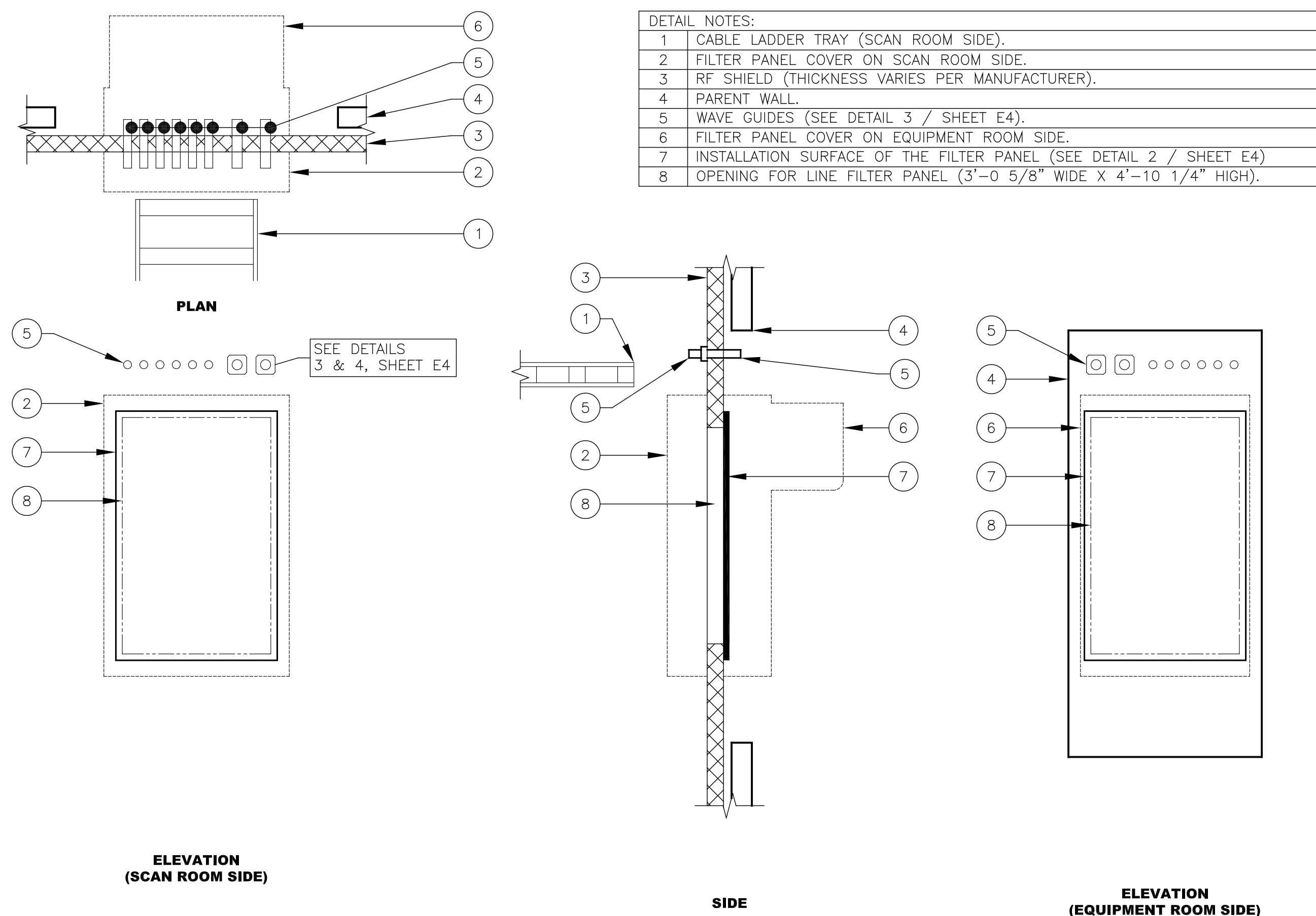
PLANNER: M.S.

