AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
	1 | 3

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO.(If applicable)
0002	17-Nov-2009		

6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than item 6)	CODE
U.S. ARMY ENGINEER DISTRICT, AK CEPOA-CT (W911KB) PO BOX 6898 ELMENDORF AFB AK 99506-0898	W911KB	**See Item 6**	

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)		
	X	9A. AMENDMENT OF SOLICITATION NO. W911KB-09-R-0007
	X	9B. DATED (SEE ITEM 11) 28-Sep-2009
		10A. MOD. OF CONTRACT/ORDER NO.
		10B. DATED (SEE ITEM 13)
CODE / FACILITY CODE		

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer [ ] is extended, [X] is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS.
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

[ ] A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

[ ] B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).

[ ] C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

[ ] D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

PROJECT TITLE: FTW336A, Aircraft Parts Storage Building, Fort Wainwright, Alaska.

PROPOSAL DUE DATE IS UNCHANGED and remains 24 November 2009, 12:00 PM Alaska Time.

This amendment provides changes to the solicitation as indicated on page 2 of this document.

PLEASE MARK THE OUTSIDE OF ENVELOPE IN WHICH PROPOSAL IS SUBMITTED TO SHOW AMENDMENTS RECEIVED. YOU ARE REQUIRED TO ACKNOWLEDGE RECEIPT OF THIS AMENDMENT ON THE REVERSE SIDE OF THE STANDARD FORM 1442.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) TEL: EMAIL:	
15B. CONTRACTOR/OFFEROR _____ (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY _____ (Signature of Contracting Officer)	16C. DATE SIGNED 17-Nov-2009

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

The following have been added by full text:

AMENDMENT 0002

a. The following drawings are substituted for the superseded drawings.

Sheet D1.01, Civil, Demolitions Plan
Sheet C0.01, Civil, Soil Borings Logs 1 of 2
Sheet C0.02, Civil, Soil Borings Logs 2 of 2
Sheet C1.01, Civil, Overall Site Plan
Sheet C4.03, Civil, Miscellaneous Details
Sheet A3.01, Architectural, Elevation Views
Sheet A3.02, Architectural, Elevation Views
Sheet A4.03, Architectural, Wall Sections
Sheet A4.04, Architectural, Wall Sections
Sheet A5.04, Architectural, Interior Elevations
Sheet S1.01, Structural, Foundation Plan
Sheet S3.01, Structural, Foundation Details 1
Sheet S3.05, Structural, Foundation Details 5
Sheet M4.04, Mechanical, ERV-1 Control Diagram and Matrix

b. The following revised documents are substituted for the superseded documents. The identifier "**AM#2**" appears before and after new and/or revised material, except as noted below.

SECTION 04 20 00, Masonry
Revised paragraph 2.2 (Issuing entire section)

SECTION 04 21 13.13, Non Bearing Masonry Veneer/Steel Wall Studs
Revised paragraph 2.1.1 (Issuing entire section)

SECTION 07 24 00, Exterior Insulation Finish System
Revised paragraph 2.9 (Issuing entire section)

SECTION 09 51 00, Acoustical Ceilings
Revised paragraph 2.1.2 (Issuing entire section)

SECTION 09 90 00.00 40, Painting and Coating
Revised paragraphs 3.9 and 3.10 (Issuing entire section)

SECTION 23 09 23, Direct Digital Control for HVAC and Other Local Building Systems
Revised paragraph 2.8.2.1 (Issuing entire section)

NOTE: Revisions within the following documents do not contain the above referenced identifiers.

NONE.

c. The following section (including submittal registers) is deleted

NONE.

d. The following documents are added.

NONE.

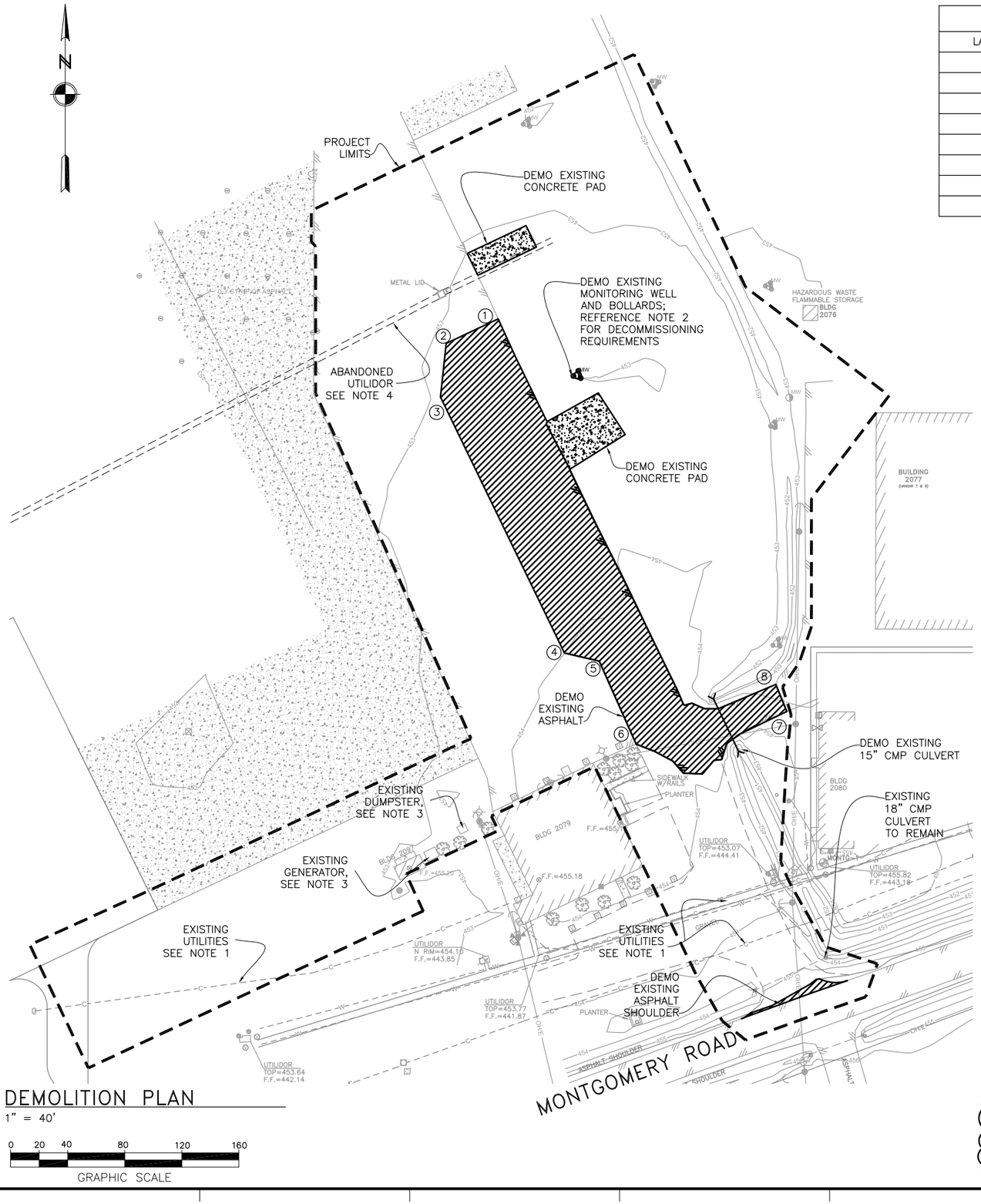
e. The following revisions are incorporated.

NONE.

f. Other:

NONE.

(End of Summary of Changes)



DEMOLITION PLAN

1" = 40'

0 20 40 80 120 160

GRAPHIC SCALE

SUMMARY DATA		
LABEL #	NORTHING	EASTING
1	3961724.95	1391425.65
2	3961707.74	1391389.25
3	3961670.25	1391385.21
4	3961490.84	1391472.12
5	3961485.11	1391496.54
6	3961427.01	1391522.39
7	3961449.85	1391627.99
8	3961468.83	1391620.28

LEGEND

EXISTING / DEMO

- SURVEY MONUMENT
- TREE
- POWER POLE
- GUY ANCHOR
- POWER POLE W/LIGHT
- TRANSFORMER
- JUNCTION BOX
- ELECTRIC PEDESTAL
- VEHICLE HEATER OUTLET
- COMMUNICATION PEDESTAL
- FIRE HYDRANT
- STORM DRAIN
- VENT PIPE
- CULVERT
- GUARD POST/BOLLARD
- AUGER POINT
- MONITORING WELL
- FINISH FLOOR
- AIRCRAFT TIE DOWN
- OVERHEAD ELECTRIC
- COMMUNICATION LINE
- WATER LINE
- EDGE OF PAVEMENT
- EDGE OF GRAVEL
- BUILDING
- CONCRETE
- MINOR CONTOUR
- MAJOR CONTOUR
- SPOT ELEVATION
- PROJECT LIMITS
- ABANDONED UTILIDOR
- EXISTING UTILIDOR

NOTES:

1. EXISTING UTILITIES (I.E. DIRECT BURIED UTILITIES, UTILITIES IN UTILIDOR, ETC.) LOCATED UNDERNEATH THE ACCESS ROAD TO BE PAVED AND PARKING AREA SHALL REMAIN. THE CONTRACTOR SHALL PROTECT EXISTING UTILITIES FROM DAMAGE. WHEN EXISTING UTILITIES ARE ENCOUNTERED OR DAMAGED DURING THE CONSTRUCTION OF THIS PROJECT THE CONTRACTOR SHALL IMMEDIATELY CONTACT DOYON UTILITIES FOR SEWER, STEAM, CONDENSATE, WATER AND POWER; COMM LINES CONTACT THE CONTRACTING OFFICER.

2. WELL DECOMMISSIONING PER ADEC (ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION):
A.) REMOVE THE ENTIRE WELL CASING AND SCREEN.
B.) FILL THE BOREHOLE WITH GROUT AFTER CASING IS REMOVED.
C.) PIPE SEALING MATERIALS DIRECTLY TO THE POINT OF APPLICATION OR EMPLACE BY MEANS OF A DUMP BAILER OR TREMIE TUBE.
D.) IF USING CEMENT GROUT, NEAT CEMENT, OR PUDDLED CLAY AS SEALING MATERIALS BELOW THE STATIC WATER LEVEL IN THE WELL, INTRODUCE FROM THE BOTTOM UP.
E.) WHEN USING A TREMIE TUBE TO PLACE GROUT, SUBMERGE THE DISCHARGE END IN THE GROUT TO AVOID BREAKING THE SEAL WHILE FILING THE ANNULAR SPACE.
F.) FOR ARTESIAN WELLS, PLACE A CEMENT GROUT OR CONCRETE PLUG IN THE CONFINING STRATUM OVERLYING THE ARTESIAN ZONE TO PREVENT UPWARD SEEPAGE FROM THE ARTESIAN ZONE. FILL THE REMAINDER OF THE WELL WITH CEMENT GROUT OR BENTONITE.
G.) RECORD DECOMMISSIONING PROCEDURES AND REPORT TO ADEC.

3. EXISTING DUMPSTER SHALL BE RELOCATED TO NEW DUMPSTER PAD; REFERENCE SHEETS C1.01, C2.02 AND C4.02. THE EXISTING GENERATOR ON PLATFORM IS TO REMAIN ON SITE.

4. AN ABANDONED UTILIDOR RUNS PERPENDICULAR TO THE PROJECT SITE. AS-BUILTS SHOW IT AS A 6 FT X 4 FT CONCRETE UTILIDOR. CONTENTS WITHIN THE UTILIDOR ARE UNKNOWN. THE CONTRACTOR SHALL IMMEDIATELY CONTACT THE CONTRACTING OFFICER IF THE EXISTING UTILIDOR IS ENCOUNTERED DURING THE CONSTRUCTION OF THIS PROJECT. LOCATION OF THIS UTILIDOR SHOWN IS ONLY APPROXIMATE. THE CONTRACTOR SHALL RETROFIT THE EXISTING UTILIDOR'S LID AS SHOWN ON DETAIL 6/S3.01 WITHIN THE PROJECT LIMITS. AT THE UTILDOR MANHOLE, THE CONTRACTOR WILL HAVE TO REMOVE THE METAL LID AND CUT THE EXISTING MANHOLE PRIOR TO PLACING THE RETROFIT CONCRETE LID. RETROFIT CONCRETE LID SHALL BE APPROXIMATELY AT THE SAME ELEVATION THROUGHOUT. PROVIDE NEW ASPHALT AS SHOWN ON SHEET C4.01.

R0002

US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

PRIME CONTRACTOR — Recommended: — CITY — CONTRACT NO.
RESIDENT ENGINEER — Approved: — CONTRACTOR — STATE
Date:

R0002 CHANGED NOTE 4.
Description — Date — Appvd

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

Designed: MED
Drawn: MED
Reviewed: T. Lubeck
Submitted: D. Frehler
Chief — CEPOA-EN-TE — Branch
Chief — CEPOA-EN-TE — Section

Date: 13 NOVEMBER 2009
Dwg Scale: AS NOTED
Plot Scale: 1:2.05
File: FTW336A-007-D1-01
Drawing #: F-211-13-01

PN 65076
INV. NO. W911KB-09-R-0007
FTW336A

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
CIVIL
PLANS
DEMOLITION PLAN

Reference number:
D1.01
Sheet 7 of 120

Drawing X:\UNIFIED\EN-TE\Jobs\FTW336A\Dwgs\FTW336A-007-D1-01.dwg last saved on 11/13/2009 2:22 PM was plotted by Oliver, Dale M POA on 11/13/2009 2:22 PM

ALASKA DISTRICT CORPS OF ENGINEERS ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A), Fort Wainwright, Alaska — Page 1 of 1 — Date: 11 Apr 2008

Drilling Agency: ☒ Alaska District ☐ Other — Datum: Vertical NAVD88, Horizontal ASP23 NAD83

Hole Number, Field: TB-1-P — Permanent: AP-9686-P — Location: Northing: 3,961,559 ft., Easting: 1,391,562 ft. — Top of Hole Elevation: 454.0 ft.

Operator: Lyle Cain — Inspector: Charles Wilson

Type of Hole: ☐ other ____ ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☒ Piezometer — Depth to Groundwater: 10.0 ft. WD — Depth Drilled: 29.5 ft. — Total Depth: 31.5 ft.

Hammer Weight: 340 lbs — Split Spoon I.D.: 2.5 in. — Size and Type of Bit: 8 in. Hollow Stem Auger — Type of Equipment: CME-850 with Automatic Hammer — Type of Samples: Drive

Depth (ft)	Biology	Sample Recovery	ASTM D 4083	Field Class. per D 2487/88	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	% Fines 0.02mm	Max Size (in)	PID (ppm)	% Water	Description and Remarks
0															SURFACE: Brass, open area
2		18	Nbs	F2*	5	SW	Poorly graded SAND with Silt and Gravel					1			Brown, frozen, subrounded gravel, fine sand, nonplastic (NP) fines, grass root fibers, possible FILL
4		18	Nbs	F2	3	SW	Silty SAND	12	42	46	12.1	0.75		13	Brown, frozen, subrounded gravel, fine sand, NP fines, possible FILL
6		18	Nbs	F4	4	ML	Sandy SILT	8	31	61	19.9	1		25	Brown, frozen to moist, subrounded gravel, fine sand, NP fines, possible FILL
8					6										
10		6	NFS*		4	SP	Poorly graded SAND with Gravel					1			Brown, moist, subrounded gravel, fine sand
12					6										
14		6	NFS*		5	GW	Well-graded GRAVEL with Sand					1.5			Brown, moist, subrounded gravel, fine to coarse sand
16					7										
18															
20					4	GP	Poorly graded GRAVEL with Sand					1			Brown, wet, subangular to subrounded gravel, fine to coarse sand
22					6										
24					4	SP	Poorly graded SAND with Gravel	48	67	3		1.25			Brown to gray, wet, subrounded gravel, fine to coarse sand
26					12										
28					4										
30					6	SP	Poorly graded SAND with Gravel					1			Brown to gray, wet, subrounded gravel, fine to coarse sand
32					8										Bottom of Hole 31.5 ft. Elevation: 422.5 ft. Groundwater Encountered While Drilling: at an elevation of 444.0 ft. PID = (ColdHot) Photo Ionization Detector
34															

* Indicates Estimated Frost Classification — Project: ATF Aircraft Parts Storage Facility (FTW336A) — Hole Number: AP-9686-P

ALASKA DISTRICT CORPS OF ENGINEERS ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A), Fort Wainwright, Alaska — Page 1 of 1 — Date: 11 Apr 2008

Drilling Agency: ☒ Alaska District ☐ Other — Datum: Vertical NAVD88, Horizontal ASP23 NAD83

Hole Number, Field: TB-2-P — Permanent: AP-9687-P — Location: Northing: 3,961,721 ft., Easting: 1,391,485 ft. — Top of Hole Elevation: 453.0 ft.

Operator: Lyle Cain — Inspector: Charles Wilson

Type of Hole: ☐ other ____ ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☒ Piezometer — Depth to Groundwater: 10.5 ft. WD — Depth Drilled: 29.5 ft. — Total Depth: 31.5 ft.

Hammer Weight: 340 lbs — Split Spoon I.D.: 2.5 in. — Size and Type of Bit: 8 in. Hollow Stem Auger — Type of Equipment: CME-850 with Automatic Hammer — Type of Samples: Drive

Depth (ft)	Biology	Sample Recovery	ASTM D 4083	Field Class. per D 2487/88	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	% Fines 0.02mm	Max Size (in)	PID (ppm)	% Water	Description and Remarks
0															SURFACE: Grass, open area
2		18	Nbs	F2*	10	SM	Organic Soil with Coal Chunks	20	45	35	13.9	2		12	Top six inches, Black, frozen, angular to subangular gravel, fine to coarse sand, nonplastic (NP) fines, grass roots, charred rapmaence, pieces of coal, FILL
4		18	Nbs	F2	3	SM	Silty SAND with Gravel	22	45	33	11.7			14	Brown, frozen, subrounded gravel, fine sand, NP fines, grass roots, some black charred particles, FILL
6		18	Nbs	PFS	4	GP	Poorly graded GRAVEL with Sand	51	44	5	2.4	2		2	Brown, frozen, subrounded gravel, fine sand, NP fines, trsips and roots to 1/2 inch, some black charred particles, FILL
8					6										Brown, moist, subrounded gravel, fine to coarse sand, NP fines
10		6	NFS*		4	GP	Poorly graded GRAVEL with Sand					2.5			Brown, moist, subrounded gravel, fine to coarse sand
12					6										
14															
16		6	NFS*	PFS	4	GP-GM	Poorly graded GRAVEL with Silt and Sand	49	46	5	2.1	1.5		8	Brown, moist to wet, subrounded gravel, fine to coarse sand, NP fines
18					6										
20					4	SP	Poorly graded SAND with Gravel					1.5			Gray, wet, subrounded gravel, fine to coarse sand
22					6										
24					4	SP	Poorly graded SAND with Gravel					1			Gray, wet, subrounded gravel, fine to coarse sand
26					6										
28					4										
30					6	SP	Poorly graded SAND with Gravel					1.5			Gray, wet, subrounded gravel, fine to coarse sand
32					8										Bottom of Hole 31.5 ft. Elevation: 421.5 ft. Groundwater Encountered While Drilling: at an elevation of 442.5 ft. PID = (ColdHot) Photo Ionization Detector
34															

* Indicates Estimated Frost Classification — Project: ATF Aircraft Parts Storage Facility (FTW336A) — Hole Number: AP-9687-P

ALASKA DISTRICT CORPS OF ENGINEERS ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A), Fort Wainwright, Alaska — Page 1 of 1 — Date: 12 Apr 2008

Drilling Agency: ☒ Alaska District ☐ Other — Datum: Vertical NAVD88, Horizontal ASP23 NAD83

Hole Number, Field: TB-3 — Permanent: AP-9688 — Location: Northing: 3,961,689 ft., Easting: 1,391,415 ft. — Top of Hole Elevation: 453.1 ft.

Operator: Lyle Cain — Inspector: Charles Wilson

Type of Hole: ☐ other ____ ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer — Depth to Groundwater: 14.5 ft. WD — Depth Drilled: 29.5 ft. — Total Depth: 31.5 ft.

Hammer Weight: 340 lbs — Split Spoon I.D.: 2.5 in. — Size and Type of Bit: 8 in. Hollow Stem Auger — Type of Equipment: CME-850 with Automatic Hammer — Type of Samples: Drive

Depth (ft)	Biology	Sample Recovery	ASTM D 4083	Field Class. per D 2487/88	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	% Fines 0.02mm	Max Size (in)	PID (ppm)	% Water	Description and Remarks
0						AC	Asphalt Concrete								SURFACE: Paved apron shoulder
2					2800*	NR	No Recovery								No Recovery.
4		3A	Nbs	NFS*	57	GW	Well-graded GRAVEL with Sand						2		Brown, frozen, subrounded gravel, fine sand, FILL
6		3B	Nbs												
8		4A	Nbs		7	GP-GM	Poorly graded GRAVEL with Silt and Sand	60	27	5	2.2	0.75		3	Brown, frozen, subrounded gravel, fine sand, nonplastic (NP) fines, possible FILL
10		4B	Nbs		7	SP-SM	Poorly graded SAND with Silt	60	33	4	1.5	1.25		1	Brown, moist, fine sand, NP fines
12		5A	NFS*		5	SP	Poorly graded SAND								Brown, moist to dry, subrounded gravel, fine to coarse sand
14		5B	NFS*		6	GW	Well-graded GRAVEL with Sand								
16		6A	NFS*		4	GP	Poorly graded GRAVEL with Sand						1		Brown, moist to dry, subrounded gravel, fine to coarse sand
18		6B	NFS*		6	SP	Poorly graded SAND								Brown, moist, fine sand, pieces of wood to one inch
20															Stowed by drill action at 12 feet
22					3	GP	Poorly graded GRAVEL with Sand	65	41	3	1.6	2			Brown, wet, subrounded gravel, fine to coarse sand
24					4										
26					4										
28					6	GP	Poorly graded GRAVEL with Sand						1		Brown/gray, wet, subrounded gravel, fine to coarse sand
30					8										
32					6	GP	Poorly graded GRAVEL with Sand						1.5		Brown/gray, wet, subrounded gravel, fine to coarse sand
34					12										Bottom of Hole 31.5 ft. Elevation: 421.6 ft. Groundwater Encountered While Drilling: at an elevation of 437.6 ft. PID = (ColdHot) Photo Ionization Detector

* Indicates Estimated Frost Classification — Project: ATF Aircraft Parts Storage Facility (FTW336A) — Hole Number: AP-9688

ALASKA DISTRICT CORPS OF ENGINEERS ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A), Fort Wainwright, Alaska — Page 1 of 1 — Date: 12 Apr 2008

Drilling Agency: ☒ Alaska District ☐ Other — Datum: Vertical NAVD88, Horizontal ASP23 NAD83

Hole Number, Field: TB-4 — Permanent: AP-9689 — Location: Northing: 3,961,524 ft., Easting: 1,391,487 ft. — Top of Hole Elevation: 454.9 ft.

Operator: Lyle Cain — Inspector: Charles Wilson

Type of Hole: ☐ other ____ ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer — Depth to Groundwater: 15.5 ft. WD — Depth Drilled: 29.5 ft. — Total Depth: 31.5 ft.

Hammer Weight: 340 lbs — Split Spoon I.D.: 2.5 in. — Size and Type of Bit: 8 in. Hollow Stem Auger — Type of Equipment: CME-850 with Automatic Hammer — Type of Samples: Drive

Depth (ft)	Biology	Sample Recovery	ASTM D 4083	Field Class. per D 2487/88	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	% Fines 0.02mm	Max Size (in)	PID (ppm)	% Water	Description and Remarks
0						AC	Asphalt Concrete								SURFACE: Paved apron shoulder
2		1			11										Six inches of asphalt concrete pavement
4		2	Nbs	S1	7	GP-GM	Poorly graded GRAVEL with Silt and Sand	56	37	8	3.7	1.25		2	Brown, frozen, subrounded gravel, fine to coarse sand, nonplastic (NP) fines, FILL
6		3A	Nbs	PFS	5	GW-GM	Well-graded GRAVEL with Silt and Sand	58	36	6	2.9	1.5		1	Brown, frozen, subrounded gravel, fine to coarse sand, NP fines, FILL
8		3B	Nbs		6										
10		4A	Nbs	NFS*	4	SP	Poorly graded SAND with Gravel	9	67	33	8.7	1		17	Brown, frozen, subrounded gravel, fine to coarse sand, NP fines, FILL
12		4B	Nbs	F2	6										Brown, frozen, fine sand, NP fines
14					8		Silty SAND								
16		5A	NFS*		4	SP	Poorly graded SAND								Brown, frozen to moist, fine sand
18		5B	NFS*		6	GP	Poorly graded GRAVEL with Sand								Brown, moist, subrounded gravel, fine to coarse sand
20					8										
22		6	NFS*		5	GP	Poorly graded GRAVEL with Sand					1.5			Brown, wet, subrounded gravel, fine to coarse sand
24					7										
26					9										
28					11	GP	Poorly graded GRAVEL with Sand	50	48	2		1.5			Brown/gray, wet, subrounded gravel, fine to coarse sand
30					6										
32					8	GP	Poorly graded GRAVEL with Sand					1			Brown/gray, wet, subrounded gravel, fine to coarse sand
34					4										Bottom of Hole 31.5 ft. Elevation: 423.4 ft. Groundwater Encountered While Drilling: at an elevation of 439.4 ft. PID = (ColdHot) Photo Ionization Detector

* Indicates Estimated Frost Classification — Project: ATF Aircraft Parts Storage Facility (FTW336A) — Hole Number: AP-9689

ALASKA DISTRICT CORPS OF ENGINEERS ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A), Fort Wainwright, Alaska — Page 1 of 1 — Date: 12 Apr 2008

Drilling Agency: ☒ Alaska District ☐ Other — Datum: Vertical NAVD88, Horizontal ASP23 NAD83

Hole Number, Field: TB-5 — Permanent: AP-9690 — Location: Northing: 3,961,583 ft., Easting: 1,391,587 ft. — Top of Hole Elevation: 453.2 ft.

Operator: Lyle Cain — Inspector: Charles Wilson

Type of Hole: ☐ other ____ ☐ Test Pit ☐ Auger Hole ☐ Monitoring Well ☒ Piezometer — Depth to Groundwater: 10.0 ft. WD — Depth Drilled: 14.5 ft. — Total Depth: 16.5 ft.

Hammer Weight: 340 lbs — Split Spoon I.D.: 2.5 in. — Size and Type of Bit: 8 in. Hollow Stem Auger — Type of Equipment: CME-850 with Automatic Hammer — Type of Samples: Drive

Depth (ft)	Biology	Sample Recovery	ASTM D 4083	Field Class. per D 2487/88	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	% Fines 0.02mm	Max Size (in)	PID (ppm)	% Water	Description and Remarks
0															SURFACE: Grass, open area
2		1A	Nbs	F2*	3	SM	Silty SAND with Gravel and Cobbles					1		19	Brown, frozen, subrounded gravel, fine sand, nonplastic (NP) fines, drove thru 3.5 inch cobble, grass roots, FILL
4		1B	Nbs	F4	3	ML	SILT with Sand	1	22	77	20.9	0.75			Brown, frozen, subrounded gravel, fine sand, NP fines, grass roots, non-inch twig
6		2A	Nbs	F4	4	ML	SILT	0	15	85	21.3			28	Brown, frozen, fine sand, NP fines, FILL
8		2B			6										Brown, frozen, fine sand, NP fines
10		3A		F2*	4	SM	Silty SAND								Brown, moist, fine sand
12		3B		NFS*	5	SP	Poorly graded SAND								Brown/red, moist, fine sand, NP fines
14				F2*	6	SM	Silty SAND								
16		4			7										
18															
20		5		S2	3	SP-SM	Poorly graded SAND with Silt	0	91	9	4.7			5	Brown, moist, fine sand, NP fines, very loose, 24-inch penetration under weight of hammer
22					4										
24					6										
26					8										Gravel by drill action at 13.5 feet
28					10										
30		6		NFS*	7	GW	Well-graded GRAVEL with Sand								Brown/gray, moist to wet, subrounded gravel, fine to coarse sand
32					9										Bottom of Hole 16.5 ft. Elevation: 436.7 ft. Groundwater Encountered While Drilling: at an elevation of 437.2 ft. PID = (ColdHot) Photo Ionization Detector
34															

* Indicates Estimated Frost Classification — Project: ATF Aircraft Parts Storage Facility (FTW336A) — Hole Number: AP-9690

ALASKA DISTRICT CORPS OF ENGINEERS ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A), Fort Wainwright, Alaska — Page 1 of 1 — Date: 13 Apr 2009

Drilling Agency: ☒ Alaska District ☐ Other — Datum: Vertical NAVD88, Horizontal ASP23 NAD83

Hole Number, Field: TB-6 — Permanent: AP-9691 — Location: Northing: 3,961,966 ft., Easting: 1,391,367 ft. — Top of Hole Elevation: 453.1 ft.

Operator: Lyle Cain — Inspector: Charles Wilson

Type of Hole: ☐ other ____ ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer — Depth to Groundwater: 17.0 ft. WD — Depth Drilled: 29.5 ft. — Total Depth: 31.5 ft.

Hammer Weight: 340 lbs — Split Spoon I.D.: 2.5 in. — Size and Type of Bit: 8 in. Hollow Stem Auger — Type of Equipment: CME-850 with Automatic Hammer — Type of Samples: Drive

Depth (ft)	Biology	Sample Recovery	ASTM D 4083	Field Class. per D 2487/88	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	% Fines 0.02mm	Max Size (in)	PID (ppm)	% Water	Description and Remarks
0															SURFACE: Grass, open area
2		1A	Nbs	F2*	3	SM	Silty SAND with Gravel					1		1	Dark brown to brown, frozen, subrounded gravel, fine sand, nonplastic (NP) fines, grass roots, FILL
4		1B	Nbs	F2*	3	SM	Poorly graded SAND with Silt and Gravel								Brown, frozen, subrounded gravel, fine to coarse sand, NP fines, FILL
6		2A	Nbs	F4	3	SM	Silty SAND								Brown, frozen, fine sand, NP fines, FILL
8		2B			4										Brown, frozen, fine sand, NP fines, FILL
10		3A		F4	3	ML	SILT	0	12	88	28.5			15	Brown, moist, fine sand, NP fines, several dark brown lenses of mostly decomposed organics to one inch, one half-inch spruce twig with needles (black), FILL
12		3B		F4	4	SM	Silty SAND								Brown, moist, fine sand, NP fines, FILL
14		4		NFS*	3	SM	Interlayered Sands and Silts							23	Brown, moist, fine sand, NP fines, three compact dark brown lenses of mostly decomposed organics to one inch thick, FILL
16					4	SP-ML									Interlayered, Brown, moist, fine sands and NP fines
18		5A		NFS*	3	GP	Poorly graded GRAVEL with Sand					1.5			Gravel indicated by drill action at 13.5 feet
20		5B		NFS*	4	SP	Poorly graded SAND with Gravel					1			Brown, moist, subrounded gravel, fine to coarse sand
22					1										Brown, moist, subrounded gravel, fine sand
24		6A			4	SP	Poorly graded SAND					1			Brown, wet, subrounded gravel, fine sand
26		6B			4	GP	Poorly graded GRAVEL with Sand					1.5			Brown, wet, subrounded gravel, fine to coarse sand
28					6										
30		7			4	SP	Poorly graded SAND with Gravel	41	57	2		1.25			Brown to gray, wet, subrounded gravel, fine to coarse sand
32					6										
34		8			3	GP	Poorly graded GRAVEL with Sand					1			Brown to gray, wet, subrounded gravel, fine to coarse sand
					4										Bottom of Hole 31.5 ft. Elevation: 421.6 ft. Groundwater Encountered While Drilling: at an elevation of 436.1 ft. PID = (ColdHot) Photo Ionization Detector

* Indicates Estimated Frost Classification — Project: ATF Aircraft Parts Storage Facility (FTW336A) — Hole Number: AP-9691

ALASKA DISTRICT CORPS OF ENGINEERS ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A), Fort Wainwright, Alaska — Page 1 of 1 — Date: 13 Apr 2009

Drilling Agency: ☒ Alaska District ☐ Other — Datum: Vertical NAVD88, Horizontal ASP23 NAD83

Hole Number, Field: TB-7 — Permanent: AP-9692 — Location: Northing: 3,961,778 ft., Easting: 1,391,555 ft. — Top of Hole Elevation: 453.3 ft.

Operator: Lyle Cain — Inspector: Charles Wilson

Type of Hole: ☐ other ____ ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer — Depth to Groundwater: 13.5 ft. WD — Depth Drilled: 14.5 ft. — Total Depth: 16.5 ft.

Hammer Weight: 340 lbs — Split Spoon I.D.: 2.5 in. — Size and Type of Bit: 8 in. Hollow Stem Auger — Type of Equipment: CME-850 with Automatic Hammer — Type of Samples: Drive

Depth (ft)	Biology	Sample Recovery	ASTM D 4083	Field Class. per D 2487/88	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	% Fines 0.02mm	Max Size (in)	PID (ppm)	% Water	Description and Remarks
0															SURFACE: Grass, open area, minor swale with standing water under snow
2		1	Nbs	F2	4	SM	Silty SAND with Gravel	24	48	28	10.5	1.5		9	Brown, frozen, subrounded gravel, fine sand, nonplastic (NP) fines, FILL
4		2	Nbs	F2	4	SM	Silty SAND with Gravel	24	42	34	15.9	1		16	Brown, frozen, subrounded gravel, fine sand, NP fines, drove through piece of concrete at three feet, FILL
6		3A	Nbs	S2*	3	SP-SM	Poorly graded SAND with Silt and Gravel					1			Brown, frozen to moist, subrounded gravel, fine sand, NP fines, drove through piece of concrete at 5.5 to 6.0 feet, FILL
8		3B			4										
10		4A		NFS*	3	GP	Poorly graded GRAVEL with Sand					1.5			Brown, moist, subrounded gravel, fine sand
12		4B		NFS*	3	SP	Poorly graded SAND								Brown, moist, fine sand
14				NFS*	3	GP	Poorly graded GRAVEL with Sand					2			Brown to gray, moist to wet, subrounded gravel, fine to coarse sand
16					4										Bottom of Hole 16.5 ft. Elevation: 436.8 ft. Groundwater Encountered While Drilling: at an elevation of 437.3 ft. PID = (ColdHot) Photo Ionization Detector
18															
20															
22															
24															
26															
28															
30															
32															
34															

* Indicates Estimated Frost Classification — Project: ATF Aircraft Parts Storage Facility (FTW336A) — Hole Number: AP-9692

ALASKA DISTRICT CORPS OF ENGINEERS ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A), Fort Wainwright, Alaska — Page 1 of 1 — Date: 13 Apr 2009

Drilling Agency: ☒ Alaska District ☐ Other — Datum: Vertical NAVD88, Horizontal ASP23 NAD83

Hole Number, Field: TB-8 — Permanent: AP-9693 — Location: Northing: 3,961,878 ft., Easting: 1,391,514 ft. — Top of Hole Elevation: 452.2 ft.

Operator: Lyle Cain — Inspector: Charles Wilson

Type of Hole: ☐ other ____ ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer — Depth to Groundwater: 13.5 ft. WD — Depth Drilled: 14.5 ft. — Total Depth: 16.5 ft.

Hammer Weight: 340 lbs — Split Spoon I.D.: 2.5 in. — Size and Type of Bit: 8 in. Hollow Stem Auger — Type of Equipment: CME-850 with Automatic Hammer — Type of Samples: Drive

Depth (ft)	Biology	Sample Recovery	ASTM D 4083	Field Class. per D 2487/88	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	Grain Size %Gravel	%Sand	%Fines	% Fines 0.02mm	Max Size (in)	PID (ppm)	% Water	Description and Remarks
0															SURFACE: Grass, open area, standing water under snow, moved 15 feet west
2		1	Nbs	S1	11	GP-GM	Poorly graded GRAVEL with Silt and Sand	48	44	8	3.6	2.5		9	Brown, frozen, subrounded gravel, fine sand, nonplastic (NP) fines, FILL
4		2	Nbs	PFS	5	GM	Poorly graded GRAVEL with Silt and Sand								Brown, moist to frozen, subrounded gravel, fine sand, nonplastic (NP) fines, FILL
6		3A	Nbs	PFS*	6	GP	Poorly graded GRAVEL with Sand					1.5			Brown, frozen, subrounded gravel, fine to coarse sand, NP fines, FILL
8		3B		NFS	8	SP	Poorly graded SAND	4	91	5	1.6	0.375		8	Brown, moist, fine sand with two-inch lenses of silty sand (SM)
10		4		NFS*	3	GP	Poorly graded GRAVEL with Sand					2.5			Brown, moist, subrounded gravel, fine sand
12					4										
14					7										
16		5		NFS*	7	GP	Poorly graded GRAVEL with Sand					2.5			Brown, moist to wet, subrounded gravel, fine to coarse sand, three-inch piece of wood
18					12										Bottom of Hole 16.5 ft. Elevation: 435.7 ft. Groundwater Encountered While Drilling: at an elevation of 436.7 ft. PID = (ColdHot) Photo Ionization Detector
20															
22															
24															
26															
28															
30															
32															
34															

* Indicates Estimated Frost Classification — Project: ATF Aircraft Parts Storage Facility (FTW336A) — Hole Number: AP-9693

US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

CONTRACT NO. ____
CONTRACTOR ____
CITY ____ STATE ____
PRIME CONTRACTOR ____
RESIDENT ENGINEER ____
Recommended: ____ Approved: ____ Date: ____

Mark	Action	Description	Initials	Date Approved
0	ADDED	CHANGED ENTIRE SHEET		

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

Designed: MED
Drawn: MED
Reviewed: T. Lukes
Chief: ____
Submitted: D. Frenier
Chief: ____

Date: 13 NOVEMBER 2009
Proj Scale: AS NOTED
Plot Scale: 1:2.05
File: FTW336A-005-C0-01
Drawing #: F-211-13-01

INV. NO. W911KB-09-R-0007
PN 65076
FTW336A

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
GWL
GENERAL
SOIL BORING LOGS 1 OF 2

Reference number:
C0.01
Sheet 5 of 120

R0002

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A)
Fort Wainwright, Alaska

Page 1 of 1
Date: 14 Apr 2008

Drilling Agency: ☒ Alaska District ☐ Other
Datum: Vertical NAVD88 Horizontal ASP23 NAD83
Location: Northing: 3,961,705 ft. Easting: 1,391,405 ft.
Top of Hole Elevation: 452.7 ft.
Operator: Lyle Cain
Inspector: Robert Weakland
Hole Number, Field: TB-9
Permanent: AP-9694
Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater: NR
Depth Drilled: 14.5 ft.
Total Depth: 16.5 ft.
Hammer Weight: 340 lbs
Split Spoon I.D.: 2.5 in.
Size and Type of Bit: 8 in. Hollow Stem Auger
Type of Equipment: CME-850 with Automatic Hammer
Type of Samples: Drive

Depth (ft.)	Geology	Sample	Recovery (ASTM D 4403 Modified)	Field Class. (ASTM D 2488)	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	%Gravel	%Sand	%Fines	% Fiber by Dry Wt.	Max. Size (in.)	PID (ppm)	% Water	Description and Remarks
0															SURFACE: Grass, sparse mss, roots to 12 inches
2		S1	16		14 35/6" 14	GP-GM	Poorly graded GRAVEL with Silt and Sand	51	36	11	3.7	1.5	0.0 CO	4	Brown, frozen, subrounded gravel, fine to coarse sand, nonplastic (NP) fines, FILL
4		S1	14		3 47 50/5"	GP-GM	Poorly graded GRAVEL with Silt, Sand, and Cobbles	62	41	7	3.5	>3	0.0 CO	2	Brown to gray, moist, subangular to subrounded gravel, fine to coarse sand, NP fines, cobble fractured while driving, FILL
6		NFS*	15		15 19 31 21	GP	Poorly graded GRAVEL with Sand					1.5	0.0 CO		Brown, moist, subangular to subrounded gravel, fine to coarse sand, FILL
10		PFS	14		3 4 7	GW	Well-graded GRAVEL with Sand	59	36	4	1.6	1	0.0 CO	1	Brown, moist, subangular to subrounded gravel, fine to coarse sand
14		NFS*	14		4 9 11 16	GP	Poorly graded GRAVEL with Sand					1	0.0 CO		Gray, moist to wet, subangular to subrounded gravel, fine to coarse sand
16															Bottom of Hole 16.5 ft. Elevation 436.2 ft. Groundwater Not Recorded PID = (Colditox) Photo Ionization Detector

* Indicates Estimated Frost Classification

Project: ATF Aircraft Parts Storage Facility (FTW336A) | Hole Number: AP-9694

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A)
Fort Wainwright, Alaska

Page 1 of 2
Date: 15 Apr 2008

Drilling Agency: ☒ Alaska District ☐ Other
Datum: Vertical NAVD88 Horizontal ASP23 NAD83
Location: Northing: 3,961,621 ft. Easting: 1,391,480 ft.
Top of Hole Elevation: 453.7 ft.
Operator: Lyle Cain
Inspector: Robert Weakland
Hole Number, Field: TB-10
Permanent: AP-9695
Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater: 19.0 ft. WD
Depth Drilled: 74.5 ft.
Total Depth: 76.0 ft.
Hammer Weight: 140 lbs
Split Spoon I.D.: 1.378 in.
Size and Type of Bit: 8 in. Hollow Stem Auger
Type of Equipment: CME-850 with Automatic Hammer
Type of Samples: Drive

Depth (ft.)	Geology	Sample	Recovery (ASTM D 4403 Modified)	Field Class. (ASTM D 2488)	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	%Gravel	%Sand	%Fines	% Fiber by Dry Wt.	Max. Size (in.)	PID (ppm)	% Water	Description and Remarks
0															SURFACE: Gravel, edge of paved apron shoulder
2		NF	6		P2	SW	Silty SAND with Gravel	34	48	17	6.7	0.375	0.0 0.0	11	Brown, frozen, subrounded gravel, fine to coarse sand, nonplastic (NF) fines, FILL
4		Nbe	18		F4	ML	Sandy SILT	6	32	62	21.2	0.375	0.0 0.0	20	Brown, frozen, fine sand, NP fines
6		NF	9		F2*	SM	Silty SAND						0.0 0.0		Brown, frozen to moist, fine sand, NP fines
8					NR		No Recovery								No recovery
10		S1	6			GP-GM	Poorly graded GRAVEL with Silt and Sand	47	45	8	3.6	0.8	0.0 0.0	5	Brown, moist, subangular to subrounded gravel, fine to coarse sand, NP fines
12															
14						SW	Well-graded SAND with Gravel					0.7			Gray, wet, subangular to subrounded gravel, fine to coarse sand
16															
18						SP	Poorly graded SAND with Gravel	37	60	3		0.5			Gray, wet, subangular to subrounded gravel, fine to coarse sand
20															
22						SP	Poorly graded SAND								Gray, wet, fine to medium sand
24															
26						GW	Well-graded GRAVEL with Sand	58	38	4		1			Gray, wet, subangular to subrounded gravel, fine to coarse sand
28															
30						GP	Poorly graded GRAVEL with Sand					0.7			Gray, wet, angular to subrounded gravel, fine to coarse sand
32															
34															

* Indicates Estimated Frost Classification

Project: ATF Aircraft Parts Storage Facility (FTW336A) | Hole Number: AP-9695

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A)
Fort Wainwright, Alaska

Page 2 of 2
Date: 15 Apr 2008

Drilling Agency: ☒ Alaska District ☐ Other
Datum: Vertical NAVD88 Horizontal ASP23 NAD83
Location: Northing: 3,961,921 ft. Easting: 1,391,480 ft.
Top of Hole Elevation: 453.7 ft.
Operator: Lyle Cain
Inspector: Robert Weakland
Hole Number, Field: TB-10
Permanent: AP-9695
Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater: 19.0 ft. WD
Depth Drilled: 74.5 ft.
Total Depth: 76.0 ft.
Hammer Weight: 140 lbs
Split Spoon I.D.: 1.378 in.
Size and Type of Bit: 8 in. Hollow Stem Auger
Type of Equipment: CME-850 with Automatic Hammer
Type of Samples: Drive

Depth (ft.)	Geology	Sample	Recovery (ASTM D 4403 Modified)	Field Class. (ASTM D 2488)	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	%Gravel	%Sand	%Fines	% Fiber by Dry Wt.	Max. Size (in.)	PID (ppm)	% Water	Description and Remarks
42					10										
44			11		11 9	SW	Well-graded SAND with Gravel					0.6			Gray, wet, subangular to subrounded gravel, fine to coarse sand
46															
48			16		3 9 14	GP	Poorly graded GRAVEL with Sand					1			Gray, wet, subangular to subrounded gravel, fine to coarse sand
50															
52			12		7 9 11	SP	Poorly graded SAND with Gravel	48	48	2		0.7			Gray, wet, subangular to subrounded gravel, fine to coarse sand
54															
56			14		8 9 9	SP	Poorly graded SAND with Gravel					0.6			Gray, wet, subangular to subrounded gravel, fine to coarse sand
58															
60			16		8 11 12	SP	Poorly graded SAND					0.6			Gray, wet, subangular to subrounded gravel, fine to coarse sand
62															
64			16		8 9 9	SP	Poorly graded SAND								Gray, wet, fine to medium sand
66															
68			11		8 9 14	NR	No Recovery								No Recovery
70															Bottom of Hole 76.0 ft. Elevation 377.7 ft. Groundwater Encountered While Drilling: at an elevation of 437.7 ft. PID = (Colditox) Photo Ionization Detector
72															
74															
76															
78															
80															
82															

* Indicates Estimated Frost Classification

Project: ATF Aircraft Parts Storage Facility (FTW336A) | Hole Number: AP-9695

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A)
Fort Wainwright, Alaska

Page 1 of 1
Date: 17 Apr 2008

Drilling Agency: ☒ Alaska District ☐ Other
Datum: Vertical NAVD88 Horizontal ASP23 NAD83
Location: Northing: 3,961,322 ft. Easting: 1,391,314 ft.
Top of Hole Elevation: 452.2 ft.
Operator: Lyle Cain
Inspector: Robert Weakland
Hole Number, Field: TB-11
Permanent: AP-9696
Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater: NR
Depth Drilled: 14.5 ft.
Total Depth: 16.0 ft.
Hammer Weight: 340 lbs
Split Spoon I.D.: 2.5 in.
Size and Type of Bit: 8 in. Hollow Stem Auger
Type of Equipment: CME-850 with Automatic Hammer
Type of Samples: Drive

Depth (ft.)	Geology	Sample	Recovery (ASTM D 4403 Modified)	Field Class. (ASTM D 2488)	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	%Gravel	%Sand	%Fines	% Fiber by Dry Wt.	Max. Size (in.)	PID (ppm)	% Water	Description and Remarks
0															SURFACE: Gravel, snow to 12 inches
2		S1	16		6/3 50/5"	GP-GM	Poorly graded GRAVEL with Silt and Sand	49	41	10	4.7	1.5	0.0 2.0	2	Brown, frozen, angular to subrounded gravel, fine to coarse sand, nonplastic (NP) fines, price of concrete, FILL
4		NFS*	14		5 6 8 9	GP	Poorly graded GRAVEL with Sand					1.5	0.0 2.0		Brown, frozen, angular to subrounded gravel, fine to coarse sand, FILL
		Nbe	18		F4	ML	SILT with Sand	2	24	74	18.4		0.0 2.0	24	Brown, frozen, fine sand, NP fines
		F4*	12		6 9 14	SM SP-SM	Silty SAND Poorly graded SAND with Silt	0	91	9	4.0		0.0 2.0	3	Brown, frozen, fine sand, NP fines Brown, moist, fine to medium sand, NP fines
10		NFS*	14		4 6 9 12	GW	Well-graded GRAVEL with Sand					2	0.0 2.0		Brown, rust staining, moist, angular to subrounded gravel, fine to coarse sand
14		NFS*	14		4 6 9 12	SW	Well-graded SAND with Gravel					1	0.0 2.0		Brown to gray, wet, subangular to subrounded gravel, fine to coarse sand
16															Bottom of Hole 16.0 ft. Elevation 436.2 ft. Groundwater Not Recorded PID = (Colditox) Photo Ionization Detector

* Indicates Estimated Frost Classification

Project: ATF Aircraft Parts Storage Facility (FTW336A) | Hole Number: AP-9696

ALASKA DISTRICT
CORPS OF ENGINEERS
ENGINEERING SERVICES

Soils and Geology Section
EXPLORATION LOG

Project: ATF Aircraft Parts Storage Facility (FTW336A)
Fort Wainwright, Alaska

Page 1 of 1
Date: 17 Apr 2008

Drilling Agency: ☒ Alaska District ☐ Other
Datum: Vertical NAVD88 Horizontal ASP23 NAD83
Location: Northing: 3,961,270 ft. Easting: 1,391,222 ft.
Top of Hole Elevation: 452.1 ft.
Operator: Lyle Cain
Inspector: Robert Weakland
Hole Number, Field: TB-12
Permanent: AP-9697
Type of Hole: ☐ other ☐ Test Pit ☒ Auger Hole ☐ Monitoring Well ☐ Piezometer
Depth to Groundwater: 14.4 ft. WD
Depth Drilled: 14.5 ft.
Total Depth: 16.0 ft.
Hammer Weight: 340 lbs
Split Spoon I.D.: 2.5 in.
Size and Type of Bit: 8 in. Hollow Stem Auger
Type of Equipment: CME-850 with Automatic Hammer
Type of Samples: Drive

Depth (ft.)	Geology	Sample	Recovery (ASTM D 4403 Modified)	Field Class. (ASTM D 2488)	Blow Count	Symbol	Classification ASTM D 2487 or D 2488	%Gravel	%Sand	%Fines	% Fiber by Dry Wt.	Max. Size (in.)	PID (ppm)	% Water	Description and Remarks
0															SURFACE: Gravel, snow to 12 inches
2		S1	16		50 50 80 80	GP-GM	Poorly graded GRAVEL with Silt and Sand	45	44	11	4.8	1	0.0 2.0	3	Brown, frozen, subangular to subrounded gravel, fine to coarse sand, nonplastic (NP) fines, FILL
4		NF	6		PFS*	SW	Well-graded SAND with Gravel					2	0.0 2.0		Brown, frozen, subangular to subrounded gravel, fine to coarse sand, FILL
		Nbe	18		F4	ML	SILT with Sand	0	17	83	24.2		0.0 2.0	26	Brown, frozen, fine sand, NP fines
6		NFS*	14		6 9 14	SP	Poorly graded SAND								Brown, moist, fine to medium sand, NP fines
10		NFS*	14		9 9 17 19	SW	Well-graded SAND with Gravel					1	0.0 2.0		Brown, moist, subangular to subrounded gravel, fine to coarse sand
14		NFS	16		5 8 9	SP	Poorly graded SAND with Gravel	45	51	4	1.9	1.5	0.0 2.0		Brown, wet, subangular to subrounded gravel, fine to coarse sand
16															Bottom of Hole 16.0 ft. Elevation 436.1 ft. Groundwater Encountered While Drilling: at an elevation of 437.7 ft. PID = (C4&5&6) Photo Ionization Detector

* Indicates Estimated Frost Classification

Project: ATF Aircraft Parts Storage Facility (FTW336A) | Hole Number: AP-9697

US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

CONTRACT NO. _____
CONTRACTOR _____
CITY _____ STATE _____
PRIME CONTRACTOR _____
Recommended: _____
RESIDENT ENGINEER _____
Approved: _____
Date: _____

Mark	Description	Initials	Date Approved
0	ORIGINAL		
1	CHANGED ENTIRE SHEET		

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

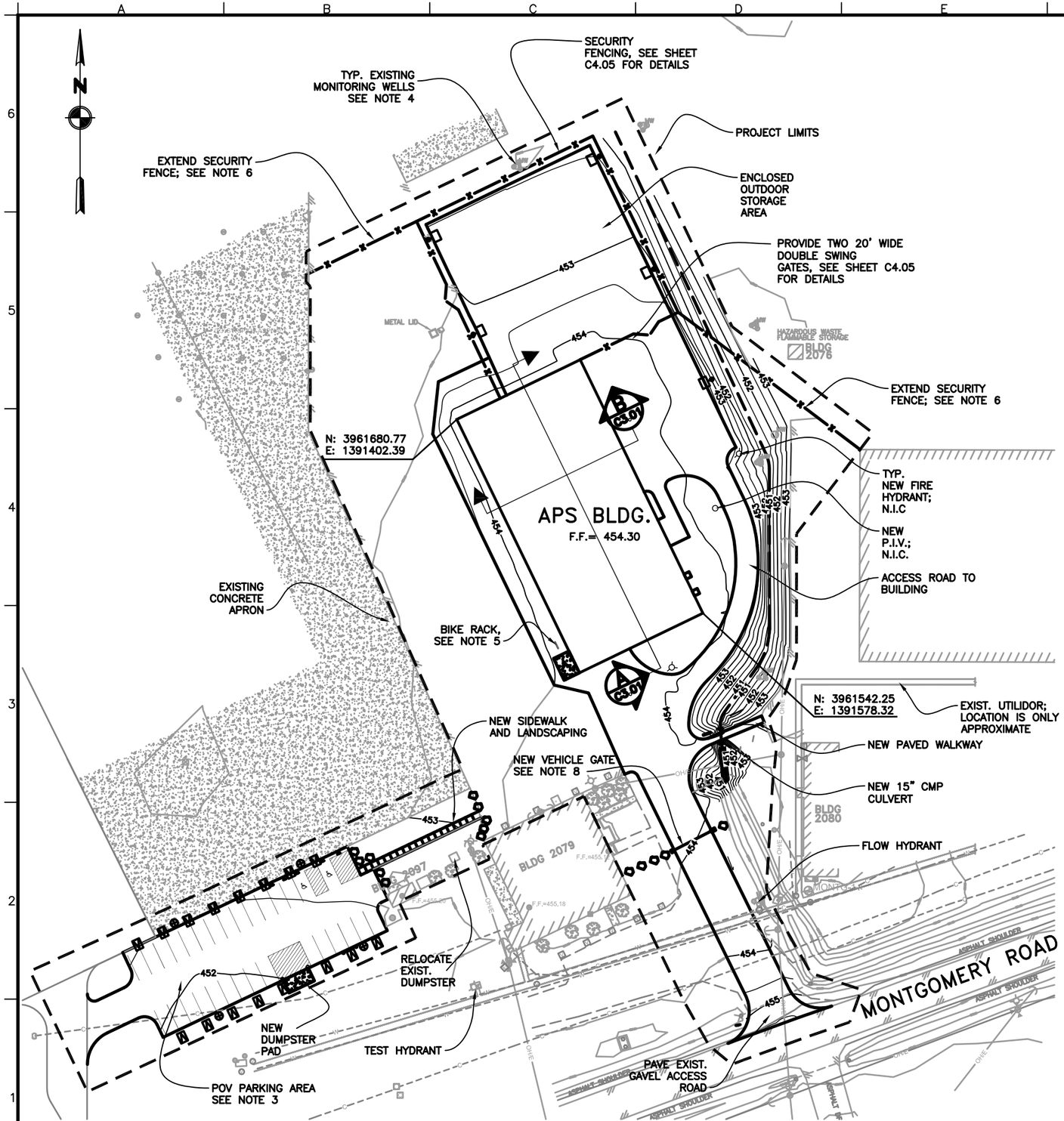
Designed: MED
Drawn: A.S.D.
Reviewed: T. Lukert
Prep'd: ---
Submitted: D. Frenier
Chief: ---
Date: 13 NOVEMBER 2009
Dwg Scale: AS NOTED
Plot Scale: 1:2.05
File: FTW336-006-03-02
Drawing #: F-211-13-01

INV. NO. W911KB-09-R-0007
PN 65076
FTW336A

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
GWL
GENERAL
SOIL BORING LOGS 2 OF 2

Reference number:
C0.02
Sheet 6 of 120

R0002



OVERALL SITE PLAN

1" = 40'

0 20 40 80 120 160

GRAPHIC SCALE

NOTES:

1. SEE SHEET D1.01 FOR LEGEND FOR EXISTING AND SHEET C2.02 FOR NEW.

2. PERMANENT UTILITY SYSTEMS (WATER, SEWER, STEAM AND CONDENSATE AND ELECTRICITY) TO THIS FACILITY WILL BE DESIGNED AND INSTALLED BY DOYON UTILITIES (DU) UP TO THE DEMARCATION POINTS.

POINTS OF DEMARCATION (POD) ARE AS FOLLOWS:
– WATER: POD IS THE DISTRIBUTION SIDE OF THE FIRST VALVE AFTER THE METER. WHERE DU PROVIDES FOR FIRE SERVICE LINES COMBINED WITH BUILDING SERVICE WATER LINES, THE POD FOR THE FIRE SERVICE IS THE DOWNSTREAM SIDE OF THE FIRST COUPLING AFTER THE FIRE SERVICE LINE SPLITS FROM THE WATER SERVICE LINE INSIDE THE FACILITY; THE POD FOR THE WATER SERVICE LINE REMAINS AT THE DISTRIBUTION SIDE OF THE FIRST VALVE AFTER THE FIRST METER.
– SEWER: POD IS UPSTREAM OF THE FIRST CLEANOUT OUTSIDE THE BUILDING. THE CONTRACTOR SHALL PROVIDE THE CLEANOUT UNLESS DU AND THE GOVERNMENT DETERMINE A CLEANOUT IS NOT NEEDED, IN WHICH CASE THE POD IS WHERE THE SERVICE LINE EXITS THE STRUCTURE. SEE MECHANICAL FOR LOCATION OF CLEANOUT.
– STEAM: POD IS AT THE DISTRIBUTION SIDE OF THE FIRST VALVE AFTER THE METER.
– CONDENSATE: POD IS IMMEDIATELY AFTER THE GATE VALVE (OR CHECK VALVE IF NO GATE VALVES ARE PRESENT) DOWNSTREAM FROM THE FACILITY'S CONDENSATE PUMPS.
–POWER TO FACILITY: A METER AND DISCONNECTING MEANS WILL BE PROVIDED AND INSTALLED BY DU ON THE EXTERIOR OF THE STRUCTURE. THE LOAD SIDE OF THE DISCONNECTING MEANS IS THE POD FOR ELECTRICAL POWER.

3. PROVIDE 30 POV PARKING SPACES. SEE SHEET C2.02 FOR NEW PARKING AREA REQUIREMENTS.

4. PROTECT EXISTING MONITORING WELLS TO REMAIN ON SITE. MONITORING WELLS THAT HAVE BEEN DAMAGED DURING THE CONSTRUCTION OF THIS PROJECT SHALL BE REPLACED BY THE CONTRACTOR AT NO COST TO THE GOVERNMENT.

5. PROVIDE A BICYCLE RACK. BICYCLE RACK SHALL BE A RIBBON TYPE TUBULAR ALUMINUM WITH AN ANODIZED DARK BRONZE FINISH RIBBON RACK, INC., OR APPROVED EQUAL SEE SHEET C4.03 FOR DETAIL. 2

6. PROVIDE SECURITY FENCING FROM THE NORTHWEST CORNER OF THE ENCLOSED OUTSIDE PARTS STORAGE AREA FENCE LINE TO EDGE OF CONCRETE APRON; CONNECT TO FENCE TO BE INSTALLED UNDER FTW336D IF IT IS IN PLACE WHEN FENCE IN THIS CONTRACT IS INSTALLED. PROVIDE SECURITY FENCING FROM A POINT 6–INCHES OFF THE NORTHWEST CORNER OF BUILDING 2077 (HANGAR 7 & 8) TO THE SOUTHEAST CORNER OF THE ENCLOSED OUTSIDE PARTS STORAGE AREA FENCE LINE. BUILDING 2077 SHOWN ON THIS SHEET AND ON SHEET C2.01 IS ONLY APPROXIMATE. EXACT LOCATION OF THE FENCE IN THIS AREA WILL BE FIELD VERIFIED AND COORDINATED WITH CONTRACTING OFFICER; COORDINATES, DIMENSIONS, PROVIDED ARE ONLY APPROXIMATE.

7. BUILDINGS 2097, 2079, 2077 AND 2080 WILL REMAIN OPERATIONAL DURING THE CONSTRUCTION OF THE AIRCRAFT PARTS STORAGE BUILDING, PARKING AREA AND ACCESS ROAD. THE CONTRACTOR SHALL COORDINATE WITH THE CONTRACTING OFFICER TO ESTABLISH ENTRY/EXIT INTO PROJECT SITES; TEMPORARY CONSTRUCTION BARRICADES; ETC.

8. THE CONTRACTOR SHALL PROVIDE A DROP DOWN VEHICLE GATE AT THE ACCESS ROAD OFF OF MONTGOMERY ROAD. THE VEHICLE GATE WILL BE DSC7000 DELTA SCIENTIFIC GATE OR EQUAL. THE VEHICLE GATE SHALL BE A DS (DIPLOMATIC SECURITY) CERTIFIED ANTI–RAM VEHICLE BARRIER. VEHICLE GATE SHALL BE INSTALL PER MANUFACTURER'S RECOMMENDATION. PROVIDE BOULDERS ON EACH SIDE OF THE VEHICLE GATE; SEE SHEET L1.01 FOR BOULDER DETAIL.

9. TOPSOIL AND SEED ALL DISTURBED AREAS.

US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

PRIME CONTRACTOR | CONTRACTOR | CONTRACT NO.
RESIDENT ENGINEER | Recommended: | CITY | Approved: | STATE | Date:

Mod.	Date	Description	Initials
R0002		CHANGED NOTE 5.	

Designed: MED
Drawn: MED
Reviewed: T. Lebeck
Chief – Section
Submitted: D. Fowler
Chief – Branch
Date: 13 NOVEMBER 2009
Dwg Scale: AS NOTED
Plot Scale: 1:2.05
File: FTW336A-008-C1-01
Drawing #: F-211-13-01

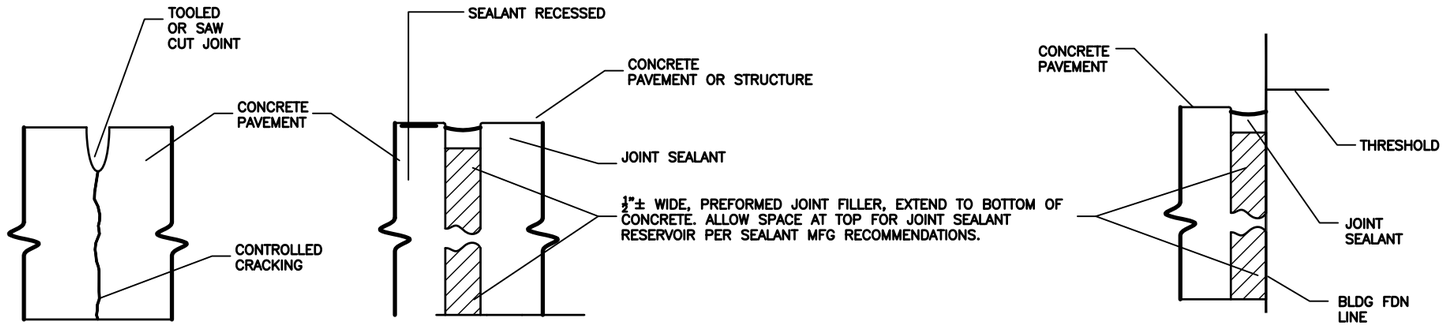
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

PN 65076
INV. NO. W911KB-09-R-0007
FTW336A

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
CIVIL
PLANS
OVERALL SITE PLAN

Reference number:
C1.01
Sheet 8 of 120

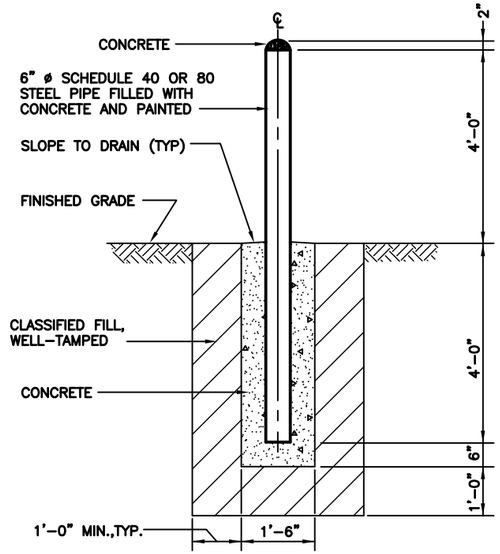
R0002



CONTRACTION JOINT

CONSTRUCTION/ISOLATION JOINT

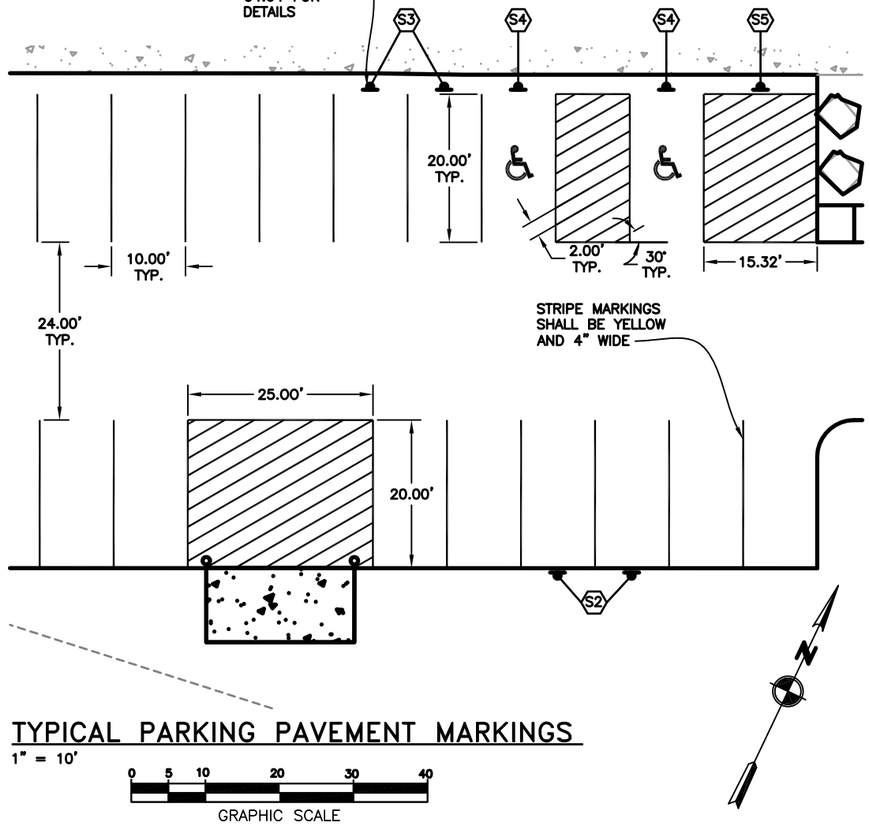
ENTRANCE JOINT



NOTE: POSTS SHALL BE PRIMED AND RECEIVE TWO COATS MINIMUM OF "SAFETY YELLOW" PAINT IN ACCORDANCE WITH MANUFACTURERS'S RECOMMENDATIONS.

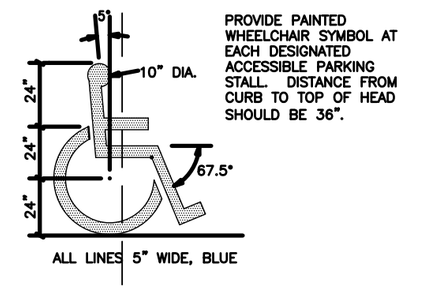
TYP. BOLLARD DETAIL

NTS



TYPICAL PARKING PAVEMENT MARKINGS

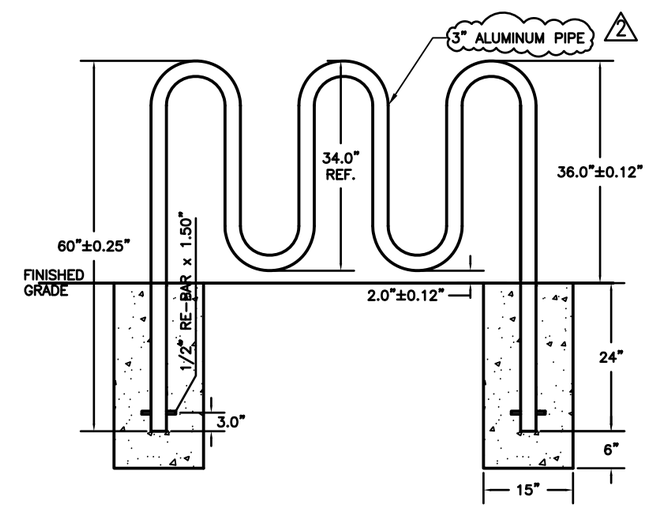
1" = 10'



PROVIDE PAINTED WHEELCHAIR SYMBOL AT EACH DESIGNATED ACCESSIBLE PARKING STALL. DISTANCE FROM CURB TO TOP OF HEAD SHOULD BE 36".