SID: 30008346

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**E3**

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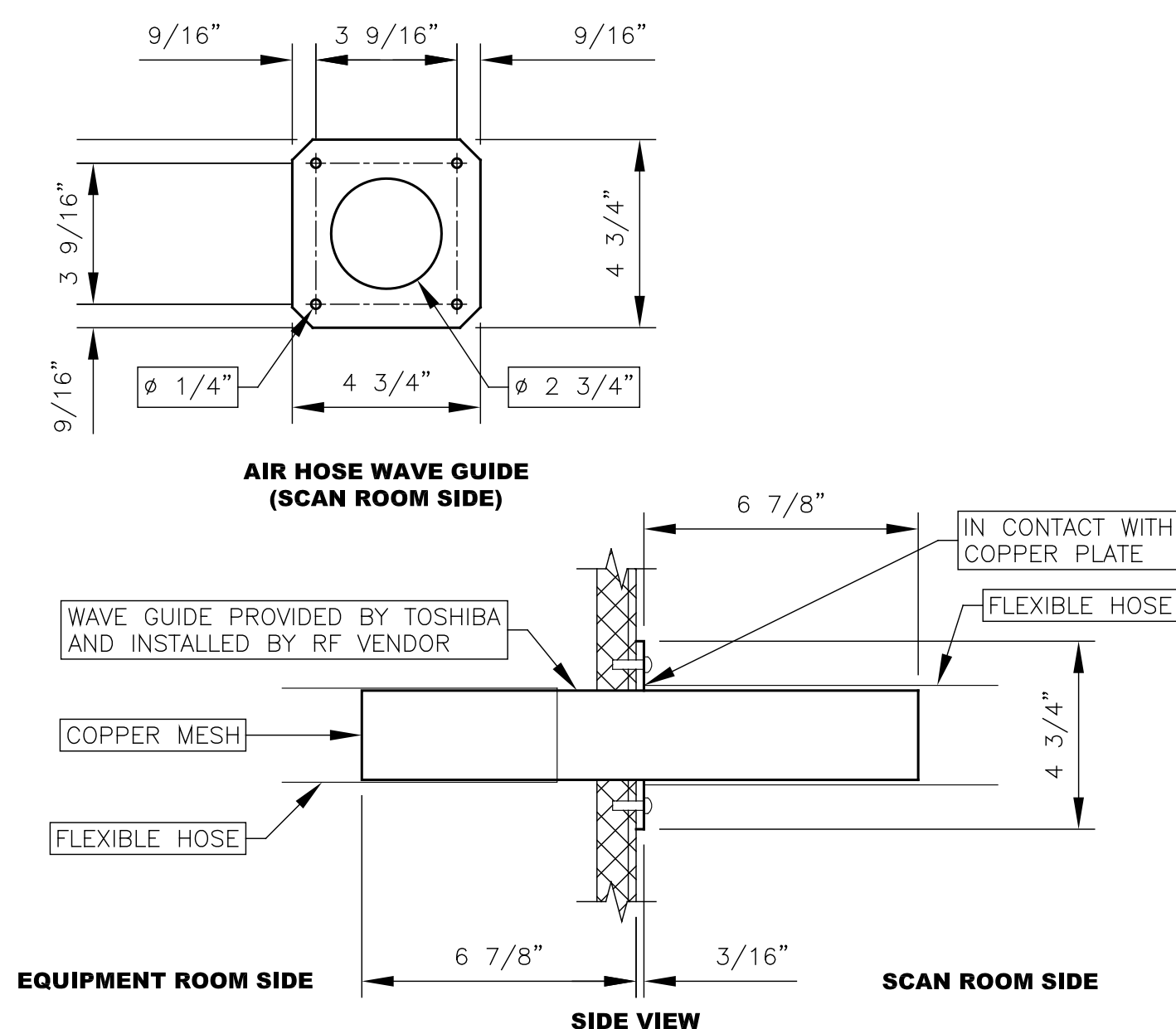
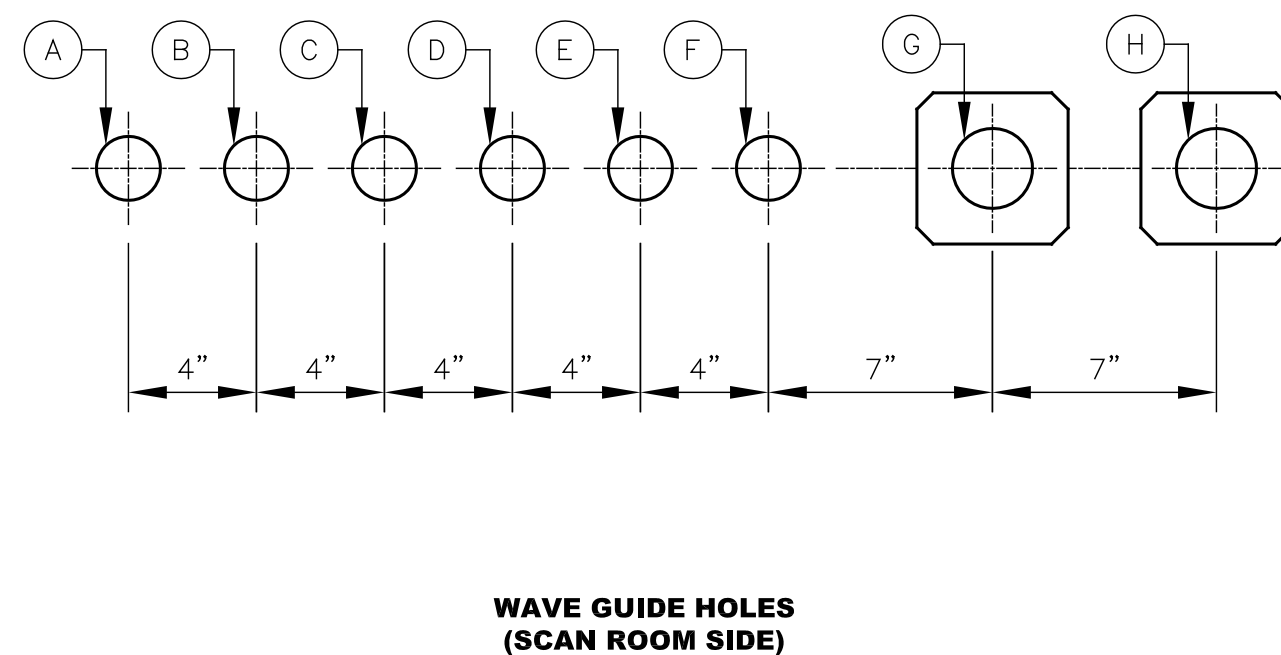