PAVEMENT HANDICAP SYMBOL

N.T.S.



BIKE RACK

N.T.S.

R0002

US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

CONTRACT NO.
CONTRACTOR
CITY
STATE
PRIME CONTRACTOR
Recommended:
RESIDENT ENGINEER
Approved:
Date:

Seq#	Action	Description	Date	Appvd
2	R0002	CHANGED MATERIAL TYPE FOR BIKE RACK	11/13/09	

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

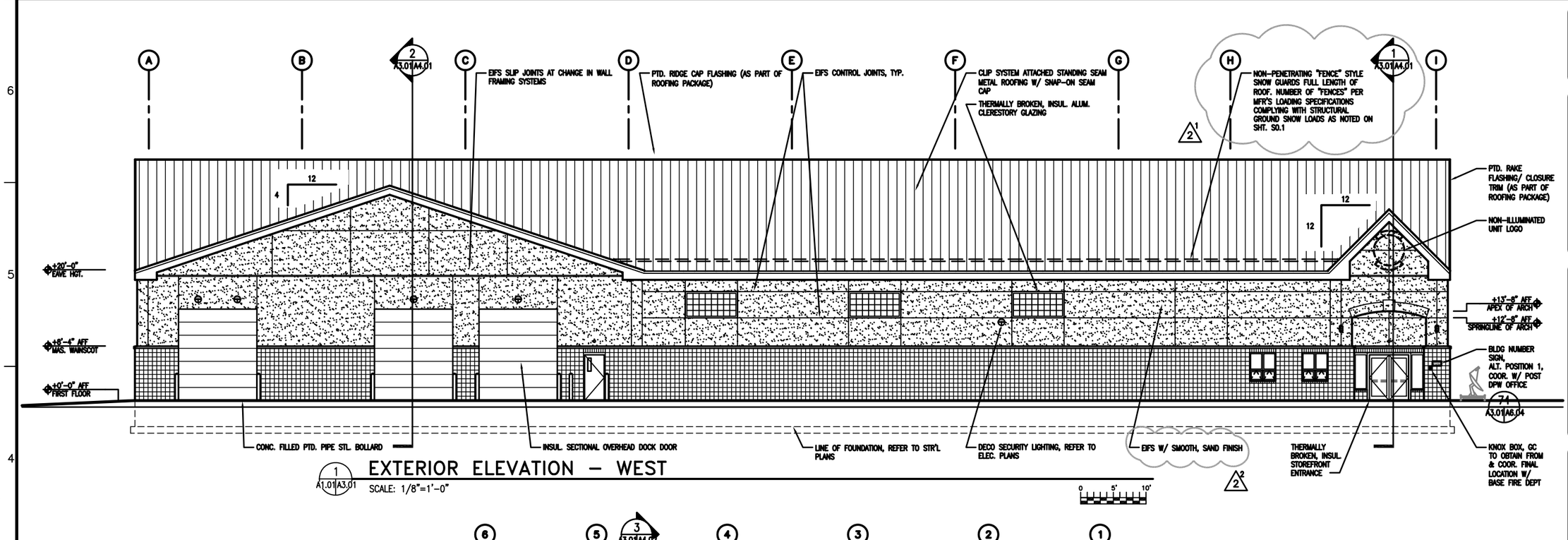
Designed: MED
Drawn: MED
Reviewed: T. Lubeck
Chief, ——— Section
Submitted: D. Fowler
Chief, ——— Branch
Date: 13 NOVEMBER 2009
Proj. Scale: AS NOTED
Plot Scale: 1:2.05
Plot: FTW336A-015-C4-03
Drawing # F-211-13-01

PN 65076
INV. NO. W911KB-09-R-0007
FTW336A

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
CIVIL
DETAILS
MISCELLANEOUS DETAILS

Reference number:
C4.03
Sheet 15 of 120

Drawing X:\UNIFIED\EN-TE\Jobs\FTW336A\Dwgs\FTW336A-015-C4-03.dwg last saved on 11/13/2009 9:13 AM was plotted by Oliver, Dale M POA on 11/13/2009 12:54 PM



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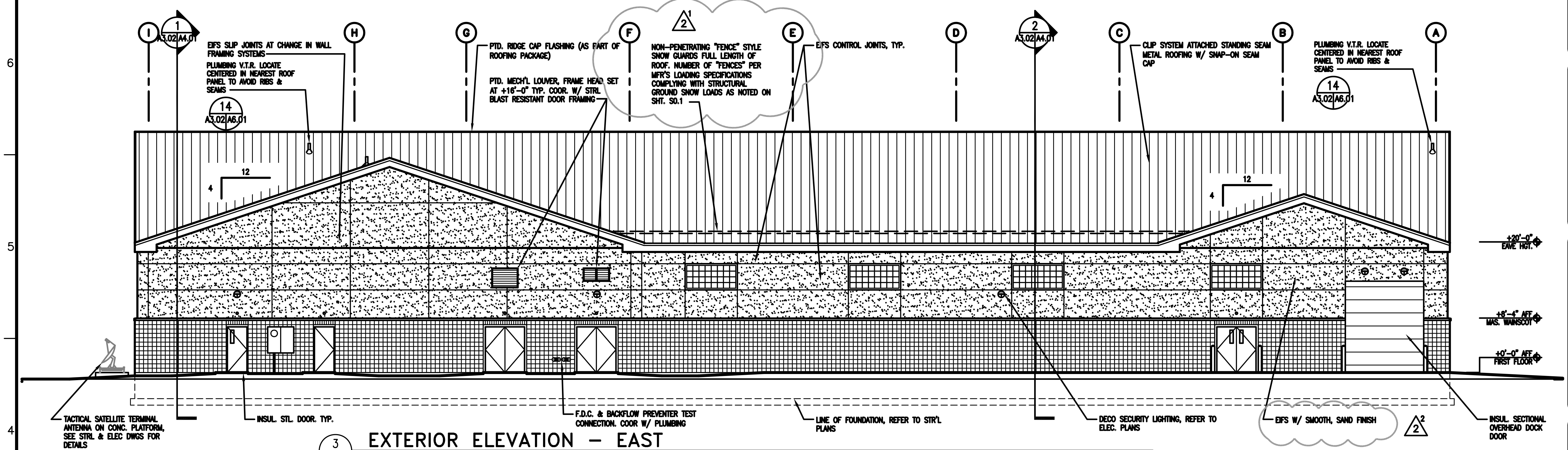
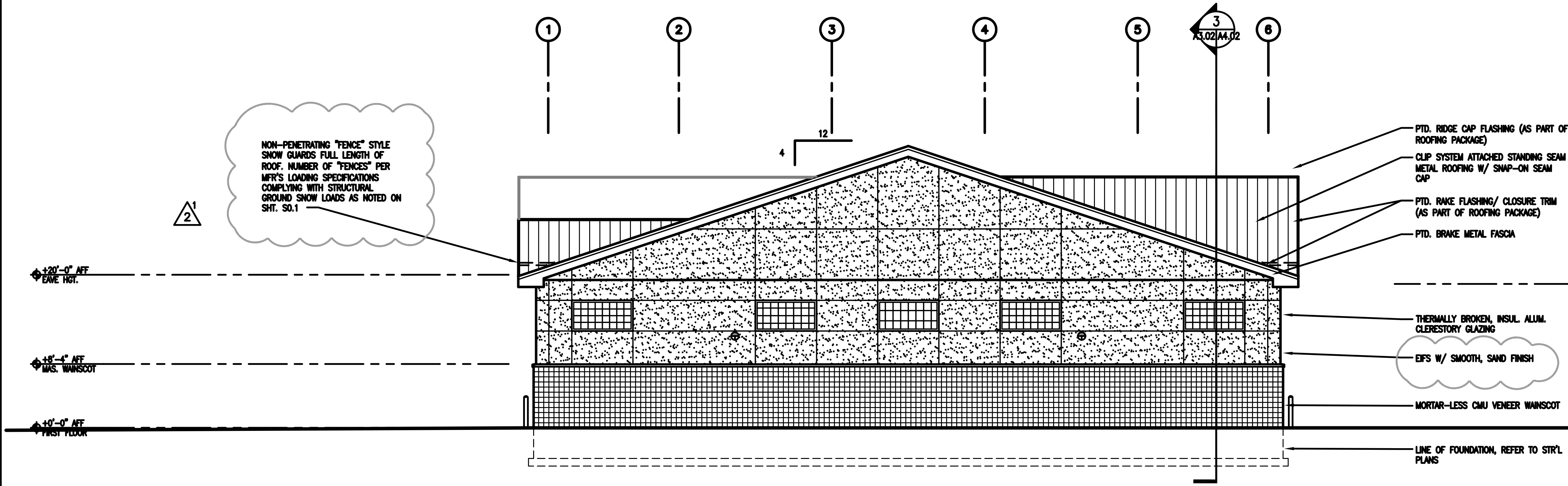


3 (A1.01 | A3.02) EXTERIOR ELEVATION – EAST

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

0 5' 10'



4 (A1.01 | A3.02) EXTERIOR ELEVATION – NORTH

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

0 5' 10'

US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

CONTRACT NO. ____
CONTRACTOR ____
CITY ____ STATE ____
Recommended: ____ Approved: ____ Date: ____
PRIME CONTRACTOR | RESIDENT ENGINEER

Sym.	Action	Description	Date	Appvd
2 (1)	0001	CLARIFIED EIFS	11/13/09	
2 (2)	0001	INSERTED SNOW GUARDS	11/13/09	

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

Designed: R.W.K.
Drawn: R.W.K.
Reviewed: Robert Clayton
Chief, CEPOA-EN-TE-SA Section
Submitted: D. Frenier
Chief, CEPOA-EN-TE Branch
Date: 13 NOVEMBER 2009
Dwg Scale: AS NOTED
Plot Scale: 1:2.0465
File: FTW336A-030-A3-02
Drawing #: F-211-13-01

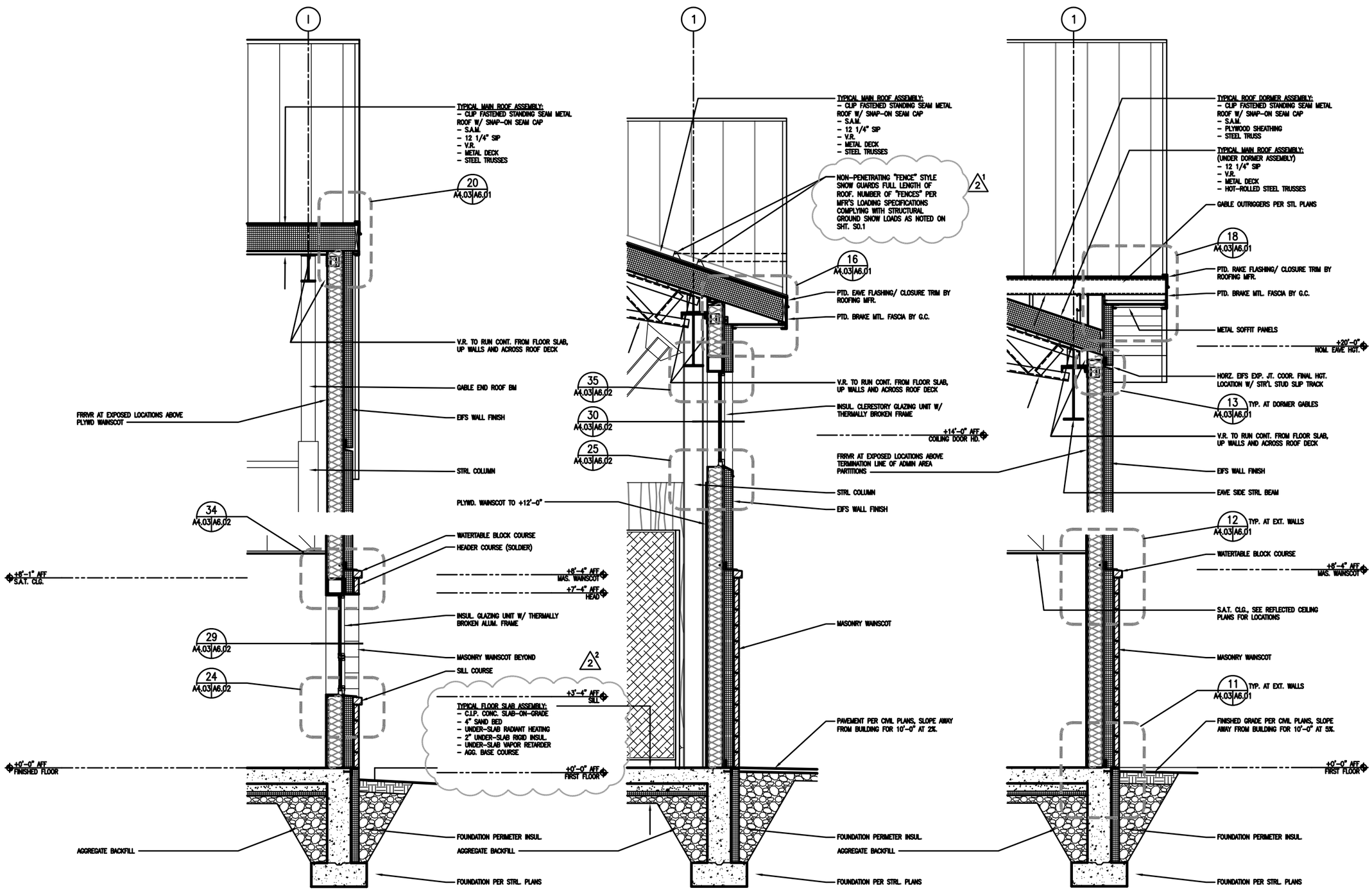
INV. NO. W911KB-09-R-0007

PN 65076 FTW336A

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
ARCHITECTURAL
ELEVATIONS
ELEVATION VIEWS

Reference number:
A3.02
Sheet 30 of 120

R0002



US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

CONTRACT NO. _____
CONTRACTOR _____
CITY _____ STATE _____
PRIME CONTRACTOR
RESIDENT ENGINEER
Recommended: _____
Approved: _____
Date: _____

Sym	Action	Description	Date	Appvd
A	ADD	ADDED SHEET A4.03	11/13/09	

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

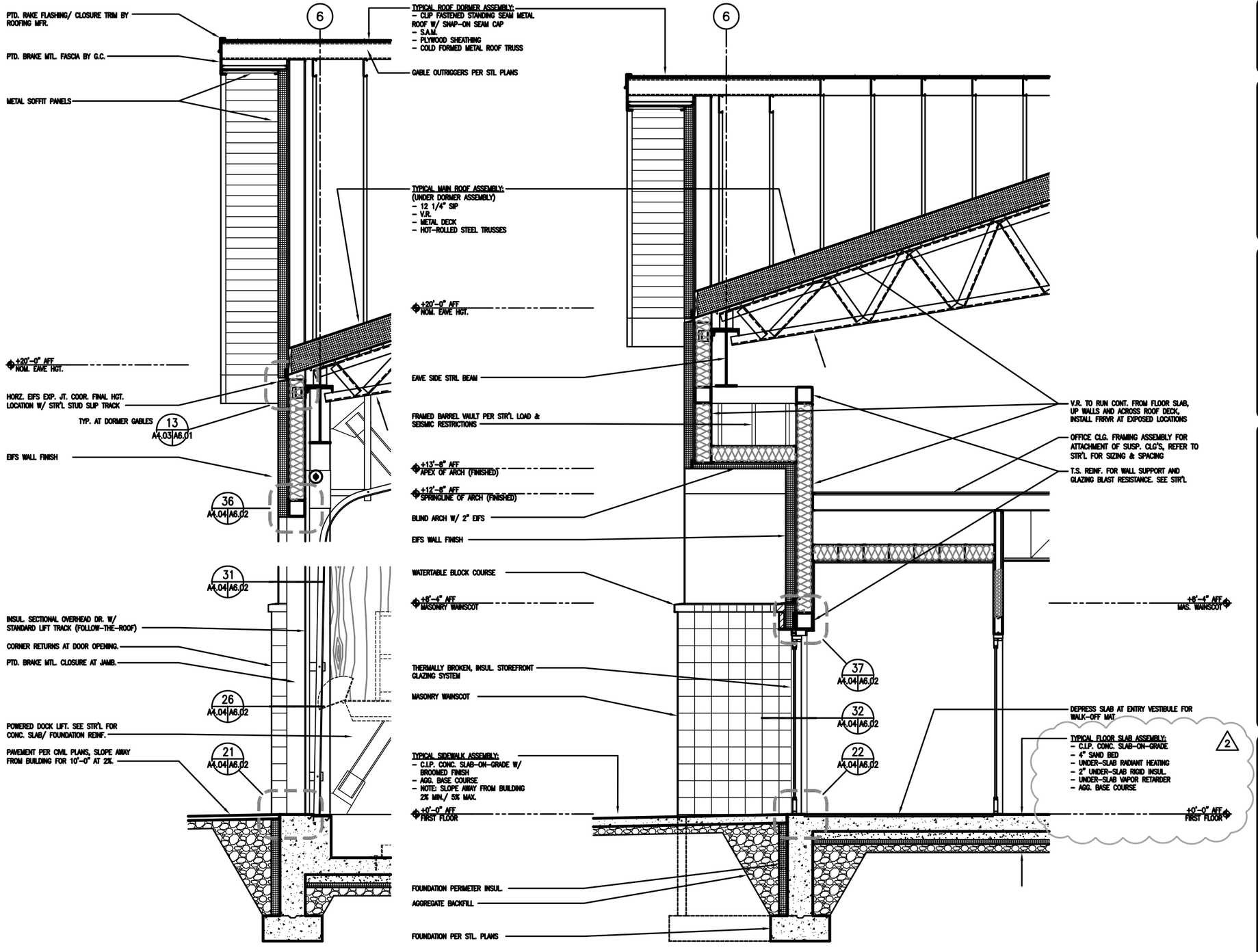
Designed: R.M.K.
Drawn: R.M.K.
Reviewed: Robert Clayton
Submitted: D. Fowler
Date: 13 NOVEMBER 2009
Dwg Scale: AS NOTED
Prof Scale: 1:2.04551158
File: FTW336-033-A4-03
Drawing #: F-211-13-01

INV. NO. W911KB-09-R-0007
PN 65076
FTW336A

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
ARCHITECTURAL
SECTIONS
WALL SECTIONS

Reference number:
A4.03
Sheet 33 of 120

R0002



5 A4.01|A4.04 WALL SECTION
SCALE: 1/2"=1'-0"
0 1' 2'

4 A4.01|A4.04 WALL SECTION
SCALE: 1/2"=1'-0"
0 1' 2'

US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

CONTRACT NO. _____
CONTRACTOR _____
CITY _____ STATE _____
PRIME CONTRACTOR
RESIDENT ENGINEER
Recommended: _____
Approved: _____
Date: _____

Mark	Brief Action	Description	Date Approd
A	ISSUED	CLARIFIED UNDER-SLAB INSULATION	11/13/09

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

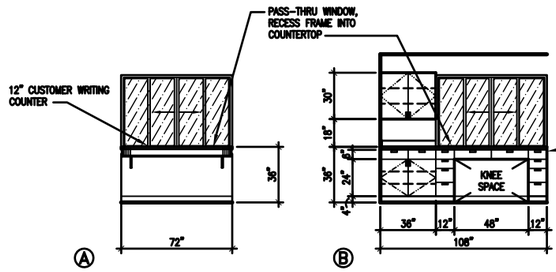
Designed: R.W.K.
Drawn: R.W.K.
Reviewed: Robert Clayton
Submitted: D. Frenier
Date: 13 NOVEMBER 2009
Dwg Scale: AS NOTED
Print Scale: 1:2.04651158
File: FTW336A-D34-A4-04
Drawing #: F-211-13-01

INV. NO. W911KB-09-R-0007
PN 65076
FTW336A

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
ARCHITECTURAL
SECTIONS
WALL SECTIONS

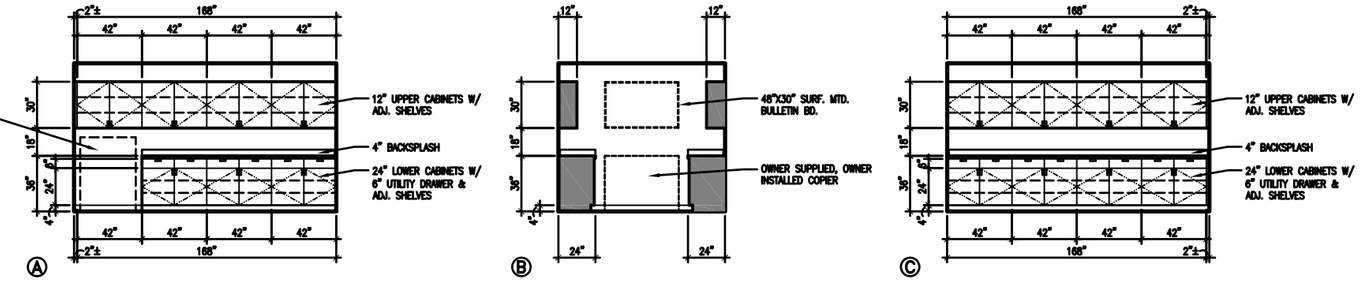
Reference number:
A4.04
Sheet 34 of 120

R0002



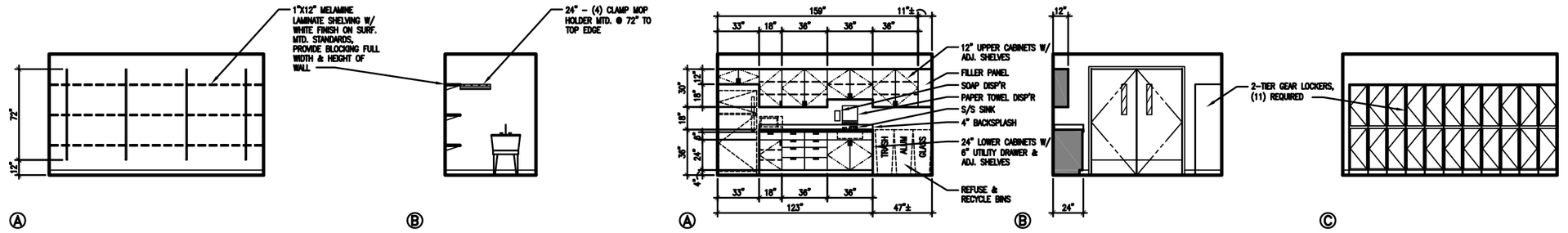
1 LOBBY WINDOW – ROOM 103

A1.02|A5.04 SCALE: 1/4"=1'-0"



2 COPY – ROOM 119

A1.02|A5.04 SCALE: 1/4"=1'-0"

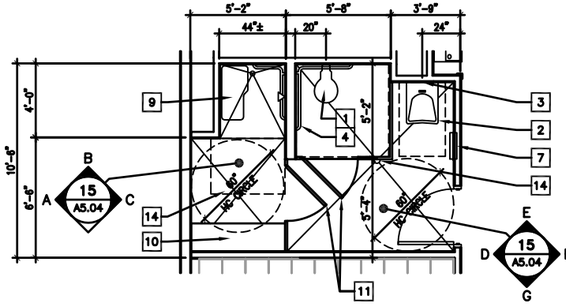


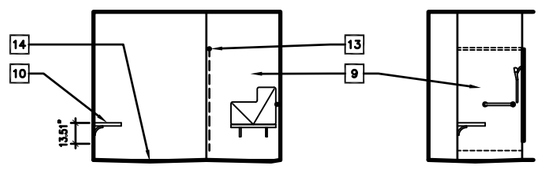
3 JANITOR'S CLOSET – ROOM 117

A1.02|A5.04 SCALE: 1/4"=1'-0"

4 CORRIDOR/ BREAKROOM – ROOM 116

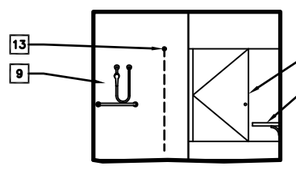
A1.02|A5.04 SCALE: 1/4"=1'-0"





Ⓐ SHOWER – NORTH

Ⓑ SHOWER – EAST



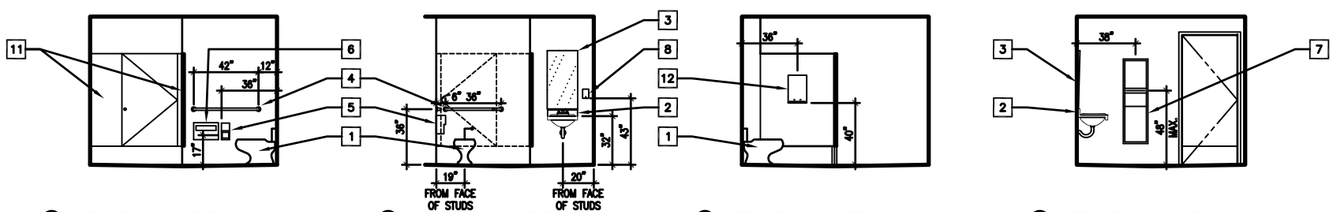
Ⓒ SHOWER – NORTH

#	TOILET KEYNOTES	
	DESCRIPTION	DESCRIPTION
1.	ADA APPROVED WATER CLOSET-SEAT MTD. @ +17"–19" A.F.F (RE. PLUMBING PLANS)	
2.	ADA APPROVED WALL LAVATORY-INSULATE PIPES. (RE: PLUMBING PLANS)	
3.	ADA APPROVED TILT MIRROR, 24"X36"	
4.	ADA APPROVED GRAB BARS., 36" & 42" PROVIDE WOOD BLOCKING AS REQUIRED FOR INSTALLATION	
5.	ADA APPROVED TOILET TISSUE DISP'R, SURF. MTD. W/ S/S FINISH	
6.	ADA APPROVED SEAT COVER DISP'R, SURF. MTD. W/ S/S FINISH	
7.	ADA APPROVED PAPER TOWEL DISP'R/ WASTE RECEPTACLE, SEMI-RECESSED W/ S/S FINISH	
8.	ADA APPROVED ANTI-BACTERIAL SOAP DISP'R, SURF. MTD. W/ S/S FINISH	
9.	ADA APPROVED 36"X36" PRE-FAB ACRYLIC ROLL-IN SHOWER W/ WHITE FINISH	
10.	FIXED SOLID SURF. DRESSING BENCH	
11.	FLOOR MTD. OVERHEAD BRACED PAINTED METAL TOILET PARTITIONS W/ 36" WIDE DOOR	
12.	ADA APPROVED SANITARY NAPKIN/ TAMPON DISP'R, SURF. MTD. W/ S/S FINISH (FEMALE LATRINE ONLY)	
13.	CURTAIN ROD W/ S/S FINISH & VINYL CURTAIN W/ OPAQUE WHITE FINISH	
14.	SLOPE TO FLOOR DRAIN, TYP.	

5 MALE LATRINE – ROOM 115

FEMALE LATRINE ROOM 114 SIMILAR, OPPOSITE HAND

A1.02|A5.04 SCALE: 1/4"=1'-0"



Ⓓ LATRINE – NORTH

Ⓔ LATRINE – NORTH

Ⓕ LATRINE – NORTH

Ⓖ LATRINE – NORTH

5 MALE LATRINE – ROOM 115

A5.04|A5.04 SCALE: 1/4"=1'-0"

R0002

US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

CONTRACT NO. _____
CONTRACTOR _____
CITY _____ STATE _____
PRIME CONTRACTOR
RESIDENT ENGINEER
Recommended: _____
Approved: _____
Date: _____

Mark	Date	Description	Approved
A	6/09	Submittal Action	
		CLARIFIED TRUST PARTITIONS IN #11	11/13/09

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS, ANCHORAGE, ALASKA

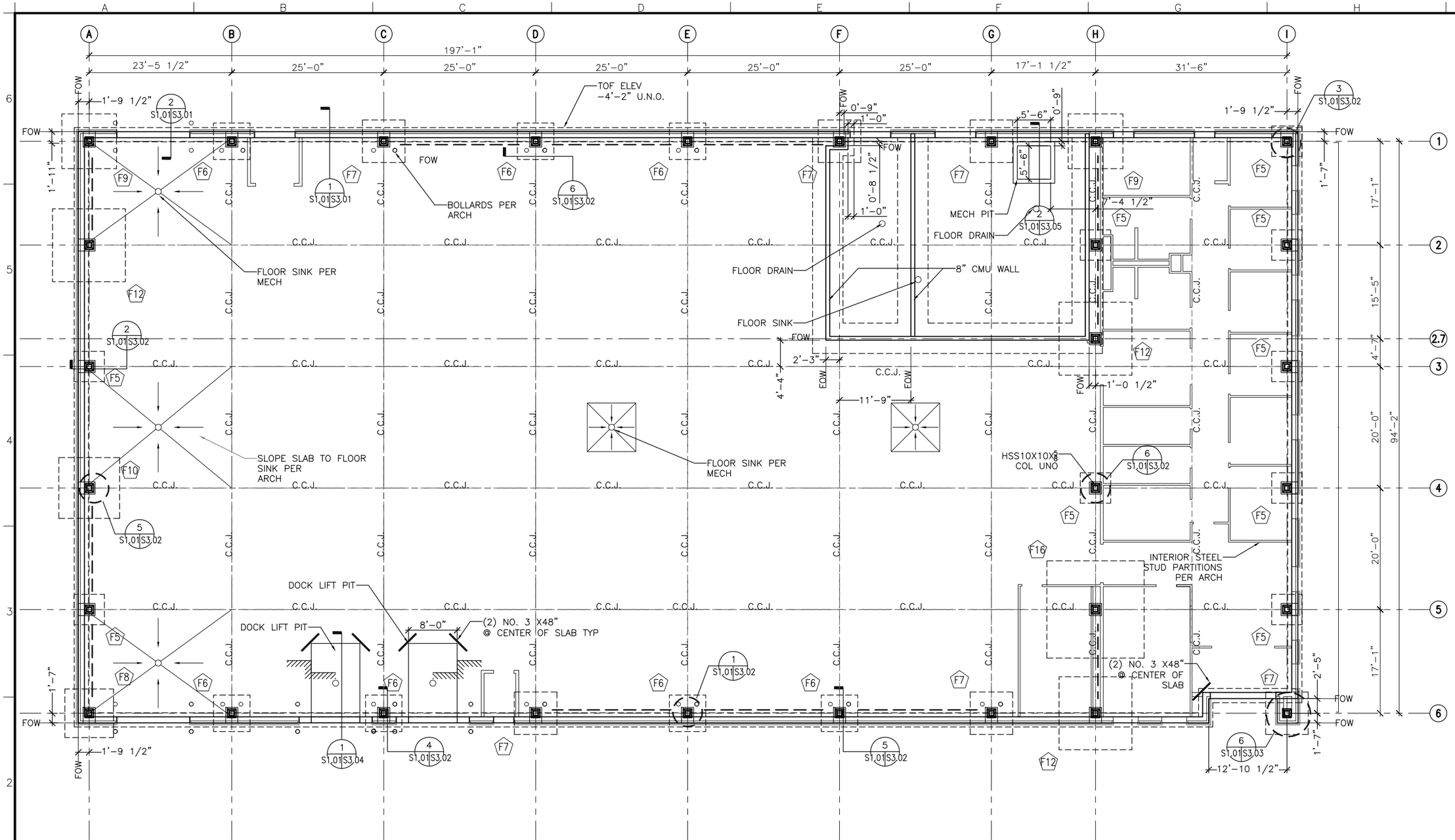
Designed: R.W.K.
Drawn: R.W.K.
Reviewed: Robert Clayton
Chief, ____ Section
Submitted: D. Frenier
Chief, ____ Branch

Date: 13 NOVEMBER 2009
Dwg Scale: AS NOTED
Print Scale: 1:2.046511158
File: FTW336-038-A5-04
Drawing #: F-211-13-01

INV. NO. W911KB-09-R-0007
PN 65076
FTW336A

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
ARCHITECTURAL
INTERIOR ELEVATIONS

Reference number:
A5.04
Sheet 38 of 120



DENOTES HSS10X10X5/8 COL

DENOTES CONCENTRICALLY BRACED FRAME LOCATION

FOUNDATION PLAN

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

NOTES:

1. TOP OF SLAB-ON-GRADE ELEVATION 0'-0" U.N.O.
2. TOP OF PEDESTAL ELEVATION -8" U.N.O..
3. TOP OF EXTERIOR FOUNDATION WALL -8" U.N.O.
4. TOP OF INTERIOR/EXTERIOR FOOTING ELEVATION -50" U.N.O..
5. SEE FOOTING SCHEDULE ON SHEET S0.4.
6. TOTAL 8" SLAB-ON-GRADE THICKNESS ON 4" SAND 95% COMPACT ON INSULATION PER MECHANICAL PLANS. REINFORCE WITH NO. 5 @ 12" OC EA. WAY W/ 2.5" COVER FROM TOP. f'c=4000 psi. NO ENTRAINED AIR IN POWER TROWELED SLAB-ON-GRADE. PROTECT SLAB-ON-GRADE FROM FREEZE-THAW AFTER INSTALLATION.
7. FLOOR DRAIN LOCATIONS PER PLUMBING PLANS. HOUSE KEEPING PAD CONSTRUCTION AND LOCATIONS PER MECHANICAL PLANS. SLOPE SLAB PER ARCHITECTURAL PLANS.
8. VERIFY AND COORDINATE DOCK LIFT PIT DIMENSIONS WITH DOCK LIFT MANUFACTURER.