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REV	DATE	DESCRIPTION	INT
1	09-04-13	ORIGINAL FINAL DRAWINGS COMPLETED.	MS
2	11-12-13	UPDATED DETAIL #2.	MS

## 1 TYPICAL INSTALLATION AREA OF THE FILTER PANEL

SCALE: 1/2" = 1'-0"



DETAIL NOTES:					
ITEM	DESCRIPTION	SIZE (DIAMETER)	MIN. LENGTH	PROVIDED BY	INSTALLED BY
A	HELIUM (SUPPLY)	2"	12"	RF VENDOR	RF VENDOR
B	HELIUM (RETURN)	2"	12"	RF VENDOR	RF VENDOR
C	WATER HOSES (SUPPLY & RETURN)	2"	12"	RF VENDOR	RF VENDOR
D	FIBER OPTIC	2"	12"	RF VENDOR	RF VENDOR
E	VACUUM	2"	12"	RF VENDOR	RF VENDOR
F	SERVICE	2"	12"	RF VENDOR	RF VENDOR
G	AIR HOSE (TO MAGNET FAN BOX)	2 1/2"	15"	TOSHIBA	RF VENDOR
H	AIR HOSE (TO MAGNET FAN BOX)	2 1/2"	15"	TOSHIBA	RF VENDOR

**DETAIL NOTES:**

- A. INSTALL THE DEDICATED WAVE GUIDE (SHIPPED BEFOREHAND IN THE PRE-INSTALLATION KIT) THE RF SHIELD TO COOL THE WB COIL OF THE TITAN SYSTEM USING THE FAN IN THE EQUIPMENT ROOM.
- B. WAVE GUIDE RECOMMENDED SIZE IS 2 1/2" IN DIAMETER (WAVE GUIDE SIZE RANGE IS BETWEEN 2 3/8" – 2 3/4" IN DIAMETER)
- C. THE LENGTH OF HOSE FROM THE REAR OF THE GANTRY TO THE FANBOX SHOULD BE LESS THAN 49'-2".
- D. THE COPPER PLATE (SHOWN ABOVE) OF THE WAVE GUIDE MUST BE IN CONTACT WITH THE SHIELD.
- E. IF THERE ARE (6) TAPPED HOLES, 4 SCREWS ARE USED TO INSTALL THE WAVE GUIDE, IF NOT, (4) WOOD SCREW (NOT PROVIDED BY TOSHIBA) ARE NEEDED.
- F. SCREWS OF ANY MATERIAL CAN BE USED TO SECURE THE COPPER PLATE IN THE COMPUTER ROOM.
- G. SCREWS OF A NON-MAGNETIC MATERIAL MUST BE USED TO SECURE THE COPPER PLATE IN THE SCAN ROOM.
- H. INSTALL COPPER MESH (PROVIDED BY TOSHIBA) ON EQUIPMENT ROOM SIDE OF AIR HOSE WAVE GUIDE.

### 3 TYPICAL FILTER PANEL WAVE GUIDES

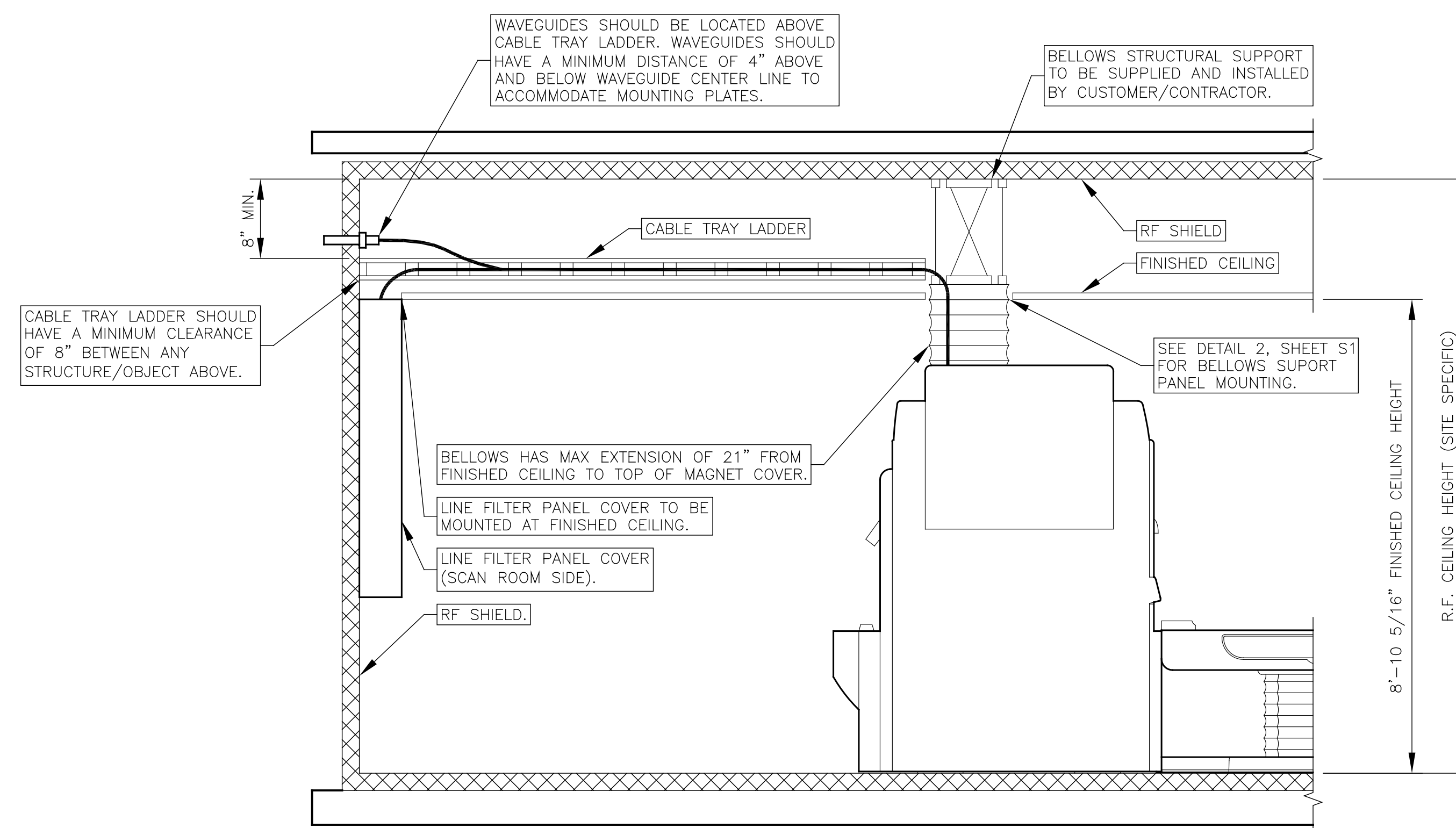
SCALE: 2" = 1'-0"