US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

CONTRACT NO. _____
CONTRACTOR _____
CITY _____ STATE _____
PRIME CONTRACTOR
Recommended: _____
RESIDENT ENGINEER
Approved: _____
Date: _____

Gen	Action	Description	Date
1	R0002		12/8/2009
2	R0002	HOUSEKEEPING PAD PER MECHANICAL PLANS	12/8/2009
3	R0002	REVISED SLAB-ON-GRADE NOTE	12/8/2009

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

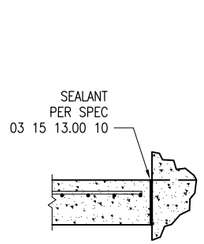
Designed: SMH	Drawn: SMH	Reviewed: P. Lorn	Chief, ---- Section
Submitted: D. Frender	Chief, ---- Branch	Date: 13 NOVEMBER 2009	
Dwg Scale: AS NOTED	Plot Scale: 1:2.0465	Plot: FTW336A-049-S1-01	Drawing #: F-211-13-01

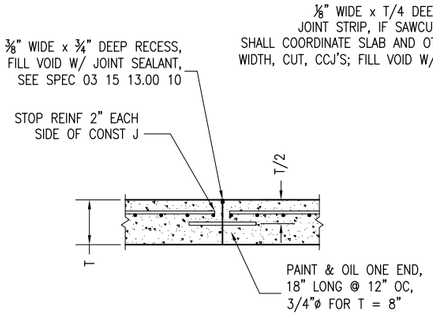
INV. NO. W911KB-09-R-0007
PN 65076
FTW336A

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
STRUCTURAL
PLANS
FOUNDATION PLAN

Reference number:
S1.01
Sheet 49 of 120

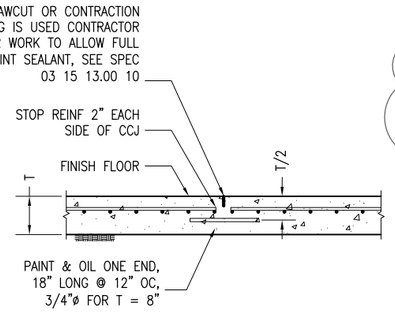
R0002



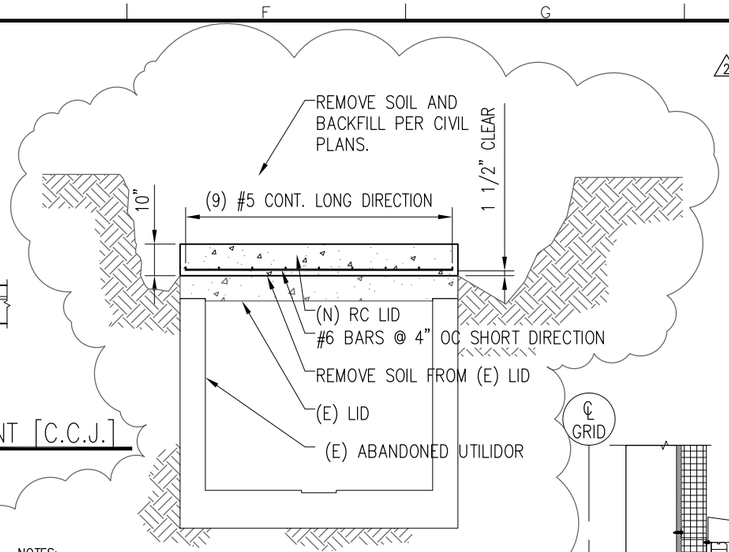


7 S1.01|S3.01 S.O.G. ISOLATION JOINT
SCALE: 1"=1'-0"

6 S1.01|S3.01 S.O.G. CONSTRUCTION JOINT
SCALE: 1"=1'-0"

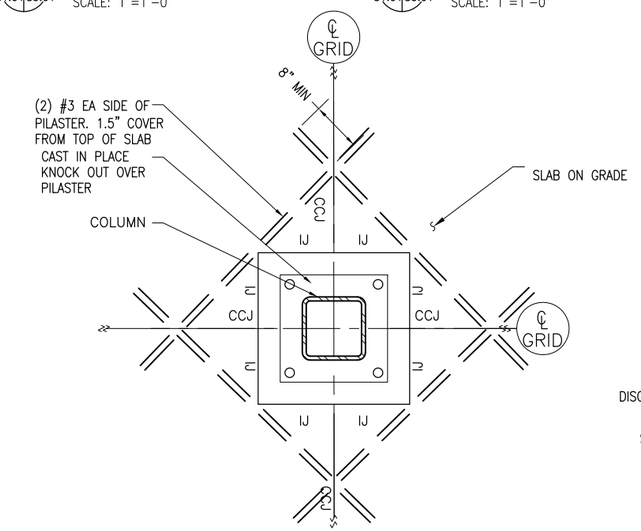


5 S1.01|S3.01 CRACK CONTROL JOINT [C.C.J.]
SCALE: 1"=1'-0"

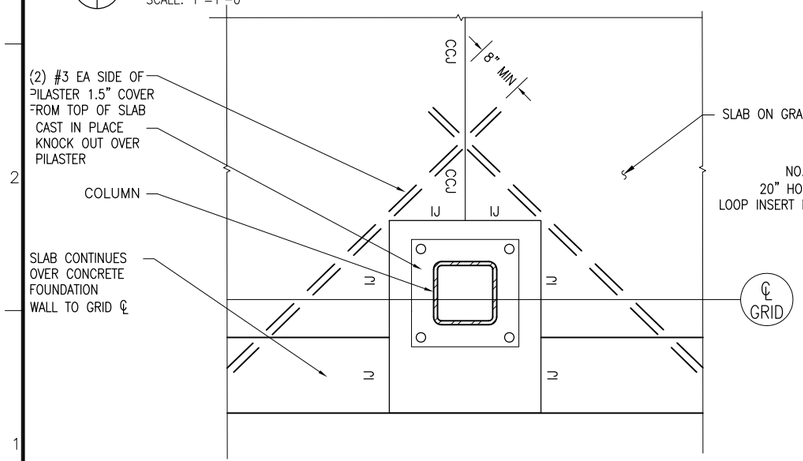


NOTES:
1) f'c=4000 psi
2) PROVIDE CONSTRUCTION JOINTS @ 25' OC MAXIMUM. DISCONTINUE REINFORCEMENT ACROSS CONSTRUCTION JOINTS.
3) DESIGN LOAD = MILITARY ATLAS TELEHANDLER WITH 10 KIP LOAD, 2 FEET SOIL, 60 PSF GROUND SNOW LOAD.

6 S3.01|S3.01 EXISTING UTILIDOR RETROFIT LID
SCALE: 1/4"=1'-0"



8 S1.01|S3.01 TYPICAL CONTROL JOINT @ INTERIOR COLUMN
SCALE: 1"=1'-0"



3 S1.01|S3.01 TYPICAL CONTROL JOINT @ EXTERIOR COLUMN
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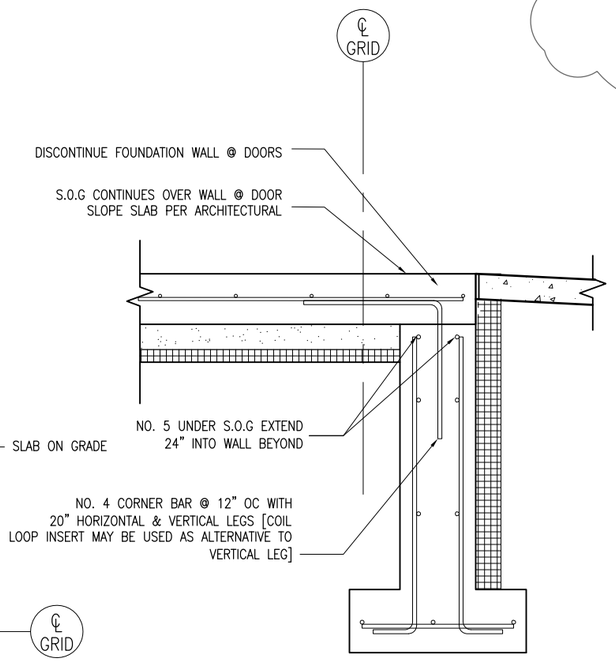
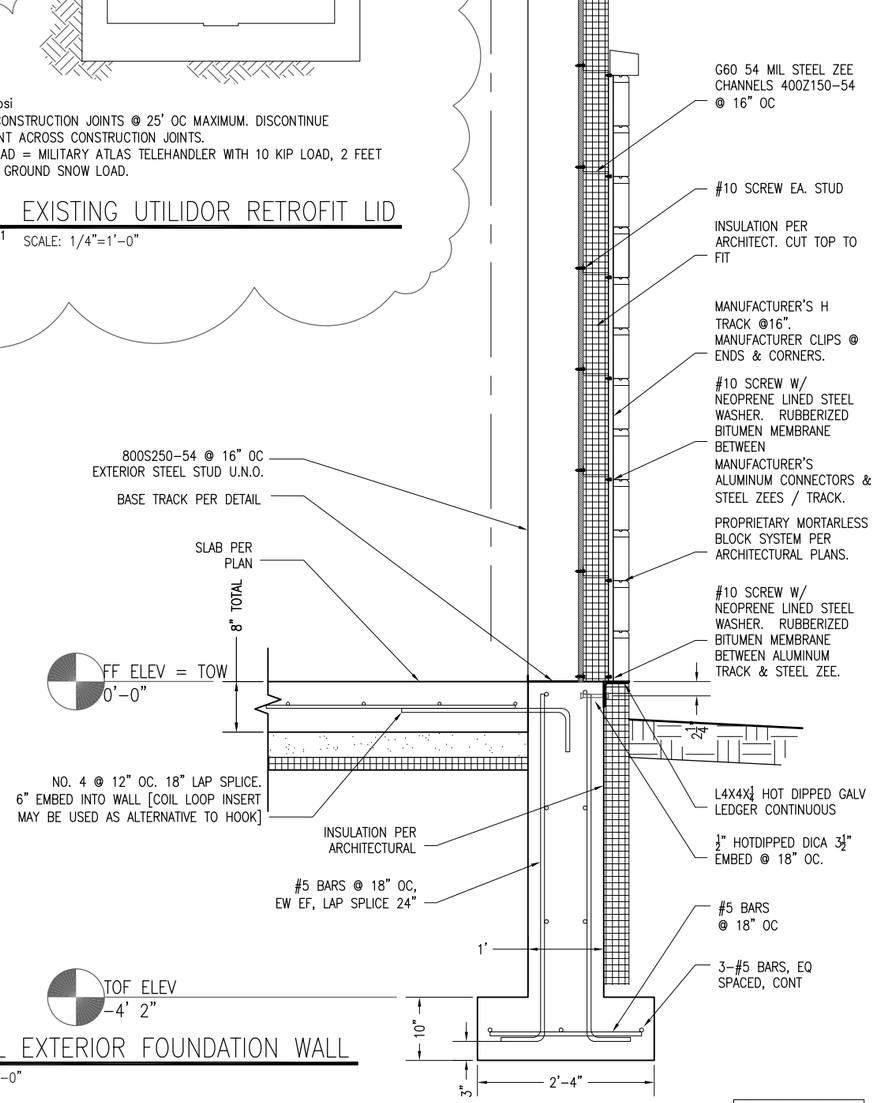


NOTES:
1. SEE DETAIL 1/S3,01 FOR INFORMATION NOT SHOWN.

2 S1.01|S3.01 TYPICAL S.O.G. @ DOOR
SCALE: 1"=1'-0"



1 S1.01|S3.01 TYPICAL EXTERIOR FOUNDATION WALL
SCALE: 1"=1'-0"

US ARMY CORPS OF ENGINEERS
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CONTRACT NO. _____
CONTRACTOR _____
CITY _____ STATE _____
PRIME CONTRACTOR
Recommended: _____
RESIDENT ENGINEER
Approved: _____
Date: _____

Mark	Date	Description	Sent/Action
2	R0002	EXISTING UTILIDOR LID RETROFIT DETAIL	
1	R0002	HOUSEKEEPING PAD PER MECHANICAL PLANS	

U.S. ARMY ENGINEER DISTRICT, ALASKA
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

Designed: SMH
Drawn: SMH
Reviewed: P. Lam
Chief — CorpsCAD/Pro-E Task — Section
Submitted: D. Frenier
Chief — CorpsCAD/Pro-E Task — Branch
Date: 13 NOVEMBER 2009
Dwg Scale: AS NOTED
Plot Scale: 1:2
File: FTW336A-058_S3_01
Drawing #: F-211-13-01

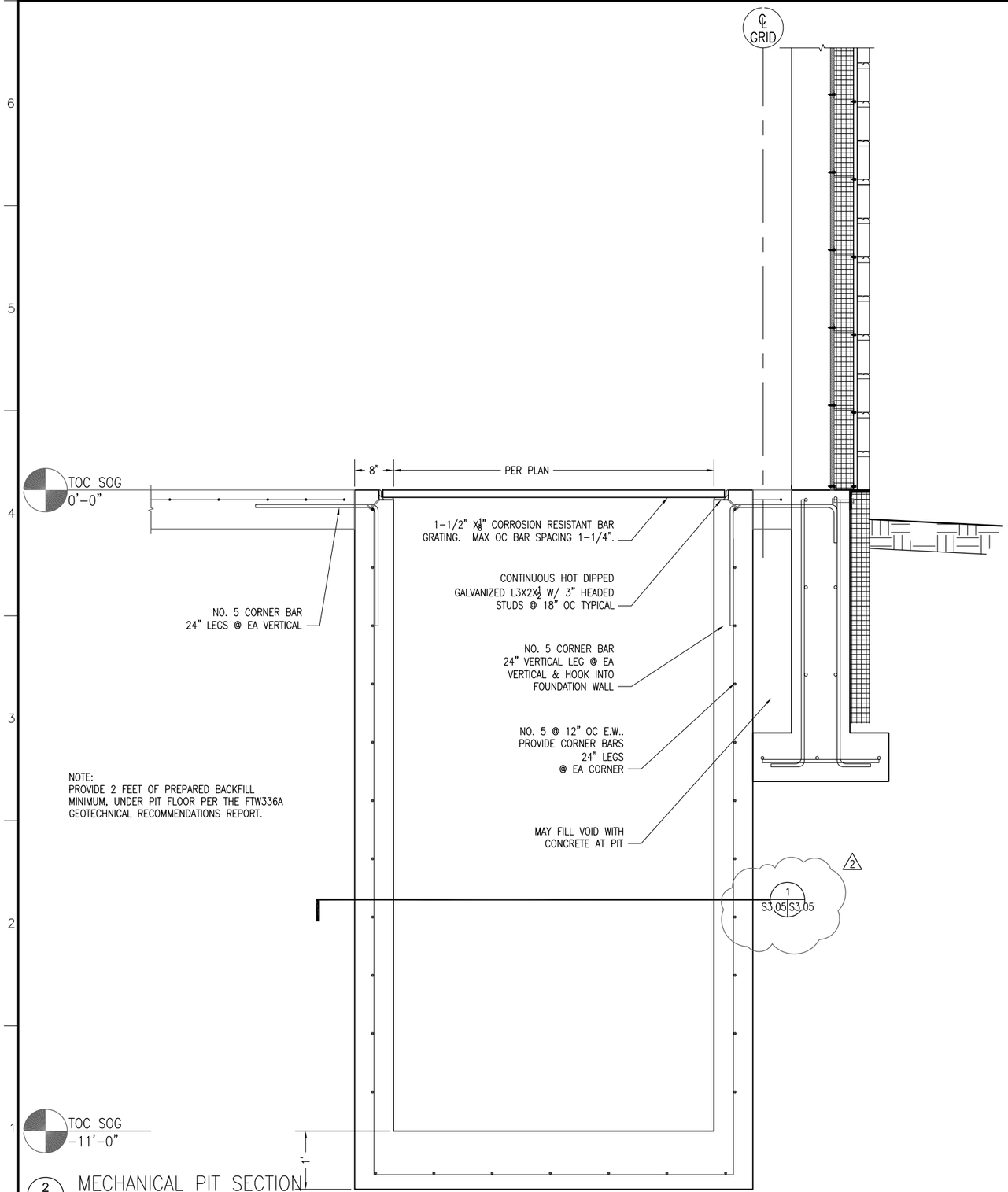
INV. NO. W911KB-09-R-0007
PN 65076 FTW336A

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
STRUCTURAL
DETAILS
FOUNDATION DETAILS 1

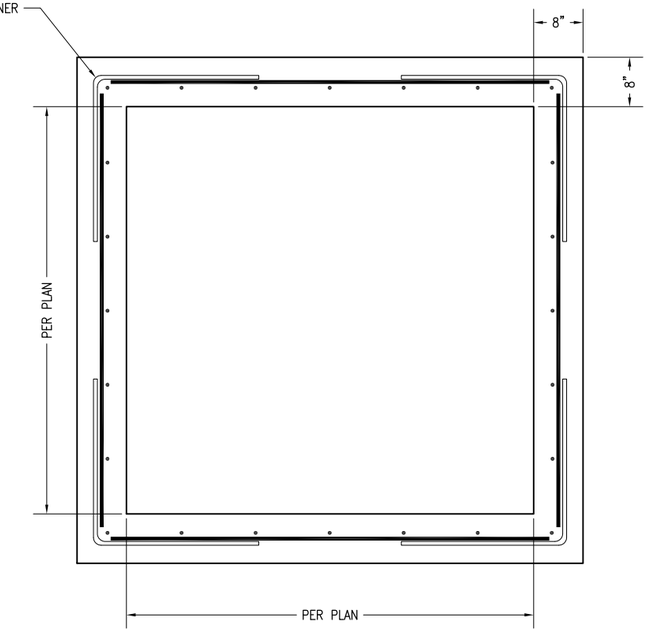
Reference number:
S3.01
Sheet 58 of 120

R0002

Drawing X:\UNIFIED\EN-TE\Jobs\FTW336A\Dwgs\FTW336A-058-S3-01.dwg last saved on 11/16/2009 12:22 PM was plotted by Haan, Scott M POA on 11/16/2009 2:18 PM



2 S1.01 S3.05 MECHANICAL PIT SECTION
SCALE: 1"=1'-0"



1 S3.05 S3.05 MECHANICAL PIT REINFORCING PLAN
SCALE: 1"=1'-0"

R0002

US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

CONTRACT NO. _____
CONTRACTOR _____
CITY _____ STATE _____
Recommended: _____ PRIME CONTRACTOR
Approved: _____ RESIDENT ENGINEER
Date: _____

Sym	Action	Description	Date	Appvd
2	R0002	REVISED SEISM. REFERENCE	12NOV09	

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

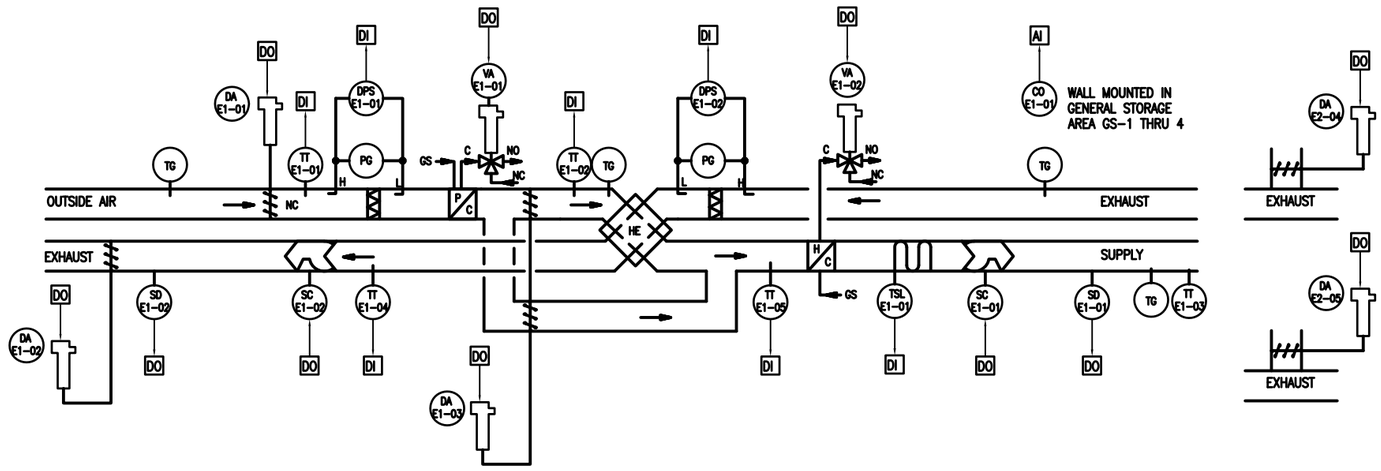
Designed: SMH
Drawn: SMH
Reviewed: P. Lorn
Chief, ---
Submitted: D. Frenier
Chief, ---

PN 65076
INV. NO. W911KB-09-R-0007
FTW336A

Date: 13 NOVEMBER 2009
Proj Scale: AS NOTED
Plot Scale: 1:2.0465
File: FTW336A-062-S3-05
Drawing # F-211-S3-01

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
STRUCTURAL
DETAILS
FOUNDATION DETAILS 5

Reference number:
S3.05
Sheet 62 of 120



ERV-1 CONTROL DIAGRAM (GENERAL STORAGE AREA)

NTS

I/O MATRIX																		SOFTWARE					
	OUTPUT							INPUT										APPLICATION PROGRAMS					
	DIGITAL			ANALOG				DIGITAL			ANALOG												
	START/STOP	FAN MOTOR SPEED (RPM)		POSITION ADJUSTMENT				ALARM	CARBON MONOXIDE (PPM)		TEMPERATURE	POSITION INDICATION	ALARM	CURRENT				TIME SCHEDULE	TRENDING	RUNTIME ERRORS	ALARM REPORTING	SETPOINT ADJUSTMENT	GRAPHIC
SUPPLY FAN	1	1																X	X				X
EXHAUST FAN	1	1																X	X		X		X
SUPPLY AIR											1											X	X
RETURN AIR											1		1										X
EXHAUST AIR											1												X
OUTSIDE AIR											1												X
OUTSIDE AIR DAMPER				1								1											X
EXHAUST AIR DAMPER				1								1											X
BYPASS AIR DAMPER				1								1											X
PREHEAT COIL VALVES				1								1						X	X				X
HEATING COIL VALVES				1								1						X	X				X
DUCT SMOKE DETECTOR								2												X		X	X
THERMOSTAT											1								X		X	X	X
FILTERS								2												X	X	X	X
FREEZESTAT								1											X		X	X	X
CO DETECTORS								1	4										X		X	X	X
CURRENT SENSOR														1					X			X	X

SEQUENCE OF OPERATION

SCHEDULE: OPERATES BASED ON USER VARIABLE OCCUPANCY SCHEDULE, MONDAY – SATURDAY 7AM TO 7PM, SCHEDULE ON/OFF IS OVERRIDDEN BY CO LEVEL, BATTERY CHARGING MODES, OR USER INPUT.

MODES OF OPERATION

– CO LEVEL CONTROL: GAS SENSORS GS-1 THRU 4 MONITOR THE CARBON MONOXIDE LEVELS IN THE GENERAL STORAGE AREA. WHEN THE CO LEVEL EXCEEDS SETPOINT SHOWN, ERV-1 SUPPLY AND EXHAUST FAN MOTOR SPEEDS ARE SET TO HIGH. WHEN THE CO LEVEL DROPS BELOW SETPOINT SHOWN, THE FAN MOTORS ARE SET TO LOW SPEED AFTER A 10 MINUTE DELAY.

– BATTERY CHARGING: THE BATTERY CHARGERS ARE MONITORED BY CURRENT SENSORS, CURRENT FLOW TO EITHER BATTERY CHARGER INITIATES HIGH MOTOR SPEED FOR THE SUPPLY AND EXHAUST FANS. THE MOTORIZED DAMPERS AT EG-4 & 7 OPEN. WHEN NEITHER OF THE BATTERY CHARGER CURRENT SENSORS DETECT CURRENT FLOW, EG-4 & 7 DAMPERS CLOSE AND THE FAN SPEEDS ARE SET TO LOW AFTER A 10 MINUTE DELAY.

– GENERAL VENTILATION CONTROL: IF THE CARBON MONOXIDE LEVEL IS BELOW THE SETPOINT AND THE BATTERY CHARGERS ARE NOT CHARGING, ERV-1 SUPPLY AND EXHAUST FAN MOTOR SPEEDS ARE SET TO LOW. IN ALL MODES OF OPERATION, THE AIR VOLUME IS MODULATED THROUGH THE USE OF SPEED CONTROLS ON BOTH SUPPLY AND EXHAUST FAN MOTORS. HIGH SPEED IS THE MOTOR NAMEPLATE RPM, LOW SPEED IS 1/2 OF HIGH SPEED RPM.

OUTSIDE AND EXHAUST AIR DAMPERS
– SET TO FULLY OPEN WHEN FANS ARE ON.

BYPASS DAMPER
– FULLY OPEN WHEN THE OUTDOOR AIR TEMPERATURE >60°F

SUPPLY AND EXHAUST FAN CONTROL
– BOTH FANS RUN SIMULTANEOUSLY WHEN UNIT IS ON. 2-SPEED FANS ARE CONTROLLED PER "MODES OF OPERATION" ABOVE. 2

FILTERS
– A DIFFERENTIAL PRESSURE SENSOR ACROSS THE FILTERS SHALL INITIATE A FILTER ALARM WHEN THE PRESSURE DROP ACROSS THE FILTER REACHES THE SEPOINT AS SHOWN. THE ALARM SHALL DISPLAY AT THE BUILDING AUTOMATION SYSTEM TERMINAL.

FREEZE PROTECTION
– A TEMPERATURE SENSOR (LOW TEMPERATURE) SHALL STOP THE SUPPLY FAN, AND CAUSE THE OUTSIDE AND EXHAUST AIR DAMPERS TO CLOSE, AND SHALL INITATE A LOW TEMPERATURE ALARM IF THE TEMPERATURE DROPS BELOW THE SETPOINT SHOWN. RETURN TO THE NORMAL MODE OF OPERATION SHALL REQUIRE MANUAL RESET OF THE SENSOR. THE ALARM SHALL ANNUNCIATE AT THE BUILDING AUTOMATION SYSTEM TERMINAL.

PREHEAT COIL
– THE CONTROL VALVE SHALL BE MODULATED BY THE DDC SYSTEM FROM THE SIGNAL OF A TEMPERATURE SENSING ELEMENT AND TRANSMITTER LOCATED IN THE COIL DISCHARGE AIR TO MAINTAIN THE SETPOINT SHOWN.

HEATING COIL
– THE CONTROL VALVE SHALL BE MODULATED BY THE DDC SYSTEM FROM THE SIGNAL OF A TEMPERATURE SENSING ELEMENT AND TRANSMITTER LOCATED IN THE SUPPLY AIR DUCT TO MAINTAIN THE SETPOINT SHOWN.

EMERGENCY HVAC SHUTOFF
– THE BUILDING AUTOMATION SYSTEM (BAS) SHALL SHUTOFF ERV-1 THRU 3 AND CLOSE THE OUTSIDE AIR

CONTROL DAMPER SCHEDULE					
IDENTIFIER	FUNCTION	TYPE	SIZE	RANGE	REMARKS
DA-E1-01	OUTSIDE AIR DAMPER	OPEN/CLOSED	LOUVER DIMENSION	0–4 IN WG/–60°F TO 90°F	PARALLEL BLADE, COLD TEMPERATURE, AT EXTERIOR WALL
DA-E1-02	EXHAUST AIR DAMPER	OPEN/CLOSED	LOUVER DIMENSION	0–4 IN WG/–60°F TO 90°F	PARALLEL BLADE, COLD TEMPERATURE, AT EXTERIOR WALL
DA-E1-03	HEAT EXCHANGER FACE AND BYPASS AIR DAMPER	OPEN/CLOSED	MANUFACTURERS STANDARD	0–4 IN WG/0°F TO 100°F	PARALLEL BLADE, IN ERV UNIT
DA-E1-04	BATTERY CHARGING OPERATION – AIR DEVICE EG-4	OPEN/CLOSED	DUCT SIZE	0–4 IN WG/0°F TO 100°F	PARALLEL BLADE, AT AIR DEVICE EG-4
DA-E1-05	BATTERY CHARGING OPERATION – AIR DEVICE EG-7	OPEN/CLOSED	DUCT SIZE	0–4 IN WG/0°F TO 100°F	PARALLEL BLADE, AT AIR DEVICE EG-7

CONTROL VALVE SCHEDULE						
IDENTIFIER	FUNCTION	TYPE	RANGE	CV	CLOSE OFF RATING	REMARKS
VA-E1-01	PRE-HEAT COIL VALVE	3-WAY, MODULATING	MANUFACTURERS STANDARD	16	70 PSIG	GLOBE VALVE, 24V ACTUATOR
VA-E1-02	VALVE ACTUATOR, HEATING COIL	3-WAY, MODULATING	MANUFACTURERS STANDARD	6.3	70 PSIG	GLOBE VALVE, 24V ACTUATOR

SENSOR SCHEDULE		
IDENTIFIER	FUNCTION	RANGE/SETPOINT
CO-E1-01	CARBON MONOXIDE SENSOR, WALL MOUNTED	0–100 PPM/25 PPM
DPS-E1-01	DIFFERENTIAL PRESSURE SENSOR, OUTSIDE AIR FILTER	0–1.0 IN WG/.65 IN WG
DPS-E1-02	DIFFERENTIAL PRESSURE SENSOR, EXHAUST AIR FILTER	0–1.0 IN WG/.65 IN WG
SD-E1-01	DUCT SMOKE DETECTOR, SUPPLY DUCT	ON/OFF
SD-E1-02	DUCT SMOKE DETECTOR, EXHAUST DUCT	ON/OFF
TSL-E1-01	TEMPERATURE SENSOR, LOW TEMPERATURE PROTECTION	0°F – 80°F/40°F
TT-E1-01	TEMPERATURE TRANSMITTER, DUCT MOUNTED, OUTSIDE AIR	–60°F TO 100°F
TT-E1-02	TEMPERATURE TRANSMITTER, UNIT MOUNTED, OUTSIDE AIR LEAVING PRE-HEAT COIL	–60°F – 100°F/20°F
TT-E1-03	TEMPERATURE TRANSMITTER, UNIT MOUNTED, OUTSIDE AIR LEAVING ERV	40°F – 100°F/68°F/55°F UNOCCUPIED SETBACK
TT-E1-04	TEMPERATURE TRANSMITTER, UNIT MOUNTED, EXHAUST LEAVING HEAT EXCHANGER	40°F – 100°F
TT-E1-05	TEMPERATURE TRANSMITTER, UNIT MOUNTED, OUTSIDE AIR LEAVING HEAT EXCHANGER	40°F – 100°F
SC-E1-01	FAN MOTOR SPEED CONTROL, SUPPLY AIR	OFF-LOW-HIGH
SC-E1-02	FAN MOTOR SPEED CONTROL, EXHAUST AIR	OFF-LOW-HIGH

R0002

US ARMY CORPS OF ENGINEERS
ALASKA DISTRICT

CONTRACT NO. _____
CONTRACTOR _____
CITY _____ STATE _____
PRIME CONTRACTOR — Recommended: — Approved: — Date:
RESIDENT ENGINEER

Mark	Description	Date	Appvd
2	ADDED VFD TO 2-SPEED		

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA

Designed: BFC
Drawn: BFC
Reviewed: C. VANCANTEN
Chief — Section
Submitted: D. FREDMER
Chief — Section — Project
Date: 13 NOVEMBER 2006
Dwg Scale: AS NOTED
Print Scale: 1:2.0465
File: FTW336A-095-M4-04
Drawing #: F-211-13-01

INV. NO. W911KB-09-R-0007
PN 65076
FTW336A

FT. WAINWRIGHT, ALASKA
AIRCRAFT PARTS STORAGE
MECHANICAL
CONTROLS
ERV-1 CONTROL DIAGRAM AND MATRIX

Reference number:
M4.04
Sheet 95 of 120

SECTION TABLE OF CONTENTS

DIVISION 04 - MASONRY

SECTION 04 20 00

MASONRY

-- End of Section Table of Contents --

SECTION 04 20 00

MASONRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 530	(2005) Building Code Requirements for Masonry Structures Commentaries
ACI 530.1	(2005) Specification for Masonry Structures
ACI SP-66	(2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A 82/A 82M	(2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A 153/A 153M	(2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 615/A 615M	(2008a) Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 641/A 641M	(2003) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM C 1019	(2007) Standard Test Method for Sampling and Testing Grout
ASTM C 1072	(2006) Standard Test Method for Measurement of Masonry Flexural Bond Strength
ASTM C 129	(2006) Standard Specification for Nonloadbearing Concrete Masonry Units
ASTM C 270	(2007) Standard Specification for Mortar for Unit Masonry
ASTM C 476	(2002) Standard Specification for Grout for Masonry
ASTM C 494/C 494M	(2008a) Standard Specification for Chemical Admixtures for Concrete

ASTM C 593	(2006) Fly Ash and Other Pozzolans for Use with Lime
ASTM C 641	(2007) Staining Materials in Lightweight Concrete Aggregates
ASTM C 67	(2008) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C 744	(2005) Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C 780	(2006a) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 90	(2006b) Loadbearing Concrete Masonry Units
ASTM C 94/C 94M	(2007) Standard Specification for Ready-Mixed Concrete
ASTM C 989	(2006) Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM D 2000	(2008) Standard Classification System for Rubber Products in Automotive Applications
ASTM D 2240	(2005) Standard Test Method for Rubber Property - Durometer Hardness
ASTM D 2287	(1996; R 2001) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E 514	(2006) Water Penetration and Leakage Through Masonry

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2006; Errata 2006; Errata 2007; Supplement 2007; Errata 2007) International Building Code

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-04	(2007) Seismic Design for Buildings

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED	(2002; R 2005) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Structural Masonry; G

Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; lintels; and wall openings. Bar splice locations shall be shown. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1/4 inch per foot. Reinforcement bending details shall conform to the requirements of ACI SP-66.

SD-03 Product Data

Concrete Masonry Units (CMU); G; (LEED)

Cold Weather Installation; G

Cold weather construction procedures.

SD-04 Samples

Concrete Masonry Units (CMU); G

Color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture. Submit sample of colored mortar with applicable masonry unit.

Expansion-Joint Materials;

One piece of each type used.

SD-05 Design Data

Unit Strength Method; G

Pre-mixed mortar composition. Calculations and certifications of masonry unit and mortar strength.

SD-06 Test Reports

Efflorescence Test
Field Testing of Mortar; G
Field Testing of Grout; G

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

Special Inspection; G

Copies of masonry inspector reports.

SD-07 Certificates

Concrete Masonry Units (CMU)
Control Joint Keys
Anchors, Ties, and Bar Positioners
Expansion-Joint Materials

Reinforcing Steel Bars and Rods
Admixtures for Grout

Certificates of compliance stating that the materials meet the specified requirements.

Contamination

1.3 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance and size of project site.

1.3.1 Masonry Units

Cover and protect moisture-controlled concrete masonry units and cementitious materials from precipitation. Conform to all handling and storage requirements of ASTM C 90. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.3.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall

be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.3.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

1.4 STRUCTURAL MASONRY

1.4.1 Special Inspection

A qualified masonry inspector approved by the Contracting Officer shall perform inspection of the masonry work. Minimum qualifications for the masonry inspector shall be 5 years of reinforced masonry inspection experience or acceptance by a State, municipality, or other governmental body having a program of examining and certifying inspectors for reinforced masonry construction. The masonry inspector shall be present during preparation of masonry prisms, sampling and placing of masonry units, placement of reinforcement (including placement of dowels in footings and foundation walls), inspection of grout space, immediately prior to closing of cleanouts, and during grouting operations. The masonry inspector shall assure Contractor compliance with the drawings and specifications. The masonry inspector shall keep a complete record of all inspections and shall submit daily written reports to the Quality Control Supervisory Representative reporting the quality of masonry construction.