## 4 AIR HOSE WAVE GUIDE

SCALE: 3" = 1'-0"

## 5 CEILING CABLING KIT DETAIL

SCALE: 1/2" = 1'-0"



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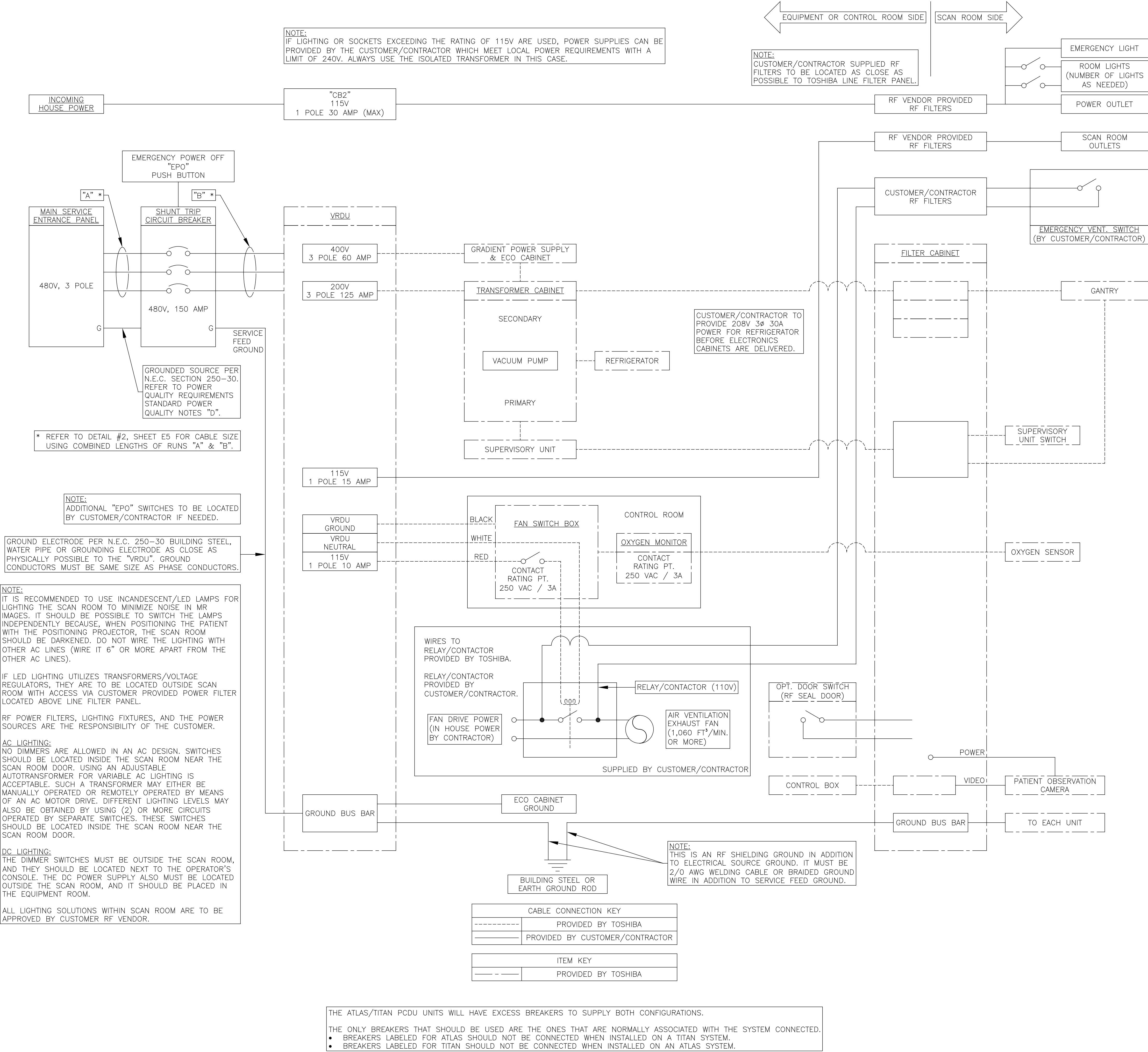
SCALE: AS NOTE

PLANNER: M.S.

SID: 300083

PROJECT NO.  
**130013741MRF1**

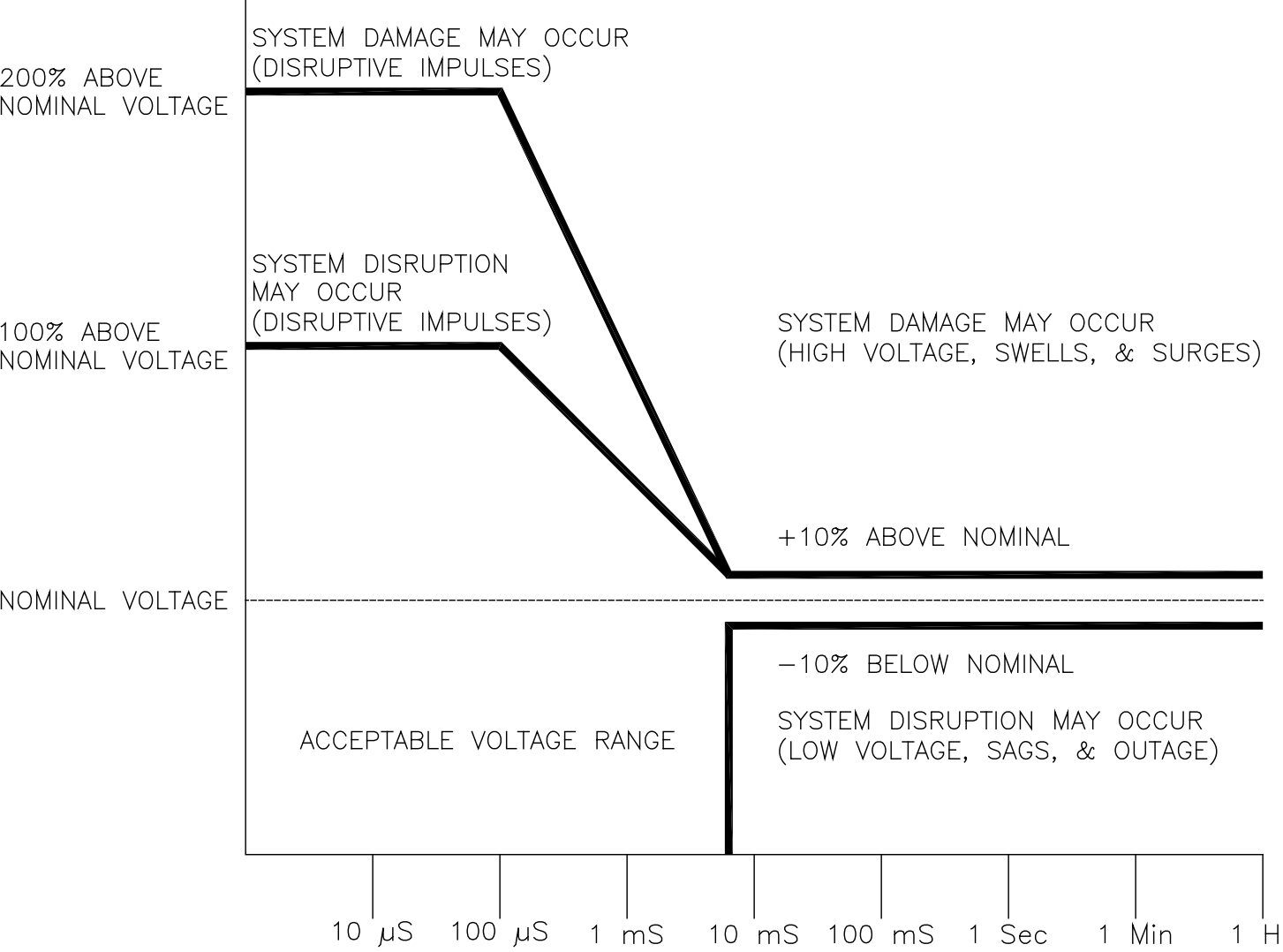
## E4



POWER QUALITY REQUIREMENTS TITAN SCANNER WITH VRDU				
SUPPLY CONFIGURATION:		3 PHASE DELTA		
KVA RATING:		102.00		
VOLTAGE (SEE NOTE B):		480V, 60Hz (PREFERRED)		
CALCULATED CURRENT (AMP):		122.69		
CIRCUIT BREAKER (AMP) (SEE NOTE F):		150		
% IMPEDANCE:		5.00		
LINE RESIST. SPEC.:		0.000		
MAXIMUM CURRENT (AMPS):		122.69		
VOLTAGE DROP (VOLTS):		24.00		
LINE RESIST. (OHMS):		0.196		
LINE DROP (PERCENT):		1.50		
LINE DROP (VOLTS):		7.20		
CONDUCTOR (OHMS):		0.059		
TEMPERATURE:		68°F (20°C)		
CONDUCTOR SIZES (SEE NOTE E)	OHMS PER 1000 FT.	TEMP DERATED	NEC 75 °C	LENGTH (FT.)
1/0 AWG	0.1270	0.1044	150	281
2/0 AWG	0.1010	0.0831	175	353
3/0 AWG	0.0797	0.0655	200	448
4/0 AWG	0.0626	0.0515	230	570
250 MCM	0.0535	0.0440	255	667
300 MCM	0.0446	0.0367	285	800
350 MCM	0.0382	0.0314	310	934
400 MCM	0.0331	0.0272	335	1,078
500 MCM	0.0265	0.0218	380	1,346
VRDU MAX INPUT LUG SIZE 500 MCM				
STEP UP TRANSFORMER MAX INPUT LUG SIZE 500 MCM				
STEP UP TRANSFORMER MAX OUTPUT LUG SIZE 350 MCM				
STEP UP BREAKER IS SET TO 150A				

STANDARD POWER QUALITY NOTES

- A. A GROUNDED NEUTRAL POWER SOURCE IS REQUIRED TO ASSURE RELIABLE EQUIPMENT OPERATION. THE NEUTRAL CONDUCTOR MAY NOT BE USED FOR A PARTICULAR SYSTEM.
- B. IN CASES WHERE MULTIPLE VOLTAGES ARE PERMITTED, THE PREFERRED SYSTEM VOLTAGE IS SPECIFIED.