1.4.2 Unit Strength Method

Compute compressive strength of masonry system "Unit Strength Method," ACI 530. Submit calculations and certifications of unit and mortar strength.

1.4.3 Seismic Requirement

In addition to design requirements of ICC IBC, the Contractor shall provide additional seismic reinforcement as detailed on the drawings. The total minimum reinforcing percentage for structural walls shall be 0.20 percent and non-structural walls shall be 0.15 percent. The maximum spacing of reinforcing bars shall be as follows:

Wall Type	Vertical	Horizontal
Structural	24 inches	48 inches
Non-structural	48 inches	80 inches

Bond beams are required at the top of footings, at the bottom and top of openings at roof and floor levels, and at the top of parapet walls.

1.5 QUALITY ASSURANCE

1.5.1 Appearance

Blocks shall be manufactured at one time and from the same batch. Blend all brick to produce a uniform appearance when installed. An observable "banding" or "layering" of colors or textures caused by improperly mixed brick is unacceptable.

1.5.2 Contamination

The supplier shall certify that the product is free from hazardous contaminants.

1.5.3 Testing

Masonry strength shall be determined in accordance with ACI 530; submit test reports on three prisms as specified in ACI 530.1. The cost of testing shall be paid by the Contractor.

1.5.4 Spare Vibrator

Maintain at least one spare vibrator on site at all times.

1.5.5 Bracing and Scaffolding

Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by local code.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

2.2 CONCRETE MASONRY UNITS (CMU)

Cement shall have a low alkali content and be of one brand. Units shall be of modular dimensions and air, water, or steam cured. Surfaces of units which are to be plastered or stuccoed shall be sufficiently rough to provide bond; exposed surfaces of units shall be smooth and of uniform texture. Concrete masonry units have water-repellant admixture added during manufacture. **AM#2...**Exterior masonry exposed to view shall be integrally colored during manufacture with color to be selected from manufacturer's standard colors with closest match to Installation Design Guide approved Pantone Color 19-1540 TPX "Maroon". **...AM#2**

a. Hollow Load-Bearing Units: ASTM C 90, made with lightweight or normal weight aggregate. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.

b. Hollow Non-Load-Bearing Units: ASTM C 129, made with lightweight or normal weight aggregate. Load-bearing units may be provided in lieu of non-load-bearing units.

c. Solid Load-Bearing Units: ASTM C 90, lightweight or normal weight units. Provide solid units as indicated.

2.2.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification. Use industrial waste by-products (air-cooled slag, cinders, or bottom ash), ground waste glass and concrete, granulated slag, and expanded slag in aggregates. Slag shall comply with ASTM C 989; Grade 80.

2.2.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 1 inch. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

2.3 MORTAR FOR STRUCTURAL MASONRY

ASTM C 270, Type M. Strength (f'm) as indicated. Test in accordance with ASTM C 780. Use Type I portland cement. Do not use admixtures containing chlorides. When structural reinforcement is incorporated, maximum air-content shall be 12 percent in cement-lime mortar and 18 percent in masonry cement mortar. Use up to 40 percent Class F fly ash with type IP cement in cement-lime mortar. Fly ash shall comply with ASTM C 593.

2.4 WATER-REPELLANT ADMIXTURE

Polymeric type formulated to reduce porosity and water transmission. Construct panels of masonry units conforming to ASTM C 744 and mortar which contain the water-repellant admixture. When tested in accordance with ASTM C 1072, such panels shall have flexural strength not less than that specified or indicated. When tested in accordance with ASTM E 514, panels shall exhibit no water visible on back of test panel and no leaks through the panel after 24 hours, and not more than 25 percent of wall area shall be damp after 72 hours.

2.5 GROUT AND READY-MIXED GROUT

Grout shall conform to ASTM C 476, fine. Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 10 inches. Minimum grout strength shall be 2000 psi in 28 days, as tested by ASTM C 1019. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements. Ready-Mixed grout shall conform to ASTM C 94/C 94M.

2.5.1 Admixtures for Grout

In cold weather, a non-chloride based accelerating admixture may be used subject to approval; accelerating admixture shall be non-corrosive, shall

contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C. In general, air-entrainment, anti-freeze or chloride admixtures shall not be used except as approved by the Contracting Officer.

2.5.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.6 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153/A 153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82/A 82M. Wire ties or anchors in exterior walls shall conform to ASTM A 641/A 641M. Anchors and ties shall be sized to provide a minimum of 5/8 inch mortar cover from either face.

2.6.1 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.7 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615/A 615M, Grade 60.

2.8 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 5/8 inch thick and 3/8 inch thick flanges, with a tolerance of plus or minus 1/16 inch. The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 30 degrees F after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

2.9 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07 92 00 JOINT SEALANTS, and shall be penetrating with a maximum volatile organic compound (VOC) content of 600 grams/liter.

2.10 WEEP HOLE VENTILATORS

Weephole ventilators shall be prefabricated aluminum, plastic or wood blocking sized to form the proper size opening in head joints. Provide aluminum and plastic inserts with grill or screen-type openings designed to

allow the passage of moisture from cavities and to prevent the entrance or insects. Ventilators shall be sized to match modular construction with a standard 3/8 inch mortar joint.

PART 3 EXECUTION

3.1 PREPARATION

Prior to start of work, masonry inspector shall verify the applicable conditions as set forth in ACI 530.1, inspection. The Contracting Officer will serve as inspector or will select a masonry inspector.

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent or the ambient air temperature exceeds 90 degrees F and the wind velocity is more than 8 mph. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F or temperature of masonry units is below 40 degrees F, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection. Conform to ACI 530.1 for hot and cold weather masonry erection.

3.1.2.1 Protection

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F

b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.

c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.

d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

a. Mean daily air temperature 40 to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

b. Mean daily air temperature 32 to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.

c. Mean Daily Air Temperature 25 to 20 degrees F. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.

d. Mean Daily Temperature 20 degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.1.3 Stains

Potect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

3.1.4 Loads

Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

3.1.5 Surfaces

Surfaces on which masonry is to be placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 1/8 inch. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2 LAYING MASONRY UNITS

Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Masonry units shall be laid in running bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 1/2 inch. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry

units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below. In double wythe construction, the inner wythe may be brought up not more than 16 inches ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 8 inches.

3.2.1 Forms and Shores

Provide bracing and scaffolding as required. Design bracing to resist wind pressure as required by local codes. Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.2 Reinforced Concrete Masonry Units Walls

Fill cores solid with grout. Reinforcement in all walls shall be per plan. Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be filled. Embed the adjacent webs in mortar to prevent leakage of grout. Remove mortar fins protruding from joints before placing grout. Minimum clear dimensions of vertical cores shall be 2 by 3 inches. Position reinforcing accurately as indicated before placing grout. As masonry work progresses, secure vertical reinforcing in place at vertical intervals not to exceed 160 bar diameters. Use puddling rod or vibrator to consolidate the grout. Minimum clear distance between masonry and vertical reinforcement shall be not less than 1/2 inch. Unless indicated or specified otherwise, form splices by lapping bars not less than 40 bar diameters and wire tying them together.

3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines and surfaces of columns, walls and arises	
In adjacent masonry units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch
Variations from the plumb for external corners, expansion joints, and other conspicuous lines	
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch
Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch
Variation from level for bed joints and top surfaces of bearing walls	
In 10 feet	1/4 inch
In 40 feet or more	1/2 inch
Variations from horizontal lines	
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch
Variations in cross sectional dimensions of columns and in thickness of walls	
Minus	1/4 inch
Plus	1/2 inch

3.2.5 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will

completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.6 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.6.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

3.2.6.2 Tooled Joints

Joints in exposed exterior and interior masonry surfaces shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.6.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

3.2.7 Joint Widths

Joint widths shall be as follows:

3.2.7.1 Concrete Masonry Units

Concrete masonry units shall have 3/8 inch joints, except for prefaced concrete masonry units.

3.2.7.2 Prefaced Concrete Masonry Units

Prefaced concrete masonry units shall have a joint width of 3/8 inch wide on unfaced side and not less than 3/16 inch nor more than 1/4 inch wide on prefaced side.

3.2.7.3 Brick

Brick joint widths shall be the difference between the actual and nominal dimensions of the brick in either height or length. Brick expansion joint widths shall be as shown.

3.2.8 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

3.2.9 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

3.2.10 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement.

3.2.11 Partitions

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved.

3.3 COMPRESSED EARTH BLOCK

Install according to manufacturer instructions and accepted industry standards.

3.4 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2.5 hours after mixing shall be discarded.

3.5 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

3.5.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions

indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.5.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.6 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

3.6.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.6.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

3.6.3 Grout Holes and Cleanouts

3.6.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 16 inches on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

3.6.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, cleanout courses shall be

constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 32 inches where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.6.3.3 Cleanouts for Solid Unit Masonry Construction

Cleanouts for construction of walls consisting of a grout filled cavity between solid masonry wythes shall be provided at the bottom of every pour by omitting every other masonry unit from one wythe. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanout holes shall not be plugged until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.6.4 Grouting Equipment

3.6.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

3.6.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

3.6.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

3.6.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.6.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2) Multiwythe Masonry (3)	Hollow-unit Masonry
1	Fine	Low Lift	3/4	1-1/2 x 2
5	Fine	Low Lift	2	2 x 3
8	Fine	High Lift	2	2 x 3
12	Fine	High Lift	2-1/2	2-1/2 x 3

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2) Multiwythe Masonry (3)	Hollow-unit Masonry
24	Fine	High Lift	3	3 x 3
1	Coarse	Low Lift	1-1/2	1-1/2 x 3
5	Coarse	Low Lift	2	2-1/2 x 3
8	Coarse	High Lift	2	3 x 3
12	Coarse	High Lift	2-1/2	3 x 3
24	Coarse	High Lift	3	3 x 4

Notes:

(1) The actual grout space or cell dimension must be larger than the sum of the following items:

a) The required minimum dimensions of total clear areas given in the table above;

b) The width of any mortar projections within the space;

c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.

(2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.

(3) For grouting spaces between masonry wythes.

(4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.7 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

3.8 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed in accordance with the details shown on the drawings. Sash jamb units shall have a 3/4 by 3/4 inch groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints

shall be raked to a depth of 3/4 inch; backer rod and sealant shall be installed in accordance with Section 07 92 00 JOINT SEALANTS. Exposed interior control joints shall be raked to a depth of 1/4 inch. Concealed control joints shall be flush cut.

3.9 BRICK EXPANSION JOINTS AND CONCRETE MASONRY VENEER JOINTS

Brick expansion joints and concrete masonry veneer joints shall be provided and constructed as shown on the drawings. Joints shall be kept free of mortar and other debris.

3.10 SHELF ANGLES

Shelf angles shall be adjusted as required to keep the masonry level and at the proper elevation. Shelf angles shall be galvanized. Shelf angles shall be provided in sections not longer than 10 feet and installed with a 1/4 inch gap between sections. Shelf angles shall be mitered and welded at building corners with each angle not shorter than 4 feet, unless limited by wall configuration.

3.11 LINTELS

3.11.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 1/2 inch above the bottom inside surface of the lintel unit.

3.11.2 Precast Concrete and Steel Lintels

Precast concrete and steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel and precast lintels shall have a minimum bearing length of 8 inches unless otherwise indicated on the drawings.

3.12 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

3.13 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.13.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 16 inches on centers vertically and 24 inches on center horizontally.

3.13.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 16 inches on centers vertically, and if applicable, not over 24 inches on centers horizontally.

3.14 PARGING

The outside face of below-grade exterior concrete-masonry unit walls enclosing usable rooms and spaces, except crawl spaces, shall be parged with type S mortar. Parging shall not be less than 1/2 inch thick troweled to a smooth dense surface so as to provide a continuous unbroken shield from top of footings to a line 6 inches below adjacent finish grade, unless otherwise indicated. Parging shall be coved at junction of wall and footing. Parging shall be damp-cured for 48 hours or more before backfilling. Parging shall be protected from freezing temperatures until hardened.

3.15 INSULATION

Anchored veneer walls shall be insulated, where shown, by installing board-type insulation on the cavity side of the inner wythe. Board type insulation shall be applied directly to the masonry or thru-wall flashing with adhesive. Insulation shall be neatly fitted between obstructions without impaling of insulation on ties or anchors. The insulation shall be applied in parallel courses with vertical joints breaking midway over the course below and shall be applied in moderate contact with adjoining units without forcing, and shall be cut to fit neatly against adjoining surfaces.

3.16 SPLASH BLOCKS

Splash blocks shall be located as shown.

3.17 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

3.17.1 Concrete Masonry Unit and Concrete Brick Surfaces

Exposed concrete masonry unit and concrete brick surfaces shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.17.2 Clay or Shale Brick Surfaces

Exposed clay or shale brick masonry surfaces shall be cleaned as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, the sample panel of similar material shall be examined for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, the method of cleaning shall be changed to assure that the masonry surfaces in the structure will not be adversely affected.

The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 1/2 cup trisodium phosphate and 1/2 cup laundry detergent to one gallon of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

3.18 BEARING PLATES

Bearing plates for beams, joists, joist girders and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated.

3.19 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.20 WASTE MANAGEMENT

Manage waste according to the Waste Management Plan and as follows. Minimize water used to wash mixing equipment. Use trigger operated spray nozzles for water hoses.

3.20.1 Separate and Recycle Waste

Place materials defined as hazardous or toxic waste in designated containers. Fold up metal banding, flatten, and place in designated area for recycling.

3.21 TEST REPORTS

3.21.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 1/2 to 5/8 inch thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

3.21.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 2000 psi at 28 days.

3.21.3 Efflorescence Test

Brick which will be exposed to weathering shall be tested for efflorescence. Tests shall be scheduled far enough in advance of starting

masonry work to permit retesting if necessary. Sampling and testing shall conform to the applicable provisions of ASTM C 67. Units meeting the definition of "effloresced" will be subject to rejection.

3.22 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with UFC 3-310-04 SEISMIC DESIGN FOR BUILDINGS and Section 01 45 35 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 04 - MASONRY

SECTION 04 21 13.13

NONBEARING MASONRY VENEER/STEEL STUD WALLS

-- End of Section Table of Contents --

SECTION 04 21 13.13

NONBEARING MASONRY VENEER/STEEL STUD WALLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 316	(1989) ASD Manual of Steel Construction

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-971-Spec	(1996) Specification and Commentary for the Design of Cold-Formed Steel Structural Members and Commentary; includes SG-2000-1 Supp 1 to 1996 Spec, dated 2000

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE Fundamentals Handbook	(2001) Fundamentals Handbook

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3	(1998; Errata 1998) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2008) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 36/A 36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A 653/A 653M	(2008) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 82	(2002) Steel Wire, Plain, for Concrete Reinforcement
ASTM C 1002	(2007) Steel Self-Piercing Tapping Screws

	for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM C 1072	(2006) Standard Test Method for Measurement of Masonry Flexural Bond Strength
ASTM C 270	(2007) Standard Specification for Mortar for Unit Masonry
ASTM C 494/C 494M	(2008a) Standard Specification for Chemical Admixtures for Concrete
ASTM C 578	(2008) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(2008a) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 665	(2006) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 67	(2008) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C 780	(2006a) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 90	(2006b) Loadbearing Concrete Masonry Units
ASTM C 91	(2003a) Masonry Cement
ASTM C 955	(2008a) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM D 1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1330	(1985; R 2000) Rubber Sheet Gaskets
ASTM D 1667	(1997) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)
ASTM D 2103	(2005) Standard Specification for Polyethylene Film and Sheeting
ASTM D 226	(2006) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

U.S. DEPARTMENT OF COMMERCE (DOC)

PS1 (1995) Construction and Industrial Plywood (APA V995)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

Detail drawings as specified.

SD-04 Samples

Expansion Joint Materials
Concrete Masonry Unit
Sample Panel

A portable panel, approximately 2 by 2 feet, containing approximately 24 concrete masonry units to establish the range of color and texture. One of each type of masonry veneer anchor used.

SD-06 Test Reports

Calculations

Calculations demonstrating the structural adequacy of steel lintels and shelf angles for the calculated gravity loads being supported; this analysis shall be in accordance with AISC 316. Test results demonstrating that the veneer anchors are structurally adequate to resist the specified loadings shall be submitted for approval. Calculations demonstrating the insulation shown on the drawings provides the specified U-value for heat transmission of the completed exterior wall construction; this analysis shall be in accordance with ASHRAE Fundamentals Handbook. Manufacturer's descriptive data and installation instructions for the insulation, the vapor barrier and the moisture barrier.

SD-07 Certificates

Concrete Masonry Unit
Integral Water-Repellant Admixtures for Concrete Masonry Units and Mortar
Joint Reinforcement
Expansion Joint Materials
Insulation
Exterior Sheathing
Moisture Barrier
Vapor Retarder
Veneer Anchors
Welding

Certificates stating that the materials and welders meet the requirements specified. Each certificate shall be signed by an authorized certification official and shall include their organization and position and shall identify the products covered under their certifying signature.

1.3 SAMPLE PANEL

After the material samples are approved and prior to starting masonry work, a sample masonry panel shall be built on the project site where directed. The sample panel shall be not less than 6 feet long by 4 feet high. The panel shall be of typical wall thickness for the construction represented. The panel shall show color range, texture, bond pattern, expansion joints, and cleaning of the masonry as required in the work. The panel shall also show cold-formed steel framing, insulation, gypsum wallboard, gypsum sheathing, moisture barrier, vapor barrier, veneer anchors, joint reinforcement, steel shelf angles, flashing and weep holes. The approved sample panel shall be used as a standard of workmanship required in the actual installation. The sample panel shall be protected from weather and construction operations and shall not be removed until the masonry veneer/steel stud wall work has been completed and accepted.

1.4 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered and handled avoiding chipping, breakage, bending or other damage, and contact with soil or other contaminating materials. The masonry products shall be stored off the ground and protected from inclement weather. Cementitious materials shall be delivered in unopened containers plainly marked and labeled with manufacturer's names and brands. Cementitious materials shall be stored in dry, weather-tight enclosures or covers. Sand and other aggregates shall be stored preventing contamination or segregation and under a weather-tight covering permitting good air circulation. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust. Insulation, moisture barrier, and gypsum sheathing shall be stored in dry, well ventilated, weather-tight areas protected from sunlight and excessive heat. Air infiltration type vapor barrier shall be stored in accordance with the manufacturer's recommendations.

1.5 EFFLORESCENCE TESTS

Efflorescence tests shall be performed by an approved commercial testing laboratory. Sampling for the tests shall be the responsibility of the Contractor. Brick shall be sampled and tested for efflorescence in accordance with ASTM C 67 and the rating shall be: "not effloresced".

1.6 DETAIL DRAWINGS

The Contractor shall submit details of cold-formed steel framing and support around openings, including framing connections, steel lintels, steel shelf angles, attachment to other building elements and bridging. Drawings shall indicate thickness, material, dimensions, protective coatings, and section properties of all steel lintels and shelf angles used in exterior wall framing. Drawings shall also indicate size and type of all fasteners including size and type of all welds.

PART 2 PRODUCTS

2.1 VENEER WYTHE

The source of masonry materials which will affect the appearance of the finished work shall not be changed after the work has started except with the Contracting Officer's approval.

2.1.1 Concrete Masonry Unit

Concrete masonry unit veneer shall be solid and conform to ASTM C 90. Architectural type, color range and texture shall be as indicated and shall conform to the approved sample. Masonry unit sizes shall be as shown. **AM#2...**Concrete masonry units to be integrally colored during manufacture with color to be selected from manufacturer's standard colors with closest match to Installation Design Guide approved Pantone Color 19-1540 TPX "Maroon". **...AM#2**

2.2 MORTAR

Mortar shall conform to ASTM C 270, Type S. Mortar mix shall be based on proportion specifications. Laboratory testing of mortar shall be in accordance with the preconstruction evaluation of mortar section of ASTM C 780. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.2.1 Masonry Cement

Masonry cement in conformance with ASTM C 91 may be used in the mortar. When using a masonry cement a comparative test shall be performed between a Portland cement-lime mortar and the masonry cement mortar proposed for the project to evaluate the ASTM C 1072 bond and the ASTM C 780 compressive strength of the two mixes. The test shall be conducted with the proposed masonry units for the project. The masonry cement mortar will be acceptable if the bond and compressive strength values are equal to or higher than the portland cement-lime mix. The air-content of the masonry cement shall be limited to 12 percent maximum.

2.2.2 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixtures shall be non-corrosive, contain less than 0.2 percent chlorides, and conform to ASTM C 494/C 494M, Type C.

2.2.3 Integral Water-Repellant Admixtures for Concrete Masonry Units and Mortar

Integral water-repellant admixtures used for both concrete masonry units and mortar shall be the product of one manufacturer.

2.3 JOINT REINFORCEMENT

Joint reinforcement shall be of steel wire conforming to ASTM A 82. Fabrication shall be by welding. Tack welding will not be permitted. Reinforcement shall be zinc-coated after fabrication in accordance with ASTM A 153/A 153M, Class B-2. Joint reinforcement shall consist of at least 1 continuous longitudinal wire in the veneer wythe. Minimum wire cross section shall be 0.017 square inches.

2.4 COLD-FORMED STEEL FRAMING

Cold-formed framing shall consist of steel studs, top and bottom tracks, runners, horizontal bridging, and other cold-formed members and other accessories. All members and components made of sheet steel shall be hot-dip galvanized in accordance with ASTM A 653/A 653M with a minimum coating thickness of G 60. Framing covered herein shall be used only in framing the exterior masonry veneer steel stud wall system as indicated on the detail drawings.

2.4.1 Steel Studs

Studs shall be furnished as shown in the contract drawings.

2.4.2 Runners, Tracks, Bridging and Accessories

Cold-formed steel sheet framing members, components, and accessories, other than the steel studs, shall conform to ASTM C 955 and be of steel conforming to ASTM A 653/A 653M, Grade 33, having a minimum yield strength of 33,000 psi for thickness of 43 mil or less, Grade 50, having a minimum yield strength of 50,000 psi for thickness of 54 mil or more.

2.5 INSULATION

The Contractor shall comply with EPA requirements.

2.5.1 Blanket Insulation

Insulation placed between the steel studs shall be batt or blanket type mineral wool conforming to ASTM C 665, Type I.

2.5.2 Rigid Board-Type Insulation

Insulation for wall cavities shall be rigid board-type insulation. Rigid board-type insulation shall be either polystyrene conforming to ASTM C 578, Type I or II, Grade 2 or polyurethane conforming to ASTM C 591. Insulation thickness shall be sufficient to provide an R-value of R19.

2.6 GYPSUM WALLBOARD

Gypsum wallboard that is installed on the interior side of the cold-formed steel framing system shall be as specified in Section 09 29 00 GYPSUM BOARD.

2.7 EXTERIOR SHEATHING

Plywood sheathing that is installed on the exterior side of the cold-formed steel framing system shall have a minimum thickness of 3/4" inch and shall be 4 feet wide. Plywood sheathing shall be in accordance with PS1, grade C-D with exterior glue.

2.8 MOISTURE PROTECTION

2.8.1 Moisture Barrier

The moisture barrier shall be 15-lb asphalt-saturated felt conforming to ASTM D 226 Type I (No. 15).

2.8.2 Vapor Retarder

The vapor retarder shall be polyethylene film conforming to ASTM D 2103, 6 mil minimum thickness.

2.8.3 Staples

Staples for attaching the moisture barrier to the exterior sheathing shall be the type and size best suited to provide a secure connection. Staples shall be made from either galvanized steel or stainless steel wire.

2.8.4 Joint Tape

Tape for sealing the joints in the vapor retarder shall be laminated tape with pressure sensitive adhesive as recommended by the manufacturer of the polyethylene film.

2.9 VENEER ANCHORS

Anchor assemblies for the attachment of the masonry veneer to the cold-formed steel framing, structural steel shall be as shown. Length of anchor wires shall be such that the outermost wires lie between 1-1/4 inch from each face of the masonry veneer. Anchors wires shall not have drips. Anchor assemblies including wires and anchor plates shall be hot-dip galvanized conforming to ASTM A 153/A 153M, Class B-2.

2.10 CONNECTIONS

Screws, bolts and anchors shall be hot-dip galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.

2.10.1 Framing Screws, Bolts and Anchors

Screws, bolts and anchors used in the assembly of the cold-formed steel framing system shall be as required by design of the framing system for the specified loading. Screw, bolt and anchor sizes shall be shown on the detail drawings.

2.10.2 Welding

Welded connections shall be designed and all welding shall be performed in accordance with AWS D1.3, as modified by AISI SG-971-Spec. Welders shall be qualified in accordance with AWS D1.3. All welds shall be cleaned and touched-up with zinc-rich paint.

2.10.3 Veneer Anchor Screws

Screws for attachment of the veneer anchors to the cold-formed steel framing members shall be as shown. Screws shall be shown on the detail drawings. The length of screws shall be such that the screws penetrate the holding member by not less than 5/8 inch.

2.10.4 Gypsum Sheathing Screws

Screws for attachment of gypsum sheathing to cold-formed steel framing shall conform to ASTM C 1002, Type S.

2.11 SYNTHETIC RUBBER WASHERS

Synthetic rubber washers for placement between veneer anchors and the moisture barrier on the outside face of the exterior sheathing shall conform to ASTM D 1330, Grade I.

2.12 EXPANSION JOINT MATERIALS

Expansion joint materials shall be bellows or U-shaped type conforming to Section 07 60 00 FLASHING AND SHEET METAL. Premolded type shall be closed-cell cellular rubber conforming to ASTM D 1056 or closed-cell vinyl or polyvinyl chloride conforming to ASTM D 1667.

2.13 FLASHING

Copper or stainless steel flashing shall conform to the requirements in Section 07 60 00 FLASHING AND SHEET METAL. Flashing shall be supplied in a continuous sheet extending from the exterior sheathing across the cavity and through the masonry veneer as shown.

2.14 STEEL LINTELS AND SHELF ANGLES

Steel shapes used for lintels and shelf angles shall conform to ASTM A 36/A 36M. Lintels and shelf angles shall be provided as shown. These steel members shall be hot-dip galvanized in accordance with ASTM A 123/A 123M.

2.15 CAULKING AND SEALANTS

Caulking and sealants shall be as specified in Section 07 92 00 JOINT SEALANTS.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Wall sections, types of construction and dimensions shall be as shown. Metal door and window frames and other special framing shall be built and anchored into the wall system as indicated. The Contractor shall submit Calculations as specified in the Submittals paragraph.

3.2 STEEL STUD WALL FRAMING

The top of the stud wall system shall be attached with deflection clips to accommodate vertical deflections of the supporting members as shown on the drawings. Top and bottom tracks shall be anchored by one anchor at each stud location as shown on the drawings. Both flanges of all steel studs shall be securely fastened with screws to the flanges of the top and bottom tracks as shown on the drawings. All details for affixing steel studs to runners and all other sheet steel framing members along with all details necessary for anchorage of the steel stud wall system to the building structural systems shall be as shown on the drawings. Horizontal bridging shall be provided as necessary. Studs shall be spaced 16 inches on center unless shown otherwise on contract drawings. Coordinate stud spacing with sheathing and anchor requirements. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Double

studs shall be provided at both jambs of all door openings. Door frames and other built-in items shall be grouted solid.

3.3 STEEL SHELF ANGLES

Unless otherwise shown, steel shelf angles shall be provided in segments that do not exceed 10 feet in length. At building corners, shelf angle segments shall be mitered and securely attached together by welding with legs no less than 4 feet where possible. Shelf angle segments shall not be connected together but instead shall be installed with 1/4 inch wide gaps between the segments. Fabrication and erection tolerances shall be in accordance with the AISC Code of Standard Practice, as indicated in AISC 316.

3.4 INSULATION

The actual installed thickness of insulation shall provide a maximum thermal R of R19 for the completed exterior wall construction as determined in accordance with ASHRAE Fundamentals Handbook. Insulation thickness shall be as shown on the approved drawings. Installation, except as otherwise specified or shown, shall be in accordance with the manufacturer's instructions which shall be approved by the Contracting Officer. Insulation shall be installed between wall framing members. Rigid insulation shall be installed in accordance with the manufacturer's instructions with proper connections through the insulation to prevent the insulation from carrying loads directly. Insulation with facings shall be secured to the sides of the framing members to provide a continuous seal so that the entire weight of the insulation is carried by the framing members. Where electrical outlets, ducts, pipes, vents or other utility items occur, insulation shall be placed on the dry side of the item away from excessive humidity.

3.5 GYPSUM WALLBOARD

Gypsum wallboard shall be installed on the interior face of the cold-formed steel framing system. Installation shall be as specified in Section 09 29 00 GYPSUM BOARD except at vertical slip joints, the gypsum wallboard shall be connected to the vertical studs to prevent movement at the slip joint.

3.6 EXTERIOR SHEATHING

Sheathing shall be installed on the exterior face of the cold-formed steel framing system with self-drilling screws. Screws shall be located a minimum of 3/8 inch from the ends and edges of sheathing panels and shall be spaced not more than 8 inches on each supporting member except at vertical slip joints, the sheathing shall be connected to the vertical studs to prevent movement of the slip joint. Edges and ends of gypsum sheathing panels shall be butted snugly with vertical joints staggered to provide full and even support for the moisture barrier. Holes and gaps resulting from abandoned screw installations, from damage to panels, and from cutting and fitting of panels at junctures with doors, windows, foundation walls, floor slabs and other similar locations shall be filled with exterior rubber-base caulk.

3.7 MOISTURE PROTECTION

3.7.1 Moisture Barrier

The asphalt-saturated felt or other approved moisture barrier shall be

installed on the outer face of the exterior sheathing. The moisture barrier shall be installed horizontally and shingled with each sheet lapped not less than 6 inches over the sheet below. Vertical end joints shall be lapped not less than 6 inches and shall be staggered. Attachment of the moisture barrier shall be with staples spaced not greater than 16 inches on center or as required by the manufacturer.

3.7.2 Vapor Retarder

A vapor retarder shall be installed between the steel studs and the gypsum wall board. The vapor retarder shall be installed in accordance with the manufacturer's recommendations to form a complete retarder to vapor infiltration. The joints shall be lapped and sealed with tape.

3.8 VENEER ANCHORS

Veneer anchors shall be attached with screws through the sheathing and rigid insulation to the steel studs or other support members at the locations shown. When rigid insulation is used, the method of connecting the veneer anchor through the insulation shall be approved by the Contracting Officer. Veneer anchors shall be installed with the outermost wires lying between 5/8 inch from each face of the masonry veneer. Synthetic rubber washers shall be used between the anchor connector plates and the moisture barrier. A clutch torque slip screw gun shall be used on screws attaching veneer anchors to cold-formed steel members. Veneer anchors with corrugated sheet metal or wire mesh members extending across the wall cavity shall not be used. There shall be one veneer anchor for each two square feet of wall and shall be attached to steel studs and other supports with a maximum spacing of 16 inches on center.

3.9 FLASHING

Continuous flashing shall be provided at the bottom of the wall cavity just above grade. Flashing shall also be provided above and below openings at lintels and sills, at shelf angles, and as indicated on the drawings. Flashing shall be as detailed and as specified in Section 07 60 00 FLASHING AND SHEET METAL. Flashing shall be lapped a minimum of 6 inches at joints and shall be sealed with a mastic as recommended by the flashing manufacturer. Ends over doors, windows and openings shall be turned up and secured. Flashing shall be lapped under the moisture barrier a minimum of 6 inches and securely attached to the gypsum sheathing. Flashing shall extend through the exterior face of the masonry veneer and shall be turned down to form a drip.

3.10 MASONRY VENEER

Exterior masonry wythes shall be constructed to the thickness indicated on the drawings. A cavity consisting of a 1 inch minimum width air space will be provided between the moisture barrier and the masonry veneer. Masonry veneer shall not be installed until the exterior sheathing, moisture barrier, veneer anchors and flashing have been installed on the cold-formed steel framing system. Extreme care shall be taken to avoid damage to the moisture barrier and flashing during construction of the masonry veneer. Any portion of the moisture barrier and flashing that is damaged shall be repaired or replaced prior to completion of the veneer. Masonry shall be placed in running bond pattern. Longitudinal reinforcement consisting of at least one continuous galvanized steel wire shall be placed in the veneer wythe. The minimum wire size shall be 9 gauge. Vertical joints on alternating courses shall be aligned and kept vertically plumb. Solid

masonry units shall be laid in a non-furrowed full bed of mortar, beveled and sloped toward the center of the wythe on which the mortar is placed. Units shall be shoved into place so that the vertical mortar joints are completely full and tight. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned and relaid. Mortar which protrudes more than 1/2 inch into the cavity space shall be removed. Means shall be provided to ensure that the cavity space is kept clean of mortar droppings and other loose debris. Chases and raked-out joints shall be kept free from mortar and debris. Faces of units used in finished exposed areas shall be free from chipped edges, material texture or color defects or other imperfections distracting from the appearance of the finished work.

3.10.1 Surface Preparation

Surfaces on which masonry is to be laid shall be cleaned of laitance or other foreign material. No units having a film of water shall be laid.

3.10.2 Hot Weather Construction

Temperatures of masonry units and mortar shall not be greater than 120 degrees F when laid. Masonry erected when the ambient air temperature is more than 99 degrees F in the shade and when the relative humidity is less than 50 percent shall be given protection from the direct exposure to wind and sun for 48 hours after the installation.

3.10.3 Cold Weather Construction

Temperatures of masonry units and mortar shall not be less than 40 degrees F when laid. When the ambient air temperature is 32 degrees F or less, masonry veneer under construction shall be protected and maintained at a temperature greater than 32 degrees F for a period of 48 hours after installation. The proposed method of maintaining the temperature within the specified range shall be submitted for approval prior to implementation. No units shall be laid on a surface having a film of frost or water.

3.10.4 Tolerances

Masonry shall be laid plumb, level and true to line within the tolerances specified in TABLE 1. All masonry corners shall be square unless otherwise indicated on the drawings.

TABLE 1

Variation From Plumb	
In adjacent units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variation From Level Or Grades	
In 10 feet	1/8 inch
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variation From Linear Building Lines	
In 20 feet	1/2 inch
In 40 feet or more	3/4 inch

Variation From Cross Sectional Dimensions Of Walls	
Plus	1/2 inch
Minus	1/4 inch

3.10.5 Mixing of Mortar

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Measurement of sand shall be accomplished by the use of a container of known capacity or shovel count based on a container of known capacity. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of the masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours shall be discarded.