- C. DUE TO THE HIGH INSTANTANEOUS POWER OF MEDICAL IMAGING SYSTEMS, USE THE HIGHEST AVAILABLE VOLTAGE SOURCE. ENSURE THAT LOWER VOLTAGE SOURCES ARE DERIVED DIRECTLY FROM THE SERVICE ENTRANCE OF THE FACILITY.
- D. GROUND CONDUCTORS ARE REQUIRED TO BE THE SAME SIZE AS THE PHASE CONDUCTORS UNLESS A LARGER SIZE IS REQUIRED BY CODE.
- E. ALL FEEDER AND BRANCH CIRCUIT CONDUCTORS MUST BE COPPER – ALUMINUM IS NOT PERMITTED.
- F. IF THE EQUIPMENT CIRCUIT BREAKER IS NOT LOCATED IN THE CONTROL AREA, A SHUNT TRIP BREAKER MUST BE USED IN ORDER TO COMPLY WITH N.E.C. 517-72(b). A PUSH-BUTTON TO OPERATE THE SHUNT TRIP MUST BE LOCATED IN THE CONTROL AREA.
- G. A SEPARATE CIRCUIT, FED FROM THE FACILITY RADIOLOGY PANEL OR A MAIN SERVICE PANEL IS REQUIRED. USE OF A SUB PANEL WITH LOADS SUCH AS ELEVATORS, HVAC, MOTORS, ETC., IS NOT PERMITTED.
- H. DEVICES SUCH AS UNINTERRUPTIBLE POWER SUPPLIES, POWER CONDITIONERS, VOLTAGE REGULATORS, AND FILTERS MAY BE INCOMPATIBLE WITH THIS IMAGING EQUIPMENT. CONSULT YOUR TOSHIBA SERVICE REPRESENTATIVE PRIOR TO PURCHASING OR INSTALLING THESE DEVICES.
- I. THE MAINS POWER GROUND CONDUCTOR IS TO BE RUN WITH THE POWER PHASE CONDUCTORS. THE GROUNDS TO BUILDING STEEL OR EARTH GROUND ARE NOT TO BE RUN WITH THE PHASE CONDUCTORS.
- J. POWER AND GROUND CABLES SHOULD BE FLEXIBLE WELDING TYPE CABLES, NOT THHN TYPE AS LONG AS IT MEETS LOCAL CODE.