3.10.6 Cutting and Fitting

Wherever possible, full units shall be used in lieu of cut units. Where cut units are required to accommodate the design, cutting shall be done by masonry mechanics using power masonry saws. Wet-cut units shall be dried to the same surface-dry appearances of uncut units before being placed in the work. Cut edges shall be clean, true and sharp. Openings to accommodate pipes, conduits, and other accessories shall be neatly formed so that framing or escutcheons required will completely conceal the cut edges. Insofar as practicable, all cutting and fitting shall be accomplished while masonry work is being erected.

3.10.7 Masonry Units

When being laid, masonry units shall have suction sufficient to hold the mortar and to absorb water from the mortar, but shall be damp enough to allow the mortar to remain in a plastic state to permit the unit to be leveled and plumbed immediately after being laid without destroying bond. Masonry units with frogging shall be laid with the frog side down and better or face side exposed to view. Masonry units that are cored, recessed or otherwise deformed may be used in sills or in other areas except where deformations will be exposed to view.

3.10.8 Mortar Joints

Mortar joint widths shall be uniform and such that the specified widths are maintained throughout. Joints shall be of thickness equal to the difference between the actual and nominal dimensions of the masonry units in either height or length but in no case shall the joints be less than 1/4 inch nor more than 1/2 inch wide. Joints shall be tooled slightly concave. Tooling shall be accomplished when mortar is thumbprint hard and in a manner that will compress and seal the mortar joint and produce joints

of straight and true lines free of tool marks.

3.10.9 Veneer Joints

Concrete masonry veneer joints shall be provided at the locations shown on the drawings. Details of joints shall be as indicated on the drawings. Joints shall be clean and free of mortar and shall contain only backer rod and sealant, installed in accordance with manufacturer installation instructions. Horizontal reinforcement shall not extend through the joints.

3.10.10 Weep Holes

Weep holes shall be provided at all flashing locations at intervals of 24 inches. Weep holes shall be placed in head joints just above the flashing. Weep holes shall be formed by leaving head joints open or head joint vents may be used. Weep holes shall be kept free of mortar and other obstructions.

3.10.11 Head Joint Vents

Head joint vents shall be provided near the top of the veneer wythe at the same spacing as the weep holes.

3.10.12 Discontinuous Work

When necessary to temporarily discontinue the work, masonry shall be stepped back for joining when work resumes. Toothing may be used only when specifically approved. Before resuming work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned. Top of walls subjected to rain or snow shall be covered with nonstaining waterproof covering or membrane when work is not in process. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place.

3.10.13 Cleaning

Mortar daubs or splashings shall be completely removed from finished exposed masonry surfaces before they harden or set up. Before completion of the work, defects in mortar joints shall be raked out as necessary, filled with mortar, and tooled to match the adjacent existing mortar in the joints. The proposed cleaning method shall be done on the sample wall panel and the sample panel shall be examined for discoloration or stain. If the sample panel is discolored or stained, the method of cleaning shall be changed to ensure that the masonry surfaces in the structure will not be adversely affected. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Cleaning shall be accomplished with the use of stiff bristle fiber brushes, wooden paddles, wooden scrapers, or other suitable nonmetallic tools. Concrete masonry unit surfaces shall be dry-brushed at the end of each day's work after any required pointing has been done. Efflorescence or other stains shall be removed in conformance with the recommendations of the masonry unit manufacturer. After construction and cleaning, masonry surfaces shall be left clean, free of mortar daubs, stain, and discolorations, including scum from cleaning operations, and will have tight mortar joints throughout. Metallic tools and brushes shall not be used for cleaning.

3.11 BUILDING EXPANSION JOINTS

Expansion joints shall be located where indicated and shall be of the size

and details shown.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07 24 00

EXTERIOR INSULATION AND FINISH SYSTEMS

-- End of Section Table of Contents --

SECTION 07 24 00

EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 1177/C 1177M	(2008) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C 150	(2007) Standard Specification for Portland Cement
ASTM C 473	(2007) Physical Testing of Gypsum Panel Products
ASTM C 578	(2008) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 67	(2008) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C 920	(2008) Standard Specification for Elastomeric Joint Sealants
ASTM D 2247	(2002) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 3273	(2000; R 2005) Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM D 968	(2005e1) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 2098	(2000; R 2006) Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS) after Exposure to a Sodium Hydroxide Solution
ASTM E 331	(2000) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM G 153	(2004) Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic

Materials

EIFS INDUSTRY MEMBERS ASSOCIATION (EIMA)

EIMA TM 101.01	(1995) Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS), Class PB
EIMA TM 101.86	(1995) Resistance of Exterior Insulation Finish Systems (EIFS), Class PB to The Effects of Rapid Deformation (Impact)

1.2 SYSTEM DESCRIPTION AND REQUIREMENTS

The exterior insulation and finish system (EIFS) shall be a job-fabricated exterior wall covering consisting of sheathing, insulation board, reinforcing fabric, base coat, finish coat, adhesive and mechanical fasteners as applicable. The system components shall be compatible with each other and with the substrate as recommended or approved by, and the products of, a single manufacturer regularly engaged in furnishing Exterior Insulation and Finish Systems. All materials shall be installed by an applicator approved by the system manufacturer. EIFS shall be as indicated. EIFS shall be Class PB. Color and finish shall be as indicated on the drawings.

1.2.1 System Requirements and Tests

The system shall meet the performance requirements as verified by the tests listed below. Where a wall system of similar type, size, and design as specified for this project has been previously tested under the condition specified herein, the resulting test reports may be submitted in lieu of job specific tests.

1.2.1.1 Water Penetration

Test the system for water penetration by uniform static air pressure in accordance with ASTM E 331. There shall be no penetration of water beyond the plane of the base coat/EPS board interface after 15 minutes at 6.4 psf), or 20% of positive design wind pressure, whichever is greater.

1.2.1.2 Wind Load

Test the system for wind load given in the structural drawings and/or specifications. There shall be no permanent deformation, delamination, or other deterioration.

1.2.2 Component Requirements and Tests

The components of the system shall meet the performance requirements as veryfied by the tests listed below.

1.2.2.1 Impact Resistance

a. Class PB Systems: Hemispherical Head Test; 28 day cured specimen of PB EIFS in accordance with EIMA TM 101.86. The test specimen shall exhibit no broken reinforcing fabric per EIMA TM 101.86 at an impact of 50 to 89 in/lb.

1.2.3 Sub-Component Requirements and Tests

Unless otherwise stated, the test specimen shall consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building. For mildew resistance, only the finish coat is applied onto glass slides for testing. These specimen shall be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to testing.

1.2.3.1 Abrasion Resistance

Test in accordance with ASTM D 968, Method A. Test a minimum of two specimens. After testing, the specimens shall show only very slight smoothing, with no loss of film integrity after 132 gallons of sand.

1.2.3.2 Accelerated Weathering

Test in accordance with ASTM G 153, Cycle 1. After 2000 hours specimens shall exhibit no visible cracking, flaking, peeling, blistering, yellowing, fading, or other such deterioration.

1.2.3.3 Mildew Resistance

Test in accordance with ASTM D 3273. The specimen shall consist of the finish coat material, applied to clean 3 inch by 4 inch glass slides and shall be allowed to cure for 28 days. After 28 days of exposure, the specimen shall not show any growth.

1.2.3.4 Water Resistance

Test in accordance with ASTM D 2247. The specimen shall be a minimum of (4 inch by 6 inch). After 14 days, the specimen shall exhibit no cracking, checking, crazing, erosion, blistering, peeling, or delamination.

1.2.3.5 Absorption-Freeze/Thaw

Class PB systems shall be tested in accordance with EIMA TM 101.01 for 60 cycles of freezing and thawing. No cracking, checking, or splitting, and neglible weight gain. Class PM systems shall be tested in accordance with ASTM C 67 for 50 cycles of freezing and thawing. After testing, the specimens shall exhibit no cracking or checking and have negligible weight gain.

1.2.3.6 Sample Boards

Unless otherwise stated, provide sample EIFS Component 12 by 24 inches), on sheathing board, including finish color and texture, typical joints and sealant. If more than one color, finish, or pattern is used, provide one sample for each. The test specimen shall consist of reinforcing mesh, base coat, and finish coat applied in accordance with manufacturer's printed recommendations to the insulation board to be used on the building.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop drawings; G

Show wall layout, construction and expansion joints, layout of sheathing board, thermal insulation board, and reinforcing mesh and strip reinforcing fabric; joint details; details at wall penetrations; types and location of fasteners; and typical details at doors.

SD-03 Product Data

Sheathing board

Thermal insulation

Adhesive

Mechanical Fasteners

Accessories

Base coat

Portland cement

Reinforcing fabric

Finish coat

Joint Sealant

Sealant Primer

Bond breaker

Backer Rod

Warranty

Include joint and other details, such as at end conditions, corners, and doors. Include shelf life and recommended cleaning solvents in data for sealants. Include material safety data sheets (MSDS)for all components of the EIFS. The MSDS shall be available at the job site.

SD-04 Samples

Sample Boards; G

Color and Texture

SD-05 Design Data

Wind load Calculations

SD-06 Test Reports

Impact resistance

Abrasion resistance

Accelerated weathering

Mildew resistance

Water vapor transmission

Demonstrating the location of the dew point within a typical wall section under a variety of local weather conditions.

Absorption-freeze-thaw

Water penetration

Water resistance

Wind load

SD-07 Certificates

Qualifications of EIFS Manufacturer

Qualification of EIFS Installer

Qualification of Sealant Applicator

Certify that EIFS installer meets requirements specified under paragraph "Qualification of Installer," and that sealant applicator is approved by the EIFS Manufacturer.

Qualifications of Third Party Inspector

Inspection Check List; G

Submit filled-out inspection check list as required in paragraph "Quality Control," certifying that the installation of critical items meets the requirements of this specification.

SD-08 Manufacturer's Instructions

Installation

Manufacturer's standard printed instructions for the installation of the EIFS. Include requirements for condition and preparation of substrate, installation of EIFS, and requirements for sealants and sealing.

SD-10 Operation and Maintenance Data

EIFS

Include detailed finish repair procedures and information regarding compatibility of sealants with base and finish coatings.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications of EIFS Manufacturer

The EIFS shall be the product of a manufacturer who has been in the practice of manufacturing and designing EIFS for a period of not less than 5 years, and has been involved in at least five projects similar to this project in size, scope, and complexity, in the same or a similar climate as this project.

1.4.2 Qualification of EIFS Installer

The EIFS Installer shall be trained by the EIFS manufacturer to perform the installation of the System and shall have successfully installed at least five projects at or near the size and complexity of this project. The contractor shall employ qualified workers trained and experienced in installing the manufacturer's EIFS.

1.4.3 Qualification of Sealant Applicator

The sealant applicator shall be experienced and competent in the installation of high performance industrial and commercial sealants and shall have successfully installed at least five projects at or near the size and complexity of this project.

1.4.4 Qualifications of Third Party Inspector

Submit evidence that third party inspector has current certification from the Exterior Design Institute or equal inspector certification as inspector for the installation of EIFS.

1.4.5 Insulation Board

Insulation Board shall be approved and labeled under third party quality program as required by applicable building code. See also Section 07 21 13 (Board Insulation).

1.4.6 Pre-Installation Conference

After approval of submittals and before commencing any work on the EIFS, including installation of sheathing board, insulation, and associated work, the Contracting Officer will hold a pre-installation conference to review:

a. Drawings, specifications, and samples;

b. Procedure for on site inspection and acceptance of EIFS substrate and pertinent details (for example, mock-up installation);

c. Contractor's plan for coordination of work of the various trades involved in providing EIF system and other components;

d. Inspection procedures; and

e. Safety requirements.

Pre-installation conference shall be attended by the Contractor, and all personnel directly responsible for installation of the EIF system, including sealant applicator, and personnel responsible for related work, such as flashing and sheet metal, windows and doors, and a representative

of the EIFS manufacturer. Before beginning EIFS work, the contractor shall confirm in writing the resolution of conflicts among those attending the pre-installation conference.

1.5 DELIVERY AND STORAGE

Deliver materials to job site in original unopened packages, marked with manufacturer's name, brand name, and description of contents. Store materials off the ground and in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Protect stored materials from rain, sunlight, and excessive heat. Keep coating materials which would be damaged by freezing at a temperature not less than 40 degrees F. Do not expose insulation board to flame or other ignition sources.

1.6 ENVIRONMENTAL CONDITIONS

a. Do not prepare materials or apply EIFS during inclement weather unless appropriate protection is provided. Protect installed materials from inclement weather until they are dry.

b. Apply sealants and wet materials only at ambient temperatures of 45 degrees F or above, or at temperatures of 40 to 45 degrees F and rising, unless supplemental heat is provided. The system shall be protected from inclement weather and to maintain this temperature for a minimum of 24 hours after installation.

c. Do not leave insulation board exposed to sunlight after installation.

1.7 WARRANTY

Furnish manufacturer's standard warranty for the EIFS. Warranty shall run directly to Government and cover a period of not less than 5 years from date Government accepted the work.

PART 2 PRODUCTS

2.1 COMPATIBILITY

Provide all materials compatible with each other and with the substrate, and as recommended by EIFS manufacturer.

2.2 Glass Mat Gypsum Sheathing Board

a. Conform to ASTM C 1177/C 1177M;

b. Flexural Strength 100 LBF, PARALLEL;

b. Nail Pull Resistance: No less than 120 lb) when tested in accordance with ASTM C 473.

2.3 ADHESIVE

Manufacturer's standard product, including primer as required, and shall be compatible with substrate and insulation board to which the system is applied.

2.4 MECHANICAL FASTENERS

Corrosion resistant and as approved by EIFS manufacturer. Select fastener type and pattern based on applicable wind loads and substrate into which fastener will be attached, to provide the necessary pull-out, tensile, and shear strengths.

2.5 THERMAL INSULATION

2.5.1 Manufacturer's Recommendations

Provide only thermal insulation recommended by the EIFS manufacturer for the type of application intended.

2.5.2 Insulation Board

Insulation board shall be standard product of manufacturer and shall be compatible with other systems components. Boards shall be factory marked individually with the manufacturer's name or trade mark, the material specification number, the R-value at 75 degree F, and thickness. No layer of insulation shall be less than (3/4 in) thick. The maximum thickness of all layers shall not exceed 4 in. Insulation Board shall be certified as aged, in block form, prior to cutting and shipping, a minimum of 6 weeks by air drying, or equivalent.

a. Thermal resistance: As indicated

b. Insulating material: ASTM C 578 Type I as recommended by the EIFS manufacturer and treated to be compatible with other EIFS components. Age insulation by air drying a minimum of 6 weeks prior to cutting and shipping.

c. Drainage: Preform channels into the interior face of insulation board or provide polypropylene drainage lath spacer to provide water drainage system.

2.6 BASE COAT

Manufacturer's standard product and compatible with other systems components.

2.7 PORTLAND CEMENT

Conform to ASTM C 150, Type I or II as required, fresh and free of lumps, and approved by the systems manufacturer.

2.8 REINFORCING FABRIC

Reinforcing fabric mesh shall be alkali-resistant, balanced, open weave , glass fiber fabric made from twisted multi-end strands specifically treated for compatibility with the other system materials, and comply with ASTM E 2098 and as recommended by EIFS manufacturer.

2.9 FINISH COAT

Manufacturer's standard product conforming to the requirements in the paragraph on Sub-Component Requirements and Tests. For color consistency, use materials from the same batch or lot number. **AM#2...**Color to be selected from manufacturer's standard colors with closest match to

Installation Design Guide approved Pantone Color 15-1309 TPX "Taupe". **...AM#2**

2.10 SEALANT PRIMER

Non-staining, quick-drying type recommended by sealant manufacturer and EIFS manufacturer.

2.11 ACCESSORIES

Conform to recommendations of EIFS manufacturer, including trim, edging, anchors, expansion joints. All metal items and fasteners to be corrosion resistant.

2.12 JOINT SEALANT

Non-staining, quick-drying type meeting ASTM C 920, as Type S or M, minimum Grade NS, minimum Class 25 and compatible with the finish system type and grade, and recommended by both the sealant manufacturer and EIFS manufacturer.

2.13 BOND BREAKER

As required by EIFS manufacturer and recommended by sealant manufacturer and EIFS manufacturer.

2.14 BACKER ROD

Closed cell polyethylene free from oil or other staining elements and as recommended by sealant manufacturer and EIFS manufacturer. Do not use absorptive materials as backer rod. The backer rod should be sized 25 percent larger than the width of the joint.

PART 3 EXECUTION

3.1 EXAMINATION

Examine substrate and existing conditions to determine that the EIFS can be installed as required by the EIFS manufacturer and that all work related to the EIFS is properly coordinated. Surface shall be sound and free of oil, loose materials or protrusions which will interfere with the system installation. If deficiencies are found, notify the Contracting Officer and do not proceed with installation until the deficiencies are corrected. The substrate shall be plane, with no deviation greater than 1/4 inch when tested with a 10 foot straightedge. Determine flatness, plumbness, and any other conditions for conformance to manufacturer's instructions.

3.2 SURFACE PREPARATION

Prepare existing surfaces for application of the EIFS to meet flatness tolerances and surface preparation according to manufacturer's installation instructions but provide a flatness of not more that 1/4 inch in 10 feet. Provide clean surfaces free of oil and loose material without protrusions adversely affecting the installation of the insulation board. Due to substrate conditions or as recommended by the system manufacturer, a primer may be required. Apply the primer to existing surfaces as recommended by the manufacturer. Use masking tape to protect areas adjacent to the EIFS to prevent base or finish coat to be applied to areas not intended to be covered with the EIFS. The contractor shall not proceed with the installation until all noted deficiencies of the substrate are corrected.

3.3 INSTALLATION

Install EIFS as indicated, comply with manufacturer's instructions except as otherwise specified, and in accordance with the shop drawings. EIFS shall be installed only by an applicator trained by the EIFS manufacturer. Specifically, include all manufacturer recommended provisions regarding flashing and treatment of wall penetrations.

3.3.1 Sheathing Board

Edges and ends of boards shall be butted snugly with vertical joints staggered to provide full and even support for the insulation. Do not align sheathing board joints with wall openings. Provide support at both vertical and horizontal joints. Attach sheathing board to metal studs with self-tapping drywall screws. Place fasteners sufficiently close to support imposed loads, but not more than:

a. Maximum of 8 inches apart on each supporting stud

Space fasteners more closely when required for negative wind load resistance.

3.3.2 Insulation Board

Unless otherwise specified by the system manufacturer, place the long edge horizontally from level base line. Stagger vertical joints and interlock at corners. Butt joints tightly. Provide flush surfaces at joints. Offset insulation board joints from joints in sheathing by at least (inches. Align drainage channels of integral drainage system or provide polypropylene drainage lath space to provide a path for any water weeped from behind the insulation to escape wall construction. Use L-shaped insulation board pieces at corners of openings. Joints of insulation shall be butted tightly. Surfaces of adjacent insulation boards shall be flush at joints. Gaps greater than 1/16 inch between the insulation boards shall be filled with slivers of insulation. Uneven board surfaces with irregularities projecting more than 1/16 inch shall be rasped in accordance with the manufacturer's instructions to produce an even surface. Attach insulation board as recommended by manufacturer. The adhered insulation board shall be allowed to remain undisturbed for 24 hours prior to proceeding with the installation of the base coat/reinforcing mesh, or longer if necessary for the adhesive to dry. However, do not leave insulation board exposed longer than recommended by insulation manufacturer.

3.3.2.1 Mechanically Fastened Insulation Boards (OPTIONAL)

Fasten with manufacturer's standard corrosion resistant anchors, spaced as recommended by manufacturer, but not more than 2 feet horizontally and vertically.

3.3.2.2 Adhesively Fastened Insulation Boards

Apply insulation board using adhesive spread with a notched trowel to the back of the insulation boards in accordance with the manufacturer’s instructions.

3.3.3 Base Coat and Reinforcing Fabric Mesh,

3.3.3.1 Class PB Systems

Allow the adhered insulation board to dry for 24 hours, or longer if necessary, prior to proceeding with the installation of the base coat/reinforcing fabric mesh Install reinforcing fabric in accordance with manufacturer's instructions. Mix base coat in accordance with the manufacturer's instructions and apply to insulated wall surfaces to the thickness specified by the system manufacturer and provide any other reinforcement recommended by EIFS manufacturer. Trowel the reinforcing fabric mesh into the wet base coat material. Fully embed the mesh in the base coat. When properly worked-in, the pattern of the reinforcing fabric mesh shall not be visible. Provide diagonal reinforcement at opening corners. Back-wrap or edge wrap all terminations of the EIFS. Overlap the reinforcing fabric mesh a minimum of 2.5 inches on previously installed mesh, or butted, in accordance with the manufacturer’s instructions.

3.3.3.2 Class PM Systems

Mechanically fasten reinforcing fabric mesh to the insulated wall using the type and spacing of fasteners specified in the manufacturer’s instructions. Provide diagonal reinforcement at opening corners. Mix base coat in accordance with manufacturer's instructions. Apply base coat in accordance with manufacturer's instruction to provide a complete, tight coating of uniform thickness as specified by the manufacturer. Cover all fiberglass reinforcing fabric, including at back wrapped areas at panel joints and at fasteners.

3.3.4 Finish Coat

The base coat/reinforcing mesh must be allowed to dry a minimum of 24 hours prior to application of the finish coat. Surface irregularities in the base coat, such as trowel marks, board lines, reinforcing mesh laps, etc., shall be corrected prior to the application of the finish coat. Apply and level finish coat in one operation. Obtain final texture by trowels, floats, or by spray application as necessary to achieve the required finish, matching the approved sample. Apply the finish coat to the dry base coat maintaining a wet edge at all times to obtain a uniform appearance. The thickness of the finish coat shall be in accordance with the system manufacturer’s current published instructions. Apply finish coat so that it does not cover surfaces to which joint sealants are to be applied.

3.4 JOINT SEALING

Seal EIFS at openings as recommended by the system manufacturer. Apply sealant only to the base coat or base coat with EIFS Manufacturer's color coating. Do not apply sealant to the finish coat.

3.4.1 Surface Preparation, Backer Rod, and Primer

Immediately prior to application, remove loose matter from joint. Ensure that joint is dry and free of finish coat, or other foreign matter. Install backer rod. Apply primer as required by sealant and EIFS manufacturer. Check that joint width is as shown on drawings but in no case shall it be less than 0.5 inch for perimeter seals and 0.75 inch for expansion joints. The width shall not be less than 4 times the anticipated movement. Check sealant manufacturer's recommendations regarding proper

width to depth ratio.

3.4.2 Sealant

Do not apply sealant until all EIFS coatings are fully dry. Apply sealant in accordance with sealant manufacturer's instructions with gun having nozzle that fits joint width. Do not use sealant that has exceeded shelf life or can not be discharged in a continuous flow. Completely fill the joint solidly with sealant without air pockets so that full contact is made with both sides of the joint. Tool sealant with a round instrument that provides a concave profile and a uniformly smooth and wrinkle free sealant surface. Do not wet tool the joint with soap, water, or any other liquid tooling aid. During inclement weather, protect the joints until sealant application. Use particular caution in sealing joints between window and door frames and the EIFS wall and at all other wall penetrations. Clean all surfaces to remove excess sealant.

3.5 FIELD QUALITY CONTROL

Throughout the installation, the contractor shall establish and maintain an inspection procedure to assure compliance of the installed EIFS with contract requirements. Work not in compliance shall be removed and replaced or corrected in an approved manner. The inspection procedures, from acceptance of deliveries through installation of sealants and final acceptance shall be performed by qualified inspector trained by the manufacturer. No work on the EIFS shall be performed unless the inspector is present at the job site.

3.5.1 Third Party Inspection

Provide full time third party inspection during the entire process of installing the EIFS, from examination through cleanup. The third party inspector shall be certified by the Exterior Design Institute (EDI), AWCI, or by an equivalent independent party and shall be trained in the proper installation of EIFS.

3.5.2 Inspection Check List

During the installation and at the completion of installation, perform inspections covering at the minimum all applicable items enumerated on the attached check list. The inspector shall initial and date all applicable items, sign the check list, and submit a copy of the annotated check list to the Contracting Officer at the completion of the EIFS erection -- AND -- after at least three other on-site inspections, conducted at approximately equal time-intervals during the course of the EIFS installation.

CHECK LIST

Item	Description	Appr'd/Date
a.	Materials are handled and stored correctly.	_____
b.	Environmental conditions are within specified limits, including temperature not below 4 degrees C (40 degrees F), and the work is protected from the elements as required.	_____
c.	Preparation and installation is performed by qualified personnel using the correct tools.	_____

CHECK LIST

Item	Description	Appr'd/Date
d.	Adjacent areas to which EIFS is not to be applied (such as on window and door frames) are protected with masking tape, plastic films, drop cloths, etc. to prevent accidental application of EIFS materials.	
e.	Control, expansion and aesthetic joints are installed as indicated or recommended. Accessories are properly installed.	
f.	Substrate is in-plane, properly attached, clean, dry, and free of contaminants. Concrete substrate is free of efflorescence.	
g.	Materials are mixed thoroughly and in proper proportions.	
h.	Adhesive is applied in sufficient quantity with proper-size notched trowel.	
i.	Mechanical attachments have proper spacing, layout and fastener depth.	
j.	Insulation boards are tightly abutted, in running bond pattern, with joints staggered with the sheathing, board corners interlocked, L-shaped boards around openings, edges free of adhesive, and provision for joints. Gaps are filled and surfaces rasped.	
k.	Insulation adhesive must be allowed to dry (a minimum of 24-hours) prior to the application of the base coat.	
l.	Reinforcing fabric mesh is properly back-wrapped at terminations.	
m.	Reinforcing fabric mesh is fully embedded and properly placed. Corners are reinforced. Openings are diagonally reinforced. Mesh overlaps minimum 65 mm (2-1/2 inches).	
n.	Base coat thickness is within specified limits.	
o.	The base coat/reinforcing fabric mesh must be allowed to dry (a minimum of 24-hours) prior to the application of the finish coat.	
p.	Finish coat is applied with sufficient number of personnel and stopped at suitable points. Floats and methods of texturing are uniform.	
q.	All Flashings are properly installed.	
r.	All joints are properly sealed in their entire length at time and under environmental conditions as specified by the manufacturer.	
s.	All scaffolding, equipment, materials, debris	

CHECK LIST

Item	Description	Appr'd/Date
	and temporary protection are removed from site upon completion.	

Name of Inspector:_____ Signed:_____ Date:_____

3.6 CLEANUP

Upon completion, remove all scaffolding, equipment, materials and debris from site. Remove all temporary protection installed to facilitate installation of EIFS.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 09 - FINISHES

SECTION 09 51 00

ACOUSTICAL CEILINGS

-- End of Section Table of Contents --

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 489	(2004e1) Standard Specification for Carbon Steel Lifting Eyes
ASTM A 641/A 641M	(2003) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM C 423	(2008a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C 635/C 635M	(2007) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636/C 636M	(2008) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C 834	(2005) Latex Sealants
ASTM E 1264	(2008) Acoustical Ceiling Products
ASTM E 1414	(2006) Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
ASTM E 1477	(1998a; R 2008) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers
ASTM E 580/E 580M	(2008a) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint
ASTM E 795	(2005) Mounting Test Specimens During Sound Absorption Tests

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-04	(2007) Seismic Design for Buildings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings

Drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan.

SD-03 Product Data

Manufacturer's data indicating percentage of recycle material in acoustic ceiling tiles to verify affirmative procurement compliance.

Total weight and volume quantities of acoustic ceiling tiles with recycle material.

SD-04 Samples

Acoustical Units
Acoustic Ceiling Tiles

Two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color.

SD-07 Certificates

Acoustical Units
Acoustic Ceiling Tiles

Certificate attesting that the mineral based acoustical units furnished for the project contain recycled material and showing an estimated percent of such material.

1.3 GENERAL REQUIREMENTS

Provide sound controlling units mechanically mounted on a ceiling suspension system for acoustical treatment. The unit size, texture, finish, and color must be as specified. The location and extent of acoustical treatment must be as shown on the approved detail drawings. Coordinate with paragraph RECLAMATION PROCEDURES for reclamation of mineral fiber acoustical ceiling panels to be removed from the job site.

1.3.1 Ceiling Attenuation Class

Provide a ceiling system with an attenuation class (CAC) of 40 minimum when determined in accordance with ASTM E 1414. Provide fixture attenuators over light fixtures and other ceiling penetrations, and provide acoustical blanket insulation adjacent to partitions, as required to achieve the specified CAC.

1.3.2 Ceiling Sound Absorption

Determine the Noise Reduction Coefficient (NRC) in accordance with

ASTM C 423 Test Method.

1.3.3 Light Reflectance

Determine light reflectance factor in accordance with ASTM E 1477 Test Method.

1.4 DELIVERY AND STORAGE

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of acoustical units.

1.6 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period. Include an agreement to repair or replace acoustical panels that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

1.8 EXTRA MATERIALS

Furnish spare tiles, from the same lot as those installed, of each color at the rate of 5 tiles for each 100 tiles installed.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

Comply with EPA requirements in accordance with Section 01 62 35 RECYCLED / RECOVERED MATERIALS. Conform acoustical units to ASTM E 1264, Class A, and the following requirements:

2.1.1 Affirmative Procurement

Mineral Wool, Cellulose, and Laminated Paperboard used in acoustic ceiling tiles are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (http://www.epa.gov/cpg/). EPA's recommended Recovered Materials Content Levels for Mineral Wool, Cellulose, Structural Fiberboard and Laminated Paperboard are:

Product	Material	Percent of Post Consumer Materials	Percent of Total Recovered Materials
Laminate Paperboard	Post Consumer Paper	100	100
Rock Wool	Slag	75	
Cellulose	Post Consumer Paper	75	75

a. The recommended recovered materials content levels are based on the weight (not volume) of materials in the insulating core only.

b. For informational purposes, a list of known sources for acoustical ceiling tiles using recycled material is provided in the EPA/CPG Supplier database at http://www.ergweb2.com/cpg4review/user/cpg search.cfm.

c. Note that the Contractor is not limited to these sources. A product meeting CPG recycle requirements from other sources may be submitted for the Government's approval.

d. Submit recycled material content data for acoustic ceiling tiles indicating compliance with affirmative procurement.

e. Submit total weight and volume quantities of acoustic ceiling tiles with recycle material.

2.1.2 Units for Exposed-Grid System

a. Type: III (non-asbestos mineral fiber with painted finish) of IV (non-asbestos mineral fiber with membrane-faced overlay), or XII (fiberglass base with membrane-faced overlay).

b. Flame Spread: Class A, 25 or less

c. Pattern: Fissured.

d. Minimum NRC: **AM#2...** 0.55 when tested on mounting Type E-400 of ASTM E 795. **...AM#2**

e. Minimum Light Reflectance Coefficient: LR-1, 0.75 or greater.

f. Nominal size: 24 by 48 inch.

g. Edge detail: Square.

h. Finish: Factory-applied standard finish.

i. Minimum CAC: **AM#2**... 35 ...**AM#2**

2.2 SUSPENSION SYSTEM

Provide standard exposed-grid suspension system as indicated on the drawings, conforming to ASTM C 635/C 635M for intermediate-duty systems. Provide surfaces exposed to view of aluminum or steel with a factory-applied white baked-enamel finish. Provide wall molding having a flange of not less than 15/16 inch. Provide standard overlapped corners. Suspended ceiling framing system must have the capability to

support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. Provide a suspension system with a maximum deflection of 1/360 of the span length. Conform seismic details to the guidance in UFC 3-310-04 and ASTM E 580/E 580M.

2.3 HANGERS

Provide hangers and attachment capable of supporting a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

2.3.1 Wires

Conform wires to ASTM A 641/A 641M, Class 1, 0.11 inch in diameter.

2.3.2 Rods

As required, provide 3/16 inch diameter threaded steel rods, zinc or cadmium coated.

2.3.3 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with ASTM A 489. Eyebolt size must be a minimum 1/4 inch, zinc coated or cadmium plated.

2.4 ADHESIVE

Use adhesive as recommended by tile manufacturer.

2.5 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

2.6 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components as indicated herein, and on the drawings.

2.7 ACOUSTICAL SEALANT

Conform acoustical sealant to ASTM C 834, nonstaining.

PART 3 EXECUTION

3.1 INSTALLATION

Complete and dry interior finish work such as plastering, concrete, and terrazzo work before installation. Complete and approve mechanical, electrical, and other work above the ceiling line prior to the start of acoustical ceiling installation. Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object with the

hanger wires, install a subsuspension system so that all hanger wires will be plumb.

3.1.1 Suspension System

Install suspension system in accordance with ASTM C 636/C 636M and as specified herein. Do not suspend hanger wires or other loads from underside of steel decking.

3.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than 6 inches from each corner of each fixture.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, offset the resulting horizontal force by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Secure wall molding not more than 3 inches from ends of each length and not more than 16 inches on center between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf.

3.2 CEILING ACCESS PANELS

Locate ceiling access panels directly under the items which require access.

3.3 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 09 - FINISHES

SECTION 09 90 00.00 40

PAINTING AND COATING

-- End of Section Table of Contents --

SECTION 09 90 00.00 40

PAINTING AND COATING

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items. Data shall include detailed analysis of each coating material required, with constituents measured as percentages of the total weight of coating.

Inhibitive Metal Primer
Pigmented Sealer
Latex Block Filler
Alkali Resistant Primer
Enamel Undercoat
Exterior Wood Primer
Acrylic Latex
Acrylic Epoxy

SD-04 Samples

Manufacturer's Standard Color Charts shall be submitted in accordance with paragraph entitled, "Manufacturer's and Materials," of this section.

SD-07 Certificates

A Safety Plan shall be submitted in accordance with paragraph entitled, "General," of this section.

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for architectural coatings including details of thinning, mixing, handling, and application, in accordance with paragraph entitled, "General," of this section.

1.2 CONTRACTOR PERSONNEL QUALIFICATION

Personnel assigned to the work shall be certified by the Contractor to have had adequate previous experience in the successful application of paints and coatings similar to those specified.

1.3 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered in their original, unbroken containers bearing the manufacturer's name and product identification. Containers breached by

rough handling shall be removed from the site, together with their contents.

Paint materials, thinners, and cleaners shall be stored in tightly closed containers in a covered, well-ventilated area where they will not be exposed to excessive heat, sparks, flame, or direct sunlight. Water-based materials shall be protected against freezing.

PART 2 PRODUCTS

2.1 MANUFACTURER'S AND MATERIALS

Manufacturer's Standard Color Charts shall be submitted showing manufacturer's recommended finish colors. Three color chips of each color and gloss scheduled shall also be submitted.

The following are suggested paint manufacturers and their products. Other paint manufacturers' products of equal quality will be considered when submitted and approved by the Contracting Officer.

COATING	PITTSBURGH	SHERWIN WILLIAMS	GLIDDEN
Inhibitive Metal Primer	6-712	B50WZ1	6970
Pigmented Sealer	6-2	B28W200	5111
Latex Block Filler	6-7	B25W25	5317
Alkali Resistant Primer	6-3	A5V2	5212H
Enamel Undercoat	6-755	B49W2	300 or 310
Exterior Wood Primer	6-809	Y24W20	3651
Acrylic latex, flat	72 line	A6 SERIES	6500
Acrylic Latex, gloss	78 line	A8 SERIES	6600
Water base Acrylic Epoxy	16 line	B70 SERIES	5277/5278

PART 3 EXECUTION

3.1 GENERAL

A Safety Plan shall be submitted for architectural coating systems in accordance with OSHA regulations.

Manufacturer's recommendations for surface preparation, thinning, mixing, handling, and application shall be considered a part of this specification.

3.2 PROTECTION OF FACILITIES

Contractor shall remove and reinstall or provide acceptable protection for hardware, accessories, lighting and electrical components, factory-finished materials, plumbing fixtures and fittings, and any other materials that may become splattered or damaged by the painting work.

3.3 SURFACE PREPARATION

3.3.1 General Requirements

Surfaces shall be clean, dry, and free from contaminants and foreign matter. Mildew and chalking shall be removed and the surface thoroughly sterilized. Chipped, peeling, or blistered paint shall be removed and the surface spot primed. Hard glossy surfaces shall be dulled and roughened to ensure proper adhesion.

3.3.2 Ferrous Metal

Surfaces shall be free from dirt, oil, grease, wax, and other contaminants. Heavy rust and loose mill scale shall be removed by hand, power tool, or blast cleaning.

3.3.3 Galvanized Steel

Surfaces shall be cleaned of all contaminants using a solvent such as lacquer thinner or xylol.

After cleaning, the surface shall be etched with a phosporic acid pre-treatment solution.

3.3.4 Aluminum

Surfaces shall be clean, dry, and free from oil and grease. Oxide film and corrosion shall be removed by hand or power tool cleaning.

3.3.5 Wood

Surfaces shall be clean, dry, smooth, and free from oil, grease, and dirt. Knots shall be sealed with a mixture of equal parts of shellac and alcohol. Nail holes, cracks, and other defects shall be filled with plastic wood or putty. Concealed surfaces shall be back-primed before installation.

3.3.6 Masonry

Surfaces shall be free from dirt, oil, grease, wax, form-release compounds, laitance, and other contaminants. Cracks, voids, and other major surface imperfections shall be filled with mortar.

3.3.7 Plaster and Drywall

Surfaces shall be clean and dry. Cracks and other surface imperfections shall be filled with spackling compound and sanded smooth.

3.4 MIXING AND APPLICATION

3.4.1 General Procedures

No exterior painting shall be allowed in rainy weather or when rain is

imminent. No paints or coatings shall be applied when the temperature or humidity is outside the limits recommended by the manufacturer.

Paints and coatings shall be applied by brush, roller, or airless spray.

Each coat of material applied shall be free from runs, sags, bubbles, foreign contaminants, variations in color, gloss, and texture, dry overspray, brush and roller marks, holidays (missed areas), or other evidence of poor application.

Paints and coatings shall be thoroughly worked into corners and crevices.

Newly painted surfaces shall be adequately protected from damage.

3.4.2 Procedures

There shall be at least 2 coats of finish paint, applied in accordance with the manufacturer's instructions.

Coatings shall be applied as follows:

Material shall be thoroughly stirred to produce a uniform mixture.

Material shall be thinned for workability and improved spray characteristics, but only according to the manufacturer's instructions.

Each coat shall be applied uniformly at the minimum wet-film thickness specified by the manufacturer.

Special attention shall be given when coating sharp edges, corners, and crevices to ensure complete coverage.

Previous coat shall dry, per manufacturer's instruction, before subsequent coat is applied.

Finish coats shall show good hiding characteristics and uniform appearance.

3.5 Piping Identification

Piping Identification (including surfaces in concealed spaces): Provide in accordance with MIL-STD-101 and/or ASME A13.1. Place stenciling in clearly visible locations. On piping not covered by MIL-STD-101 or ASME 13.1, stencil approved names or code letters, in a minimum of 1/2 inch high font for piping, and a minimum of 2 inch high font elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

3.6 ACCEPTANCE PROVISIONS

3.6.1 Inspection

Contractor shall provide qualified personnel for inspection of his work to ensure that the requirements of this section have been fulfilled.

3.6.2 Correction

Spot-painting to correct damaged surfaces will be allowed only when touchup area blends into the surrounding finish. Otherwise, the entire area shall

be recoated. Touchup shall be accomplished using the same method of application as was used to apply the original material.

3.7 PROTECTION

"WET PAINT" signs shall be posted to indicate newly painted surfaces.

3.8 SURFACES TO BE PAINTED

Surfaces listed in the paint schedule at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled. All visible unfinished or factory-primed items shall be painted -- including exposed structural bents, columns, girders, beams, joists, metal decks, interior and exterior pipe posts, doors and door frames. In addition, miscellaneous small unfinished or factory-primed surfaces which are normally concealed from view by plates, caps, bases, covers, escutcheons, or hardware, and which might occasionally be removed for inspection or maintenance, shall also be painted.

3.9 SURFACES NOT TO BE PAINTED

Factory-finished components such as metal roof panels and flashing, shall not be painted. Other factory-finished surfaces, such as anodized aluminum window frames, glazing, ceramic tile, vinyl flooring, exterior sealants and suspended ceilings, shall not be painted. Surfaces of factory finished casework, hardware, fixtures, appliances and equipment shall not be painted. All surfaces permanently concealed from view need not be painted. **AM#2...** Exterior Insulation Finish System shall not be painted. Exterior masonry shall not be painted. **...AM#2**

3.10 PAINT SCHEDULE

Refer also to the drawings for information about surfaces to be painted.

SURFACE	PRIMER	UNDERCOAT AND FINISH COAT
Interior drywall	Pigmented sealer	Water-base acrylic enamel
Interior metal	Inhibitive metal primer	Water-base acrylic enamel
Interior masonry (rough/porous)	Latex block filler	Water-base acrylic enamel

AM#2... DELETED TEXT ...AM#2

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

SECTION 23 09 23

DIRECT DIGITAL CONTROL FOR HVAC AND OTHER LOCAL BUILDING SYSTEMS

2.3 TUBING
2.3.1 Copper
2.3.2 Stainless Steel
2.3.3 Plastic
2.4 NETWORK HARDWARE
2.4.1 CEA-709.1B Network Hardware
2.4.1.1 CEA-709.1B Routers
2.4.1.2 CEA-709.3 Repeaters
2.4.2 Gateways
2.5 WIRE AND CABLE
2.5.1 Terminal Blocks
2.5.2 Control Wiring for Binary Signals
2.5.3 Wiring for 120-Volt Circuits
2.5.4 Control Wiring for Analog Signals
2.5.5 Transformers
2.6 AUTOMATIC CONTROL VALVES
2.6.1 Ball Valves
2.6.2 Two-Way
2.6.3 Three-Way
2.6.4 Duct-Coil and Terminal-Unit-Coil
2.6.5 Glycol
2.6.6 Valves for Steam Service
2.7 DAMPERS
2.7.1 Damper Assembly
2.7.2 Operating Linkages
2.7.3 Damper Types
2.7.3.1 Flow Control Dampers
2.7.3.2 Mechanical Rooms and Other Utility Space Ventilation Dampers
2.8 SENSORS AND INSTRUMENTATION
2.8.1 Transmitters
2.8.2 Temperature Sensors
2.8.2.1 Sensor Ranges and Accuracy
2.8.2.2 Point Temperature Sensors
2.8.2.3 Averaging Temperature Sensors
2.8.2.4 Thermowells
2.8.3 Differential Pressure Instrumentation
2.8.3.1 Differential Pressure Sensors
2.8.4 Flow Sensors
2.8.4.1 Flow Switch
2.8.5 Electrical Instruments
2.8.5.1 Current Sensing Relays (CSRs)
2.8.6 Carbon Monoxide Analyzer
2.9 INDICATING DEVICES
2.9.1 Thermometers
2.9.1.1 Piping System Thermometers
2.9.1.2 Air-Duct Thermometers
2.9.2 Pressure Gauges
2.9.3 Low Differential Pressure Gauges
2.10 OUTPUT DEVICES
2.10.1 Actuators
2.10.1.1 Valve Actuators
2.10.1.2 Damper Actuators
2.10.2 Relays
2.11 USER INPUT DEVICES
2.12 MULTIFUNCTION DEVICES
2.12.1 Current Sensing Relay Command Switch
2.12.2 Thermostats
2.13 DIRECT DIGITAL CONTROL (DDC) HARDWARE
2.13.1 General Requirements

-- End of Section Table of Contents --

SECTION 23 09 23

DIRECT DIGITAL CONTROL FOR HVAC AND OTHER LOCAL BUILDING SYSTEMS

PART 1 GENERAL

The DDC control system shall be compatible with Siemens Apogee System. The DDC controls and building automation system shall communicate with the Fort Wainwright control network and UMCS (Utility Monitoring and Control System) using wireless communications.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D	(1998) Laboratory Methods of Testing Dampers for Rating

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE FUN IP	(2005) Fundamentals Handbook, I-P Edition

ASME INTERNATIONAL (ASME)

ASME B16.15	(2006) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.34	(2004) Valves - Flanged, Threaded and Welding End
ASME B40.100	(2005) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM A 269	(2008) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM B 88	(2003) Standard Specification for Seamless Copper Water Tube
ASTM B 88M	(2005) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM D 1693	(2008) Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
ASTM D 635	(2006) Standard Test Method for Rate of

	Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1B	(2002) Control Network Protocol Specification
CEA-709.3	(1999) Free-Topology Twisted-Pair Channel Specification
CEA-852-A	(2004) Tunneling Component Network Protocols Over Internet Protocol Channels

FLUID CONTROLS INSTITUTE (FCI)

FCI 70-2	(2006) Control Valve Seat Leakage

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1	(2002) IEEE Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE Std 142	(2007) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book (Color Book Series)

LONMARK INTERNATIONAL (LonMark)

LonMark Interoperability Guide	(2002) LonMark Application-Layer Interoperability Guide; Version 3.3
LonMark SNVT List	(2002) LonMark SNVT Master List; Version 11 Revision 2
LonMark XIF Guide	(2001) LonMark External Interface File Reference Guide; Revision 4.0B

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2003) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2007; AMD 1 2008) National Electrical Code - 2008 Edition
NFPA 90A	(2008) Standard for the Installation of Air Conditioning and Ventilating Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 1585	(1998; Rev thru May 2006) UL Standard for Safety Class 2 and Class 3 Transformers - Fourth Edition
UL 916	(2007) Energy Management Equipment
UL 94	(1996; Rev thru Jun 2006) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.2 DEFINITIONS

The following list of definitions may contain terms not found elsewhere in the Section but are included here for completeness.

a. Application Specific Controller: A device that is furnished with a pre-established built in application that is configurable but not re-programmable. An ASC has a fixed factory-installed application program (i.e Program ID) with configurable settings.

b. Binary: A two-state system where an "ON" condition is represented by a high signal level and an "OFF" condition is represented by a low signal level. 'Digital' is sometimes used interchangeably with 'binary'.

c. Binding: The act of establishing communications between CEA-709.1B devices by associating the output of a device to the input of another.

d. Building Control Network: The CEA-709.1B control network installed under this Section, consisting of a backbone and one or more local control busses.

e. Building Point of Connection (BPOC): The BPOC is the point of connection between the BAS network backbone (an IP network) and the building control network backbone. The hardware at this location, that provides the connection is referred to as the BPOC Hardware. In general, the term "BPOC Location" means the place where this connection occurs, and "BPOC Hardware" means the device that provides the connection. Sometimes the term "BPOC" is used to mean either and its actual meaning (i.e. location or hardware) is determined by the context in which it is used.

f. Channel: A portion of the control network consisting of one or more segments connected by repeaters. Channels are separated by routers. The device quantity limitation is dependent on the topology/media and device type. For example, a TP/FT-10 network with locally powered devices is limited to 128 devices per channel.

g. Configuration Parameter: Controller setting usually written to EEPROM. Also see 'Standard Configuration Parameter Type (SCPT)'

h. Control Logic Diagram: A graphical representation of control logic for multiple processes that make up a system.

i. Domain: A grouping of up to 32,385 nodes that can communicate directly with each other. (Devices in different domains cannot communicate directly with each other.) Part of the Node Addressing scheme.

j. Explicit Messaging: A method of communication between devices where each message contains a message code that identifies the type of message and the devices use these codes to determine the action to take when the message is received. These messages are non-standard and often vendor (application) dependent.

k. External Interface File (XIF): A file which documents a device's external interface, specifically the number and types of LonMark objects; the number, types, directions, and connection attributes of network variables; and the number of message tags.

l. Functional Profile: The description of one or more LonMark Objects used to classify and certify devices.

m. Gateway: A device that translates from one protocol to another. Gateways are also called Communications Bridges or Protocol Translators.

n. General Purpose Programmable Controller (GPPC): Unlike an ASC, a GPPC is not furnished with a fixed application program. A GPPC can be (re-)programmed, usually using vendor-supplied software.

o. LonMark Object: A collection of network variables, configuration parameters, and associated behavior defined by LonMark International and described by a Functional Profile. Defines how information is exchanged between devices on a network (inputs from and outputs to the network).

p. LNS Plug-in: Software which runs in an LNS compatible software tool. Device configuration plug-ins provide a 'user friendly' interface to configuration parameters.

q. LonMark: See LonMark International. Also, a certification issued by LonMark International to CEA-709.1B devices.

r. LonMark International: Standards committee consisting of numerous independent product developers and systems integrators dedicated to determining and maintaining the interoperability guidelines for the LonWorks industry. Maintains guidelines for the interoperability of CEA-709.1B devices and issues the LonMark Certification for CEA-709.1B devices.

s. LonMark Interoperability Association: See 'LonMark International'.

t. LonWorks: The overall communications technology, developed by Echelon Corporation, for control systems. The term is often used to refer to the technology in general, and may include reference to any/all of the: protocol, network management, and interoperability guidelines where the technology is based on the CEA-709.1B protocol and employs interoperable devices along with the capability to openly manage these devices (via multiple vendors) using a network configuration (or service) tool.

u. LonWorks Network Services (LNS): A network management and database

standard for CEA-709.1B devices.

v. Monitoring and Control (M&C) Software: The BAS 'front end' software which performs supervisory functions such as alarm handling, scheduling and data logging and provides a user interface for monitoring the system and configuring these functions.

w. Network Variable: See 'Standard Network Variable Type (SNVT)'.

x. Network Configuration Tool: The software used to configure the control network and set device configuration properties. This software creates and modifies the control network database (LNS Database).

y. Node: A device that communicates using the CEA-709.1B protocol and is connected to an CEA-709.1B network.

z. Node Address: The logical address of a node on the network. Variations in node addressing are possible, but the 'Domain, Subnet, Node' format is the established standard for this specification.

aa. Node ID: A unique 48-bit identifier assigned (at the factory) to each CEA-709.1B device, sometimes called the Neuron ID.

bb. Program ID: An identifier (number) stored in the device (usually EEPROM) that identifies the node manufacturer, functionality of device (application & sequence), transceiver used, and the intended device usage.

cc. Repeater: A device that connects two control network segments and retransmits all information received on one side onto the other.

dd. Router: A device that connects two channels and controls traffic between the channels by retransmitting signals received from one subnet onto the other based on the signal destination. Routers are used to subdivide a control network and to control bandwidth usage.

ee. Segment: A 'single' section of a control network that contains no repeaters or routers. The device quantity limitation is dependent on the topology/media and device type. For example, a TP/FT-10 network with locally powered devices is limited to 64 devices per segment.

ff. Service Pin: A hardware push-button on a device which causes the device to broadcast a message (over the control network) containing its Node ID and Program ID. This broadcast can also be initiated via software.

gg. Standard Configuration Parameter Type (SCPT): Pronounced 'skip-it'. A standard format type (maintained by LonMark International) for Configuration Parameters.

hh. Standard Network Variable Type (SNVT): Pronounced 'snivet'. A standard format type (maintained by LonMark International) used to define data information transmitted and received by the individual nodes. The term SNVT is used in two ways. Technically it is the acronym for Standard Network Variable Type, and is sometimes used in this manner. However, it is often used to indicate the network variable itself (i.e. it can mean "a network variable of a standard network variable type"). In general, the intended meaning should be clear from the context.

ii. Subnet: Consists of a logical (not physical) grouping of up to 127 nodes, where the logical grouping is defined by node addressing. Part of the Node Addressing scheme.

jj. TP/FT-10: A Free Topology Twisted Pair network defined by CEA-709.3. This is the most common media type for an ANSI-709.1 control network.

kk. BAS Network: An IP network connecting multiple building level control networks using the CEA-852-A standard.

ll. User-defined Configuration Parameter Type (UCPT): Pronounced 'u-keep-it'. A Configuration Parameter format type that is defined by the device manufacturer.

mm. User-defined Network Variable Type (UNVT): A network variable format defined by the device manufacturer. Note that UNVTs create non-standard communications (other vendor's devices may not correctly interpret it) and may close the system and therefore are not permitted by this specification.

1.3 SYSTEM DESCRIPTION

Provide a Direct Digital Control (DDC) system as a complete system suitable for the control of the heating, ventilating and air conditioning (HVAC) and other building-level systems as specified and shown.

1.3.1 System Requirements

Systems installed under this guide specification shall have the following characteristics:.

a. Open implementation of LonWorks technology using CEA-709.1B as the communications protocol and using LonMark Standard Network Variable Types as defined in LonMark SNVT List for communication over the network.

b. LonWorks Network Services (LNS) shall be used for all network management including addressing and binding of network variables. Submit a copy of the LNS database to the project site as specified.

c. The hardware shall perform the control sequences as specified and shown to provide control of the equipment as specified and shown.

d. Control sequence logic shall reside in DDC hardware in the building. The building control network shall not be dependent upon connection to a Building Automation and Control System (BAS) for performance of control sequences in this specification. The hardware shall, to the greatest extent practical, perform the sequences without reliance on the building network.

e. Install the hardware such that individual control equipment can be replaced by similar control equipment from other equipment manufacturers with no loss of system functionality.

f. All necessary documentation, configuration information, configuration tools, programs, drivers, and other software shall be licensed to and otherwise remain with the Government such that the Government or their agents are able to perform repair, replacement,

upgrades, and expansions of the system without subsequent or future dependence on the Contractor.

g. Provide sufficient documentation and data, including rights to documentation and data, such that the Government or their agents can execute work to perform repair, replacement, upgrades, and expansions of the system without subsequent or future dependence on the Contractor.

h. Install and configure hardware such that the Government or their agents are able to perform repair, replacement, and upgrades of individual hardware without further interaction with the Contractor.

i. Install and configure control hardware to provide all input and output Standard Network Variables (SNVTs) as shown and as needed to meet the requirements of this specification.

j. All DDC devices installed under this specification shall communicate via CEA-709.1B. The control system shall be installed such that a SNVT output from any node on the network can be bound to any other node in the domain.

1.3.2 Building Control Network

Provide a building control network consisting of a backbone and one or more local control busses as specified.

1.3.2.1 Backbone Media

The backbone shall be a TP/FT-10 network in accordance with CEA-709.3 or an IP network as specified in Section 25 10 10 Building Automation and Control SystemS according to the following criteria:

a. The backbone shall be an IP network as specified in Section 25 10 10 if both of the following conditions are met:

(1) the Network Bandwidth Calculations for a heavily loaded network show that more than 70 percent of the 78 kbps (kilobits per second) bandwidth is used or the Network Bandwidth Calculations for a normally loaded network show that more than 30 percent of the 78 kbps bandwidth is used.

(2) the Government has approved the Network Bandwidth Calculations submittal.

b. The backbone shall be a TP/FT-10 network otherwise.

1.3.2.2 Control Network Requirements

The control network shall meet the following requirements:

a. The backbone shall have no control devices connected to it. Only CEA-709.1B Routers and CEA-709.1B TP/FT-10 to IP Routers may be connected to the backbone. CEA-709.1B TP/FT-10 to IP Routers are specified in Section 25 10 10 BUILDING AUTOMATION AND CONTROL SYSTEMS

b. The backbone shall be installed such that a router at the Building Point of Connection (BPOC) location as shown may be connected to the backbone.

c. The local control bus shall use CEA-709.1B over a TP/FT-10 network in doubly-terminated bus topology in accordance with CEA-709.3

d. The local control busses shall be installed such that no node (device connected to the control network) has more than two CEA-709.1B Routers and CEA-709.3 Repeaters (in any combination) between it and the backbone, including the router connected to the backbone.

e. All DDC Hardware shall connect to a local control bus.

f. All DDC Hardware shall be locally powered; link power is not acceptable.

1.3.3 Network Bandwidth Usage Calculations

Perform Building Control Network Bandwidth Usage Calculations for a heavily loaded and a normally loaded control network. Calculations shall be performed for network traffic on the backbone.

a. A heavily loaded control network is characterized as one performing the following activities simultaneously:

1. Transmitting every point in the building indicated on Points Schedules as being available to the Building Point of Connection (BPOC) location in response to polling requests at 15-minute intervals (for trending at BAS).

2. Transmitting five points to the Building Point of Connection (BPOC) location in response to polling requests at 2-second intervals.

3. Transmitting 100 points to the Building Point of Connection (BPOC) location in response to polling requests at 5-second intervals.

4. Transmitting occupancy commands from the Building Point of Connection (BPOC) location to every system schedule sequence in a one-minute interval.

5. Transmitting occupancy override commands from the Building Point of Connection (BPOC) location to every system schedule sequence in a one-minute interval.

b. A normally loaded control network is characterized as one performing the following activities simultaneously:

1. Transmitting every point in the building indicated on Points Schedules as requiring a trend to the BAS in response to polling requests at 15-minute intervals (for trending at BAS).

2. Transmitting 50 points to the BAS in response to polling requests at 5-second intervals.

3. Transmitting occupancy commands from the BAS to every system scheduler sequence in a one-minute interval.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.

a. Technical data packages consisting of technical data and computer software (meaning technical data which relates to computer software) which are specifically identified in this project and which may be defined/required in other specifications shall be delivered strictly in accordance with the CONTRACT CLAUSES and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. All submittals not specified as technical data packages are considered 'shop drawings' under the Federal Acquisition Regulation Supplement (FARS) and shall contain no proprietary information and be delivered with unrestricted rights.

b. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES, the CONTRACT CLAUSES and DD Form 1423 and according to the sequencing specified in paragraph PROJECT SEQUENCING:

SD-02 Shop Drawings

DDC Contractor Design Drawings; G, AO

DDC Contractor Design Drawings in hard copy and on CDROM in AutoCAD format.

Draft As-Built Drawings; G, AO

Draft As-Built Drawings in hard copy and on CDROM in AutoCAD format.

Final As-Built Drawings; G, AO

Final As-Built Drawings in hard copy and on CDROM in AutoCAD format.

SD-03 Product Data

Manufacturer's Catalog Data;

Product specific catalog cuts for each product provided under this specification.

Programming Software;

The most recent version of the Programming software for each type (manufacturer and model) of General Purpose Programmable Controller (GPPC) as a Technical Data Package licensed to the project site. Software on CD-ROM and 3 hard copies of the software user manual for each piece of software provided.

GPPC Application Programs;

All installed GPPC Application Programs on CD-ROM as a Technical Data Package. Include in the CD-ROM a list or table of contents clearly indicating which application program is associated with each device. Submit 2 copies of the GPPC Application Program's CD-ROM.

XIF files;

External interface files (XIF files) as a technical data package for each model of DDC Hardware provided under this specification. XIF files shall be submitted on CD-ROM.

LNS Database;

Two copies of the LNS Database for the complete control network provided under this specification as a Technical Data Package. Each copy shall be on CD-ROM and shall be clearly marked identifying it as the LNS Database for the work covered under this specification and with the date of the most recent database modification.

LNS Plug-in;

LNS Plug-ins for each Application Specific Controller as a Technical Data Package. LNS Plug-ins distributed under a license shall be licensed to the project site. Submit Plug-ins on CD-ROM. Submit hard copy manuals, if available, for each plug-in provided.

SD-05 Design Data

Network Bandwidth Usage Calculations

Four copies of the Network Bandwidth Usage Calculations.

SD-06 Test Reports

Existing Conditions Report

Four copies of the Existing Conditions Report.

Start-Up and Start-Up Testing Report; G, AO

copies of the Start-Up and Start-Up Testing Report. The Start-Up and Testing report may be submitted as a Technical Data Package.

PVT Procedures

Four copies of the PVT Procedures. The PVT Procedures may be submitted as a Technical Data Package.

PVT Report

Four copies of the PVT Phase Report. The PVT Phase Report may be submitted as a Technical Data Package.

Pre-Construction QC Checklist; G, AO

copies of the Pre-Construction QC Checklist.

Post-Construction QC Checklist; G, AO

copies of the Post-Construction QC Checklist.

SD-10 Operation and Maintenance Data

Operation and Maintenance (O&M) Instructions; G, AO

2 copies of the Operation and Maintenance Instructions, indexed and in booklet form. The Operation and Maintenance Instructions shall be a single volume or in separate volumes, and may be submitted as a Technical Data Package.

Training Documentation; G, AO

Deliver training manuals for each trainee on the Course Attendee List with 2 additional copies delivered for archival at the project site. Deliver 2 copies of the Course Attendee List with the archival copies. The Training Documentation may be submitted as a Technical Data Package.

SD-11 Closeout Submittals

Closeout QC Checklist;

Four copies of the Closeout QC Checklist.

1.5 QUALITY ASSURANCE

1.5.1 QUALITY CONTROL (QC) CHECKLISTS

The Contractor's Chief Quality Control (QC) Representative shall complete the QC Checklist in APPENDIX A and submit a Pre-Construction QC Checklist, Post-Construction QC Checklist and a Closeout QC Checklist as specified. The QC Representative shall verify each item in the Checklist and initial in the provided area to indicate that the requirement has been met. The QC Representative shall sign and date the Checklist prior to submission to the Government.

1.5.2 Surge Protection

1.5.2.1 Power-Line Surge Protection

Protect equipment connected to ac circuits against or withstand power-line surges. Equipment protection shall meet the requirements of IEEE C62.41.1, IEEE C62.41.2. Fuses shall not be used for surge protection.

1.5.2.2 Surge Protection for Transmitter and Control Wiring

Protect DDC hardware against or withstand surges induced on control and transmitter wiring installed outdoors and as shown. The equipment protection shall be protected against the following two waveforms:

a. A waveform with a 10-microsecond rise time, a 1,000-microsecond decay time and a peak current of 60 amps.

b. A waveform with an 8-microsecond rise time, a 20-microsecond decay time and a peak current of 500 amperes.

1.5.3 Input Measurement Accuracy

Select, install and configure sensors, transmitters and DDC Hardware such

that the maximum error of the measured value at the SNVT output of the DDC hardware is less than 150 percent of the maximum allowable error specified for the sensor or instrumentation.

1.5.4 System Modifications

Submit recommendations for system modification in writing. No system modifications, including operating parameters and control settings, shall be made without prior approval of the Government. Incorporate any modifications made to the system into the Operations and Maintenance Instructions, and other documentation affected.

1.5.5 Drawings

The Government will not indicate all offsets, fittings, and accessories that may be required on the drawings. Carefully investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, arrange such work accordingly, and provide all work necessary to meet such conditions. Drawings shall be on A3 17 by 11 inches sheets in the form and arrangement shown. Use in the drawings the same abbreviations, symbols, nomenclature and identifiers shown. Each control system element on a drawing shall be assigned a unique identifier as shown. Deliver the DDC Contractor Design Drawings together as a complete submittal. Deviations shall be approved by the Contracting Officer. DDC Contractor Design Drawings shall include the following:

a. Drawing Index and HVAC Design Drawing Legend: The HVAC Control System Drawing Index shall show the name and number of the building, military site, State or other similar designation, and Country. The Drawing Index shall list all Contractor Design Drawings, including the drawing number, sheet number, drawing title, and computer filename when used. The Design Drawing Legend shall show and describe all symbols, abbreviations and acronyms used on the Design Drawings.

b. Valve Schedule: The valve schedule shall contain each valve's unique identifier, size, flow coefficient Kv (Cv), pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off pressure to torque data, dimensions, and access and clearance requirements data. The valve schedule shall contain actuator selection data supported by calculations of the force required to move and seal the valve, access and clearance requirements. A valve schedule shall be submitted for each HVAC system.

c. Damper Schedule: The damper schedule shall contain each damper's unique identifier, type (opposed or parallel blade), nominal and actual sizes, orientation of axis and frame, direction of blade rotation, actuator size and spring ranges, operation rate, positive positioner range, location of actuators and damper end switches, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. The Damper Schedule shall include the AMCA 500-D maximum leakage rate at the operating static-pressure differential. A damper schedule shall be submitted for each HVAC system.

d. Thermostat and Occupancy Sensor Schedule: The thermostat and occupancy sensor schedule shall contain each thermostat's unique identifier, room identifier and control features and functions as shown. A thermostat and occupancy sensor schedule shall be submitted for each HVAC system.

e. Critical Alarm Handling Schedule: The critical alarm handling schedule shall contain the same fields as the critical alarm handling schedule Contract Drawing with Contractor updated information and any other project-specific information required to implement the alarm handling function. A critical alarm handling schedule shall be submitted for each HVAC system.

f. Equipment Schedule: The equipment schedule shall contain the unique identifier, manufacturer, model number, part number and descriptive name for each control device, hardware and component provided under this specification. An equipment schedule shall be submitted for each HVAC system.

g. Occupancy Schedule: The occupancy schedule drawing shall contain the same fields as the occupancy schedule Contract Drawing with Contractor updated information. An occupancy schedule shall be submitted for each HVAC system.

h. Points Schedule: The Points Schedule drawing shall contain the same fields as the Points Schedule Contract Drawing with Contractor updated information. A Points Schedule shall be submitted for each HVAC system.

j. Riser diagram of building control network: The Riser Diagram of the Building Control Network shall show all network cabling, DDC Hardware, and Network Hardware including:

(1) All DDC Hardware with room number and location within room.

(2) DDC Hardware unique identifiers and common descriptive names.

(3) All Network hardware with room number and location within room.

(4) Network hardware unique identifiers.

(5) All cabling.

(6) Room number and location within room of all cabling termination points.

(7) Room number and location within room of all network interface jacks.

k. A single riser diagram shall be submitted for each building.

l. Control System Schematics: The control system schematics shall be in the same form as the control system schematic Contract Drawing with Contractor updated information. A control system schematic shall be submitted for each HVAC system.

m. Sequences of Operation including Control Logic Diagrams: The HVAC control system sequence of operation and control logic diagrams shall be in the same format as the Contract Drawings and shall refer to the devices by their unique identifiers. No operational deviations from specified sequences will be permitted without prior written approval of

the Government. Sequences of operation and control logic diagrams shall be submitted for each HVAC control system.

n. Controller, Motor Starter and Relay Wiring Diagram: The controller wiring diagrams shall be functional wiring diagrams which show the interconnection of conductors and cables to each controller and to the identified terminals of input and output devices, starters and package equipment. The wiring diagrams shall show necessary jumpers and ground connections. The wiring diagrams shall show the labels of all conductors. Sources of power required for control systems and for packaged equipment control systems shall be identified back to the panel board circuit breaker number, controller enclosures, magnetic starter, or packaged equipment control circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown. Wiring diagrams shall be submitted for each HVAC control system.

1.5.6 Draft As-Built Drawings

Update the Contractor Design Drawings with all as-built data and submit as specified.

1.5.7 Final As-Built Drawings

Update the Draft As-Built Drawings with all final as-built data and submit as specified.

1.6 DELIVERY, STORAGE, AND HANDLING

Store products with protection from the weather, humidity, and temperature variations, dirt and dust, and other contaminants, within the storage condition limits published by the equipment manufacturer.

1.7 PROJECT/SITE CONDITIONS

All products shall be rated for continuous operation under the following conditions:

a. Pressure: Pressure conditions normally encountered in the installed location.

b. Vibration: Vibration conditions normally encountered in the installed location.

c. Temperature:

(1) Products installed indoors: Ambient temperatures in the range of 32 to 112 degrees F and temperature conditions outside this range normally encountered at the installed location.

(2) Products installed outdoors or in unconditioned indoor spaces: Ambient temperatures in the range of -65 to plus 100 degrees F and temperature conditions outside this range normally encountered at the installed location.

d. Humidity: 10 to 95 percent relative humidity, noncondensing and humidity conditions outside this range normally encountered at the installed location.

1.8 PROJECT SEQUENCING

TABLE I. PROJECT SEQUENCING lists the submittals as specified in paragraph SUBMITTALS (denoted by an 'S' in the 'TYPE' column) and activities as specified in PART 3: EXECUTION (denoted by an 'E' in the 'TYPE' column).

a. Sequencing for submittals: The sequencing specified for submittals is the deadline by which the submittal shall be initially submitted to the Government. Following submission there will be a Government review period as specified in Section 01 33 00 SUBMITTAL PROCEDURES. If the submittal is not accepted by the Government, revise the submittal and resubmit it to the Government within 14 days of notification that the submittal has been rejected. Upon resubmittal there shall be an additional Government review period. If the submittal is not accepted the process repeats until the submittal is accepted by the Government.

b. Sequencing for Activities: The sequencing specified for activities indicates the earliest the activity may begin.

c. Abbreviations: In TABLE I the abbreviation AAO is used for 'after approval of' and 'ACO' is used for 'after completion of'.