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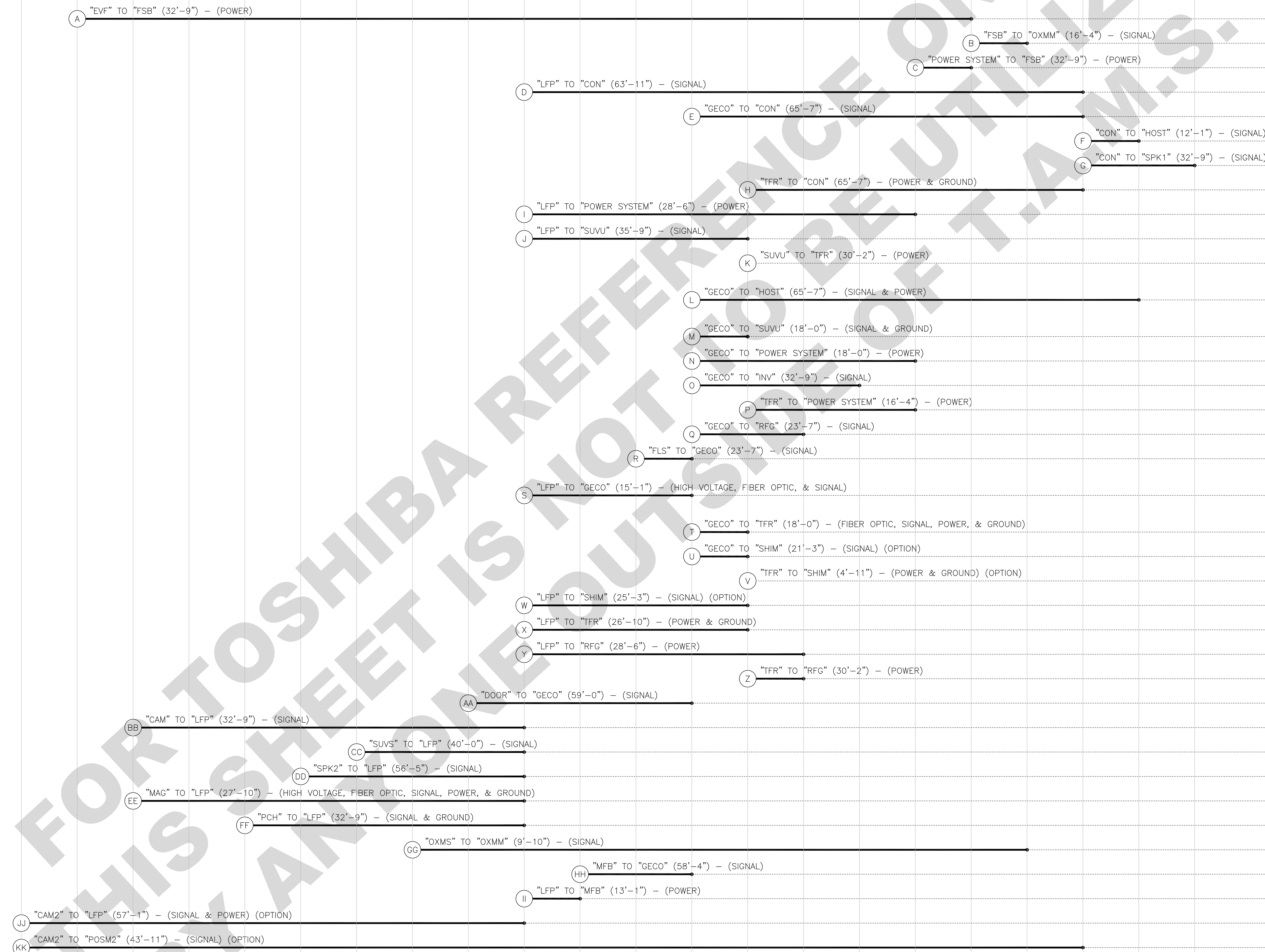
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**E5**





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						<u>A</u>	09-04-13	ORIGINAL FINAL DRAWINGS COMPLETED.	MS
						<u>A</u>	11-12-13	NO CHANGES MADE TO THIS SHEET.	MS
(MR SCAN ROOM - TITAN)									
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