TABLE I. PROJECT SEQUENCING

ITEM #	TYPE	DESCRIPTION	SEQUENCING (START OF ACTIVITY or DEADLINE FOR SUBMITTAL)
1	S	Existing Conditions Report	
2	S	DDC Contractor Design Drawings	
3	S	Manufacturer's Catalog Data	
4	S	Network Bandwidth Usage Calculations	
5	S	Pre-construction QC Checklist	
6	E	Install Building Control System	AAO #1 thru #5
7	E	Start-Up and Start-Up Testing	ACO #6
8	S	Post-Construction QC Checklist	14 days ACO #7
9	S	Programming Software	14 days ACO #7
10	S	XIF Files	14 days ACO #7
11	S	LNS Plug-ins	14 days ACO #7
12	S	Start-Up and Start-Up Testing Report	14 days ACO #7
13	S	Draft As-Built Drawings	21 days ACO #7
14	S	PVT Procedures (before schedule)	14 days start of #15 and AAO #12
15	E	PVT	AAO #13 and #14
16	S	PVT Report	14 days ACO #15
17	S	GPPC Application Programs	7 days AAO #16
18	S	LNS Database	7 days AAO #16
19	S	Final As-Built Drawings	21 days AAO #16
20	S	O&M Instructions	AAO #19
21	S	Training Documentation	AAO #12 and 7 days before scheduled start of #22
22	E	Training	AAO #20 and #21
23	S	Closeout QC Checklist	ACO #22

1.9 SCHEDULING

1.9.1 System Mode

ERVs shall operate in Occupied or Unoccupied modes as specified. Other terminal equipment shall operate in Occupied or Unoccupied modes as specified. Sources of heating/cooling for hydronic loads do not require scheduling; these systems receive requests for heating/cooling from their loads.

1.9.2 System Scheduler Requirements

The System Scheduler functionality shall reside in either a piece of DDC Hardware dedicated to this functionality or in the DDC Hardware controlling the system ERV. A single piece of DDC Hardware may contain multiple System Schedulers. A unique System Scheduler shall be provided for: each ERV and each stand-alone Terminal Unit or group of stand-alone Terminal Units acting according to a common schedule. Each System Scheduler shall provide the following functionality:

a. Scheduled Occupancy Input: Accept network variable of type SNVT_occupancy (as defined in the LonMark SNVT List). Input shall support the following possible values: OC_STANDBY, OC_OCCUPIED and OC_UNOCCUPIED.

b. Occupancy Override Input: Accept network variable of type SNVT_occupancy (as defined in the LonMark SNVT List). Input shall support the following possible values: OC_STANDBY, OC_OCCUPIED, OC_UNOCCUPIED, and OC_NUL.

c. Default Schedule: Incorporate a 24-hour 7-day default schedule as shown on the drawings which may be activated and deactivated by the System Scheduler Logic.

1.9.3 Stand-Alone Terminal Unit Scheduling

The Terminal Unit Occupancy Output shall be bound from the System Scheduler to the DDC Hardware that executes the Occupancy Mode Determination part of the Terminal Unit Sequence of Operation.

1.10 MAINTENANCE

1.10.1 General

The HVAC control System Operation and Maintenance (O&m) Instructions shall include:

a. "Manufacturer Data Package 3" as specified in Section 01 78 00 CLOSEOUT SUMITTALS for each piece of control equipment.

b. HVAC control system sequences of operation formatted as specified.

c. Procedures for the HVAC system start-up, operation and shut-down including the manufacturer's supplied procedures for each piece of equipment, and procedures for the overall HVAC system.

d. As-built HVAC control system detail drawings formatted as specified.

e. Printouts of configuration settings for all devices.

f. Routine maintenance checklist. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all installed devices, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.

g. Qualified service organization list.

h. Start-Up and Start-Up Testing Report.

i. Performance Verification Test (PVT) Procedures and Report.

1.10.2 Maintenance Service

Provide services, materials and equipment as necessary to maintain the entire system in an operational state as specified for a period of one year after successful completion and acceptance of the Performance Verification Test. Minimize impacts on facility operations.

1.10.2.1 Description of Work

The adjustment and repair of the system shall include the manufacturer's required sensor and actuator (including transducer) calibration, span and range adjustment.

1.10.2.2 Personnel

Use qualified service personnel to accomplish work promptly and satisfactorily. Advise the Government in writing of the name of the designated service representative, and of any changes in personnel.

1.10.2.3 Scheduled Inspections

Perform two inspections at six-month intervals, and all work required shall be performed. Inspections shall be scheduled in June and December. These inspections shall include:

a. Visual checks and operational tests of equipment.

b. Fan checks and filter changes for control system equipment.

c. Clean control system equipment including interior and exterior surfaces.

d. Check and calibrate each field device. Check and calibrate 50 percent of the total analog inputs and outputs during the first inspection. Check and calibrate the remaining 50 percent of the analog inputs and outputs during the second major inspection. Certify analog test instrumentation accuracy to be twice the specified accuracy of the device being calibrated. Randomly check at least 25 percent of all digital inputs and outputs for proper operation during the first inspection. Randomly check at least 25 percent of the remaining digital inputs and outputs during the second inspection.

e. Run system software diagnostics and correct diagnosed problems.

f. Resolve any previous outstanding problems.

1.10.2.4 Scheduled Work

This work shall be performed during regular working hours, Monday through Friday, excluding Federal holidays.

1.10.2.5 Emergency Service

The Government will initiate service calls when the system is not functioning properly. Qualified personnel shall be available to provide service to the system. A telephone number where the service supervisor can be reached at all times shall be provided. Service personnel shall be at the site within 24 hours after receiving a request for service. The control system shall be restored to proper operating condition as required in accordance with Section 01 78 00 CLOSEOUT SUBMITTALS.

1.10.2.6 Operation

Scheduled adjustments and repairs shall include verification of the control system operation as demonstrated by the applicable tests of the performance verification test.

1.10.2.7 Records and Logs

Keep dated records and logs of each task, with cumulative records for each major component, and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain initial analog span and zero calibration values and digital points. Complete logs shall be kept and shall be available for inspection onsite, demonstrating that planned and systematic adjustments and repairs have been accomplished for the control system.

1.10.2.8 Work Requests

Record each service call request as received and include its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion. Submit a record of the work performed within 5 days after work is accomplished.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Provide materials and equipment which are standard products of a manufacturer regularly engaged in the manufacturing of these and similar products and that have been in a satisfactory commercial or industrial use for two years prior to use on this project. The two year use shall include applications of equipment and materials under similar circumstances and of similar size. Units of the same type of equipment shall be products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. DDC Hardware not meeting the two-year field service requirement will be acceptable provided it has been successfully used in a minimum of two previous projects. The equipment items shall be supported by a service organization. Items of the same type and purpose shall be

identical, including equipment, assemblies, parts and components. Submit manufacturer's catalog data sheets documenting compliance with product specifications as specified for each product installed under this specification.

2.2 ENCLOSURES AND WEATHERSHIELDS

2.2.1 Enclosures

Enclosures shall meet the following minimum requirements:

a. Outdoors: Enclosures located outdoors shall meet NEMA 250 requirements.

b. Mechanical and Electrical Rooms: Enclosures located in mechanical or electrical rooms shall meet NEMA 250 Type 2 requirements.

c. Other Locations: Enclosures in other locations including but not limited to occupied spaces, above ceilings, and plenum returns shall meet NEMA 250 Type 1 requirements.

d. Enclosures supplied as an integral (pre-packaged) part of another product are acceptable.

2.2.2 Weathershields

Weathershields for sensors located outdoors shall prevent the sun from directly striking the sensor. Provide the weathershield with adequate ventilation so that the sensing element responds to the ambient conditions of the surroundings. The weathershield shall prevent rain from directly striking or dripping onto the sensor. Install weathershields near outside air intake ducts such that normal outside air flow does not cause rainwater to strike the sensor. Provide weathershields constructed of galvanized steel painted white, unpainted aluminum, aluminum painted white, or white PVC.

2.3 TUBING

2.3.1 Copper

Copper tubing shall conform to ASTM B 88 and ASTM B 88M

2.3.2 Stainless Steel

Stainless steel tubing shall conform to ASTM A 269

2.3.3 Plastic

Plastic tubing shall have the burning characteristics of linear low-density polyethylene tubing, shall be self-extinguishing when tested in accordance with ASTM D 635, shall have UL 94 V-2 flammability classification or better, and shall withstand stress cracking when tested in accordance with ASTM D 1693. Plastic-tubing bundles shall be provided with Mylar barrier and flame-retardant polyethylene jacket.

2.4 NETWORK HARDWARE

2.4.1 CEA-709.1B Network Hardware

2.4.1.1 CEA-709.1B Routers

CEA-709.1B Routers (including routers configured as repeaters) shall meet the requirements of CEA-709.1B and shall provide connection between two or more CEA-709.3 TP/FT-10 channels.

2.4.1.2 CEA-709.3 Repeaters

CEA-709.3 Repeaters shall be physical layer repeaters in accordance with CEA-709.3.

2.4.2 Gateways

Gateways shall perform bi-directional protocol translation from one non-CEA-709.1B protocol to CEA-709.1B. Gateways shall incorporate exactly two network connections: one shall be for connection to a TP/FT-10 network in accordance with CEA-709.3 and the second shall be as required to communicate with the non-CEA-709.1B network.

2.5 WIRE AND CABLE

All wire and cable shall meet the requirements of NFPA 70 and NFPA 90A in addition to the requirements of this specification.

2.5.1 Terminal Blocks

Terminal blocks which are not integral to other equipment shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

2.5.2 Control Wiring for Binary Signals

Control wiring for binary signals shall be 18 AWG copper and shall be rated for 300-volt service.

2.5.3 Wiring for 120-Volt Circuits

Wiring for 120-volt circuits shall be 18 AWG or thicker stranded copper and shall be rated for 600-volt service.

2.5.4 Control Wiring for Analog Signals

Control Wiring for Analog Signals shall be 18 AWG, copper, single- or multiple-twisted, minimum 2 inch lay of twist, 100 percent shielded pairs, and shall have a 300-volt insulation. Each pair shall have a 20 AWG tinned-copper drain wire and individual overall pair insulation. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape, overall 20 AWG tinned-copper cable drain wire, and overall cable insulation.

2.5.5 Transformers

Transformers shall be UL 1585 approved. Transformers shall be sized so

that the connected load is no greater than 80 percent of the transformer rated capacity.

2.6 AUTOMATIC CONTROL VALVES

Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Valve bodies shall meet ASME B16.34 or ASME B16.15 pressure and temperature class ratings based on the design operating temperature and 150 percent of the system design operating pressure. Unless otherwise specified or shown, valve leakage shall meet FCI 70-2 Class IV leakage rating (0.01 percent of valve Kv). Unless otherwise specified or shown, valves shall have globe-style bodies. Unless otherwise specified:

a. bodies for valves 1.5 inches and smaller shall be brass or bronze, with threaded or union ends

b. bodies for 2 inch valves shall have threaded ends

c. bodies for valves 2 to 3 inches shall be of brass, bronze or iron.

d. bodies for valves 2.5 inches and larger shall be provided with flanged-end connections.

e. for modulating applications, valve Kv (Cv) shall be within 100 to 125 percent of the Kv (Cv) shown.

f. for two position applications (where the two positions are full open and full closed) the Kv (Cv) shall be the largest available for the valve size.

g. valve and actuator combination shall be normally open or normally closed as shown.

2.6.1 Ball Valves

Balls shall be stainless steel or nickel plated brass. Valves shall have blow-out proof stems. In steam and high temperature hot water applications, the valve-to-actuator linkage shall provide a thermal break.

2.6.2 Two-Way

Two-way modulating valves used for liquids shall have an equal-percentage characteristic. Two-way modulating valves used for steam shall have a linear characteristic.

2.6.3 Three-Way

Three-way modulating valves shall provide equal percentage flow control with constant total flow throughout full plug travel.

2.6.4 Duct-Coil and Terminal-Unit-Coil

Control valves with either flare-type or solder-type ends shall be provided for duct or terminal-unit coils. Flare nuts shall be provided for each flare-type end valve.

2.6.5 Glycol

Valve internal trim shall be Type 316 stainless steel. Valves 4 inches and larger shall be butterfly valves.

2.6.6 Valves for Steam Service

Bodies for valves 4 inches and larger shall be iron or carbon steel. Internal valve trim shall be Type 316 stainless steel. If the specified Kv (Cv) is not available the valve manufacturer's next largest size shall be used.

2.7 DAMPERS

2.7.1 Damper Assembly

A single damper section shall have blades no longer than 48 inch and shall be no higher than 72 inch. Maximum damper blade width shall be 8 inch. Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. Blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section shall not be located directly in the air stream. Damper axles shall be 1/2 inch minimum, plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed 0.04 inches water gauge at 1,000 ft/min in the wide-open position. Frames shall not be less than 2 inch in width. Dampers shall be tested in accordance with AMCA 500-D.

2.7.2 Operating Linkages

Operating links external to dampers, such as crank arms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers, shall withstand a load equal to at least 300 percent of the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crank arms shall control the open and closed positions of dampers.

2.7.3 Damper Types

2.7.3.1 Flow Control Dampers

Outside air, return air, relief air, exhaust, face and bypass dampers shall be provided where shown and shall be parallel-blade or opposed blade type as shown on the Damper Schedule. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Unless otherwise shown, dampers shall be AMCA 500-D Class 2 and shall not leak in excess of 20 cfm per square foot at 4 inches water gauge static pressure when closed. Outside air damper seals shall be suitable for an operating temperature range of -40 to plus 167 degrees F. Dampers shall be rated at not less than 2000 ft/min air velocity.

2.7.3.2 Mechanical Rooms and Other Utility Space Ventilation Dampers

Utility space ventilation dampers shall be as shown. Unless otherwise shown, dampers shall be AMCA 500-D class 4 and shall not leak in excess of

80 cfm per square foot at 4 inches water gauge static pressure when closed. Dampers shall be rated at not less than 1500 ft/min air velocity.

2.8 SENSORS AND INSTRUMENTATION

Unless otherwise specified, sensors and instrumentation shall incorporate an integral transmitter or be provided with a transmitter co-located with the sensor. Sensors and instrumentation, including their transmitters, shall meet the specified accuracy and drift requirements at the input of the connected DDC Hardware's analog-to-digital conversion. Sensors and instrumentation, including their transmitters, shall meet or exceed the specified range.

2.8.1 Transmitters

The transmitter shall match the characteristics of the sensor. Transmitters providing analog values shall produce a linear 4-20 mAdc, 0-10 Vdc or SNVT output corresponding to the required operating range and shall have zero and span adjustment. Transmitters providing binary values shall have dry contacts or SNVT output. Transmitters with SNVT output are Application Specific Controllers (ASCs) and shall meet all ASC requirements. (note: ASCs are specified in paragraph DIRECT DIGITAL CONTROL (DDC) HARDWARE)

2.8.2 Temperature Sensors

2.8.2.1 Sensor Ranges and Accuracy

Temperature sensors may be provided without transmitters. Temperature sensors, including transmitter if used, shall have minimum operating ranges, minimum accuracy and maximum drift as specified below for the application:

a. Conditioned Space Temperature

(1) Operating Range: 50 to 86 degrees F.

(2) Accuracy: +/- 1 degree F over the operating range.

(3) Drift: Maximum 1 degree F per year.

b. Unconditioned Space Temperature

(1) Operating Range: 20 to 150 degrees F.

(2) Accuracy: +/- 1 degree F over the range of 30 to 131 degrees F and +/- 4 degrees F over the rest of the operating range.

(3) Drift: Maximum 1 degree F per year.

c. Duct Temperature

(1) Operating Range: 40 to 140 degrees F.

(2) Accuracy: +/- 2 degrees F.

(3) Drift: Maximum 2 degrees F per year.

d. Outside Air Temperature

(1) Operating Range: **AM#2...** -58 to 122 degrees F. **...AM#2**

(2) Accuracy:

(a) +/- 2 degrees F over the range of -30 to plus 130 degrees F.

(b) +/- 1 degreeF over the range of 30 to 100 degrees F.

(3) Drift: Maximum 1 degree F per year.

e. Heating Hot Water

(1) Operating Range: 70 to 250 degrees F.

(2) Accuracy: +/- 2 degrees F.

(3) Drift: Maximum 2 degrees F per year.

2.8.2.2 Point Temperature Sensors

Point Sensors shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper.

2.8.2.3 Averaging Temperature Sensors

Averaging sensors shall be a continuous element with a minimum length equal to 1 foot/square foot of duct cross-sectional area at the installed location. The sensing element shall have a bendable copper sheath.

2.8.2.4 Thermowells

Thermowells shall be Series 300 stainless steel with threaded brass plug and chain, 2 inch lagging neck and extension type well. Inside diameter and insertion length shall be as required for the application.

2.8.3 Differential Pressure Instrumentation

2.8.3.1 Differential Pressure Sensors

Differential Pressure Sensor range shall be as shown or as required for the application. Pressure sensor ranges shall not exceed the high end range shown on the Points Schedule by more than 50 percent. The over pressure rating shall be a minimum of 150 percent of the highest design pressure of either input to the sensor. The accuracy shall be +/- 2 percent of full scale.

2.8.4 Flow Sensors

2.8.4.1 Flow Switch

Flow switch shall have a repetitive accuracy of +/- 10 percent of actual flow setting. Switch actuation shall be adjustable over the operating flow range. The switch shall have Form C snap-action contacts, rated for the application. The flow switch shall have non flexible paddle with magnetically actuated contacts and be rated for service at a pressure greater than the installed conditions. Flow switch for use in sewage system shall be rated for use in corrosive environments encountered.

2.8.5 Electrical Instruments

Electrical Instruments shall have an input range as shown or sized for the application. Unless otherwise specified, AC instrumentation shall be suitable for 60 Hz operation.

2.8.5.1 Current Sensing Relays (CSRs)

Current sensing relays (CSRs) shall provide a normally-open contact with a voltage and amperage rating greater than its connected load. Current sensing relays shall be of split-core design. The CSR shall be rated for operation at 200 percent of the connected load. Voltage isolation shall be a minimum of 600 volts. The CSR shall auto-calibrate to the connected load.

2.8.6 Carbon Monoxide Analyzer

Carbon monoxide analyzer shall consist of an infrared light source and optical detector in a weather proof enclosure for wall mounting. Unit shall read parts per million (ppm) of carbon monoxide in the range of 0 to 100 ppm and the response time shall be less than 3 seconds to 90 percent value. Unit measurement range shall not exceed specified range by more that 50 percent. Repeatability shall be +/- 2 percent of full scale with an accuracy of +/- 10 percent of full scale.

2.9 INDICATING DEVICES

All indicating devices shall display readings in English (inch-pound) units.

2.9.1 Thermometers

Thermometers shall not contain mercury. Unless otherwise specified, thermometers shall have an accuracy of +/- 3 percent of scale range. Thermometers shall have a range suitable for the application with an upper end of the range not to exceed 150 percent of the design upper limit.

2.9.1.1 Piping System Thermometers

Piping system thermometers shall have brass, malleable iron or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 9 inch scale. Piping system thermometers shall have an accuracy of +/- 1 percent of scale range. Thermometers for piping systems shall have rigid stems with straight, angular, or inclined pattern. Thermometer stems shall have expansion heads as required to prevent breakage at extreme temperatures. On rigid-stem thermometers, the space between bulb and stem shall be filled with a heat-transfer medium.

2.9.1.2 Air-Duct Thermometers

Air-duct thermometers shall have perforated stem guards and 45-degree adjustable duct flanges with locking mechanism.

2.9.2 Pressure Gauges

Gauges shall be suitable for field or panel mounting as required, shall have black legend on white background, and shall have a pointer traveling through a 270-degree arc. Gauge range shall be suitable for the application with an upper end of the range not to exceed 150 percent of the

design upper limit. Accuracy shall be +/- 3 percent of scale range. Gauges shall meet requirements of ASME B40.100.

2.9.3 Low Differential Pressure Gauges

Gauges for low differential pressure measurements shall be a minimum of 3.5 inch (nominal) size with two sets of pressure taps, and shall have a diaphragm-actuated pointer, white dial with black figures, and pointer zero adjustment. Gauge range shall be suitable for the application with an upper end of the range not to exceed 150 percent of the design upper limit. Accuracy shall be plus or minus two percent of scale range.

2.10 OUTPUT DEVICES

Output Devices with SNVT input are ASCs and shall meet all ASC requirements in addition to the output device requirements. (Note: ASCs are specified in paragraph DIRECT DIGITAL CONTROL (DDC) HARDWARE.)

2.10.1 Actuators

Actuators shall be electric (electronic) . All actuators shall be normally open (NO), normally closed (NC) or fail-in-last-position (FILP) as shown. Normally open and normally closed actuators shall be of mechanical spring return type. Electric actuators shall have an electronic cut off or other means to provide burnout protection if stalled. Actuators shall have a visible position indicator. Electric actuators shall provide position feedback to the controller as shown. Actuators shall smoothly open or close the devices to which they are applied. Pneumatic actuators shall have a full stroke response time matching the connected Electric to Pneumatic Transducer (EP). Electric actuators shall have a full stroke response time in both directions of 90 seconds or less at rated load. Electric actuators shall be of the foot-mounted type with an oil-immersed gear train or the direct-coupled type. Where multiple electric actuators operate from a common signal, the actuators shall provide an output signal identical to its input signal to the additional devices.

2.10.1.1 Valve Actuators

Valve actuators shall provide shutoff pressures and torques as shown on the Valve Schedule.

2.10.1.2 Damper Actuators

Damper actuators shall provide the torque necessary in accordance with damper manufacturer's instructions to modulate the dampers smoothly over its full range of operation and torque shall be at least 6 inch-pounds/1 square foot of damper area for opposed blade dampers and 9 inch-pounds/1 square foot of damper area for parallel blade dampers.

2.10.2 Relays

Control relay contacts shall have utilization category and ratings selected for the application, with a minimum of two sets of contacts enclosed in a dust proof enclosure. Each set of contacts shall incorporate a normally open (NO), normally closed (NC) and common contact. Relays shall be rated for a minimum life of one million operations. Operating time shall be 20 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage.

2.11 USER INPUT DEVICES

User Input Devices, including potentiometers, switches and momentary contact push-buttons with SNVT output are Application Specific Controllers (ASCs) and shall meet all ASC requirements. (Note: ASCs are specified in paragraph DIRECT DIGITAL CONTROL (DDC) HARDWARE). Potentiometers shall be of the thumb wheel or sliding bar type. Momentary Contact Push-Buttons may include an adjustable timer for their output. User input devices shall be labeled for their function.

2.12 MULTIFUNCTION DEVICES

Multifunction devices are products which combine the functions of multiple sensor, user input or output devices into a single product. Unless otherwise specified, the multifunction device shall meet all requirements of each component device. Where the requirements for the component devices conflict, the multifunction device shall meet the most stringent of the requirements.

2.12.1 Current Sensing Relay Command Switch

The Current Sensing Relay portion shall meet all requirements of the Current Sensing Relay input device. The Command Switch portion shall meet all requirements of the Relay output device except that it shall have at least one normally-open (NO) contact.

2.12.2 Thermostats

Thermostats shall be multifunction devices incorporating a temperature sensor and a temperature indicating device. Thermostats shall not contain mercury (Hg). In addition, the thermostat shall have the following as specified and shown:

a. A User Input Device which shall adjust a temperature setpoint output.

b. A User Input Momentary Contact Button and an output indicating zone occupancy.

c. A three position User Input Switch labeled to indicate heating, cooling and off positions ('HEAT-COOL-OFF' switch) and providing corresponding outputs.

d. A two position User Input Switch labeled with 'AUTO' and 'ON' positions and providing corresponding outputs.

e. A multi-position User Input Switch with 'OFF' and at least two fan speed positions and providing corresponding outputs.

2.13 DIRECT DIGITAL CONTROL (DDC) HARDWARE

2.13.1 General Requirements

All DDC Hardware shall meet the following requirements:

a. It shall incorporate a "service pin" which, when pressed will cause the DDC Hardware to broadcast its 48-bit NodeID and its ProgramID over the network. The service pin shall be distinguishable and accessible.

b. It shall incorporate a light to indicate the device is receiving power.

c. It shall incorporate a TP/FT-10 transceiver in accordance with CEA-709.3 and connections for TP/FT-10 control network wiring. It shall not have connections to any other network media type.

d. It shall communicate on the network using only the CEA-709.1B protocol.

e. It shall be locally powered; link powered devices are not acceptable.

f. LonMark external interface files (XIF files), as defined in the LonMark XIF Guide, shall be submitted for each type of DDC Hardware.

g. Application programs and configuration settings shall be stored in a manner such that a loss of power does not result in a loss of the application program or configuration settings.

h. It shall have all functionality specified and required to support the application (Sequence of Operation or portion thereof) in which it is used, including but not limited to:

(1) It shall provide input and output SNVTs as specified and required to support the sequence and application in which it is used.

(2) It shall be configurable via standard or user-defined configuration parameters (SCPT or UCPT), SNVT network configuration inputs (*nci*), or hardware settings on the controller itself as specified and as required to support the sequence and application in which it is used.

i. It shall meet 47 CFR 15 requirements and have UL 916 or equivalent safety listing.

2.13.2 Hardware Input-Output (I/O) Functions

DDC Hardware incorporating hardware input-output (I/O) functions shall meet the following requirements:

a. Analog Inputs: DDC Hardware analog inputs (AIs) shall perform analog to digital (A-to-D) conversion with a minimum resolution of 8 bits plus sign or better as needed to meet the accuracy requirements specified in paragraph INPUT MEASUREMENT ACCURACY. Signal conditioning including transient rejection shall be provided for each analog input. Analog inputs shall be capable of being individually calibrated for zero and span. The AI shall incorporate common mode noise rejection of at least 50 dB from 0 to 100 Hz for differential inputs, and normal mode noise rejection of at least 20 dB at 60 Hz from a source impedance of 10,000 ohms.

b. Analog Outputs: DDC Hardware analog outputs (AOs) shall perform digital to analog (D-to-A) conversion with a minimum resolution of 8 bits plus sign, and output a signal with a range of 4-20 mAdc or 0-10 Vdc. Analog outputs shall be capable of being individually calibrated for zero and span.

c. Binary Inputs: DDC Hardware binary inputs (BIs) shall accept contact closures and shall ignore transients of less than 5 milli-second duration. Isolation and protection against an applied steady-state voltage up to 180 Vac peak shall be provided.

d. Binary Outputs: DDC Hardware binary outputs (BOs) shall provide relay contact closures or triac outputs for momentary and maintained operation of output devices.

(1) Relay Contact Closures: Closures shall have a minimum duration of 0.1 second. Relays shall provide at least 180V of isolation. Electromagnetic interference suppression shall be provided on all output lines to limit transients to non-damaging levels. Minimum contact rating shall be one ampere at 24 Vac.

(2) Triac outputs: Triac outputs shall provide at least 180 V of isolation.

e. Pulse Accumulator: DDC Hardware pulse accumulators shall have the same characteristics as the BI. In addition, a buffer shall be provided to totalize pulses. The pulse accumulator shall accept rates of at least 20 pulses per second. The totalized value shall be reset to zero upon operator's command.

2.13.3 Application Specific Controller (ASC)

Application Specific Controllers (ASCs) have a fixed factory-installed application program (i.e. ProgramID) with configurable settings. ASCs shall meet the following requirements in addition to the General DDC Hardware and DDC Hardware Input-Output (I/O) Function requirements:

a. ASCs shall be LonMark Certified.

b. Unless otherwise approved, all necessary Configuration Parameters and network configuration inputs (*ncis*) for the sequence and application in which the ASC is used shall be fully configurable through an LNS plug-in. This plug-in shall be submitted as specified for each type of ASC (manufacturer and model). (Note: configuration accomplished via hardware settings does not require configuration via plug-in)

c. Local Display Panel (LDP): The Local Display Panel shall be an Application Specific Controller (ASC) with a display and navigation buttons. It shall provide display and adjustment of SNVT inputs and SNVT outputs as shown.

2.13.4 General Purpose Programmable Controller (GPPC)

A General Purpose Programmable Controller (GPPC) is not installed with a fixed factory-installed application program. GPPCs shall meet the following requirements in addition to the general DDC Hardware requirements and Hardware Input-Output (I/O) Function:

a. The programmed GPPC shall conform to the LonMark Interoperability Guide.

b. All programming software required to program the GPPC shall be delivered to and licensed to the project site as specified.

c. Copies of the installed GPPC application programs as source code compatible with the supplied programming software shall be submitted as specified. The submitted GPPC application program shall be the complete application necessary for the GPPC to function as installed and be sufficient to allow replacement of the installed controller with a GPPC of the same type.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

3.2 EXISTING CONDITIONS SURVEY

Perform a field survey, including testing and inspection of the equipment to be controlled, and submit an Existing Conditions Report documenting the current status and its impact on the Contractor's ability to meet this specification. For those items considered nonfunctional, provide (with the report) specification sheets, or written functional requirements to support the findings and the estimated costs to correct the deficiencies. As part of the report, define the scheduled need date for connection to existing equipment.

3.3 CONTROL SYSTEM INSTALLATION

3.3.1 General Installation Requirements

3.3.1.1 HVAC Control System

The HVAC control system shall be completely installed, tested and ready for operation. Provide dielectric isolation where dissimilar metals are used for connection and support. Penetrations through and mounting holes in the building exterior shall be made watertight. The HVAC control system installation shall provide clearance for control system maintenance by maintaining access space required to calibrate, remove, repair, or replace control system devices. The control system installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

3.3.1.2 Device Mounting Criteria

Install all devices in accordance with manufacturer's recommendations and as specified and shown. Provide control devices, to be installed in piping and ductwork, with required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used except as specified. Install spare thermowells adjacent to each thermowell containing a sensor and as shown. Devices located outdoors shall have a weathershield.

3.3.1.3 Labels and Tags

Key labels and tags to the unique identifiers shown on the As-Built drawings. Label all enclosures and DDC hardware. All sensors and actuators in mechanical rooms shall be tagged. Tag airflow measurement

arrays to show flow rate range for signal output range, duct size, and pitot tube AFMA flow coefficient. Duct static pressure taps shall be tagged at the location of the pressure tap. Tags shall be plastic or metal and shall be mechanically attached directly to each device or attached by a metal chain or wire. Labels, outside of protective enclosures, shall be engraved plastic and mechanically attached to the enclosure or DDC Hardware. Labels inside protective enclosures may attached using adhesive, but shall not be hand written.

3.3.2 DDC Hardware

Install DDC hardware in an enclosure. Except for DDC hardware used to control Terminal Units, where multiple pieces of DDC hardware are used to execute one sequence, all DDC hardware executing that sequence shall be on a common local control bus and isolated from all other DDC hardware via an CEA-709.1B router or CEA-709.3 repeater.

3.3.3 Local Display Panel (LDP)

Local Display Panels shall be installed in the Mechainical room and shall provide SNVT inputs for display and outputs for adjusting SNVT values as shown on the Points Schedule.

3.3.4 Gateways

Gateways may be used for communication with non-CEA-709.1B control hardware subject to all of the following limitations:

a. Each gateway shall communicate with and perform protocol translation for non-CEA-709.1B control hardware controlling one and only one package unit.

b. Non-CEA-709.1B control hardware shall not be used for controlling built-up units.

c. Non-CEA-709.1B control hardware shall not perform system scheduling functions.

3.3.5 Network Interface Jack

A standard network interface jack shall be provided for each node on the control network. For terminal unit controllers with hardwired thermostats this network interface jack shall be located at the thermostat or within 10 ft of the controller. Locating the interface jack at the thermostat is preferred. For all other nodes the network interface jack shall be located within 10 ft of the node. If the network interface jack is other than a 1/8 inch phone jack, provide an interface cable with a standard 1/8 inch phone jack on one end and a connector suitable for mating with installed network interface jack on the other. No more than one type of interface cable shall be required to access all network interface jacks. Furnish two interface cable(s).

3.3.6 Room Instrument Mounting

Room instruments, including but not limited to wall mounted thermostats and sensors located in occupied spaces shall be mounted 60 inches above the floor unless otherwise shown. Unless otherwise shown on the Thermostat Schedule:

a. Thermostats for Fan Coil Units shall be unit mounted.

b. All other Thermostats shall be wall mounted.

3.3.7 Indication Devices Installed in Piping and Liquid Systems

Gauges in piping systems subject to pulsation shall have snubbers. Gauges for steam service shall have pigtail fittings with cock. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

3.3.8 Duct Smoke Detectors

Duct smoke detectors will be provided in supply and return air ducts in accordance with Section 28 31 64.00 10 FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. Connect the DDC System to the auxiliary contacts provided on the Smoke Detector as required for system safeties and to provide alarms to the DDC system.

3.3.9 Temperature Limit Switch

A temperature limit switch (freezestat) shall be provided to sense the temperature at the location shown. A sufficient number of temperature limit switches (freezestats) shall be installed to provide complete coverage of the duct section. Manual reset limit switches shall be installed in approved, accessible locations where they can be reset easily. The temperature limit switch (freezestat) sensing element shall be installed in a serpentine pattern and in accordance with the manufacturer's installation instructions.

3.3.10 Averaging Temperature Sensing Elements

Sensing elements shall be installed in a serpentine pattern located as shown.

3.3.11 Dampers

3.3.11.1 Damper Actuators

Actuators shall not be mounted in the air stream. Multiple actuators shall not be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

3.3.11.2 Damper Installation

Dampers shall be installed straight and true, level in all planes, and square in all dimensions. Dampers shall move freely without undue stress due to twisting, racking (parallelogramming), bowing, or other installation error. Blades shall close completely and leakage shall not exceed that specified at the rated static pressure. Structural support shall be used for multi-section dampers. Acceptable methods include but are not limited to U-channel, angle iron, corner angles and bolts, bent galvanized steel stiffeners, sleeve attachments, braces, and building structure. Where multi-section dampers are installed in ducts or sleeves, they shall not sag due to lack of support. Jackshafts shall not be used to link more than three damper sections. Blade to blade linkages shall not be used. Outside and return air dampers shall be installed such that their blades direct their respective air streams towards each other to provide for maximum

mixing of air streams.

3.3.12 Valves

3.3.12.1 Ball Valves

Two-position (open/closed) ball valves may only be used on chilled water, condenser water, hot water, or steam applications. Modulating ball valves may only be used for chilled water and condenser water applications (modulating ball valves shall not be used on steam or hot water applications). In modulating applications a characterizing equal-percentage disc shall be used.

3.3.13 Local Gauges for Actuators

Pneumatic actuators shall have an accessible and visible pressure gauge installed in the tubing lines at the actuator as shown.

3.3.14 Wire and Cable

Wire and Cable shall be installed without splices between control devices and in accordance with NFPA 70 and NFPA 90A. Instrumentation grounding shall be installed in accordance with the device manufacturer's instructions and as necessary to prevent ground loops, noise, and surges from adversely affecting operation of the system. Ground rods installed by the Contractor shall be tested as specified in IEEE Std 142. Cables and conductor wires shall be tagged at both ends, with the identifier shown on the shop drawings. Electrical work shall be as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and as shown. Wiring external to enclosures shall be run as follows:

a. Wiring other than low-voltage control and low-voltage network wiring shall be installed in raceways.

b. Low-voltage control and low-voltage network wiring not in suspended ceilings over occupied spaces shall be installed in raceways, except that nonmetallic-sheathed cables or metallic-armored cables may be installed as permitted by NFPA 70.

c. Low-voltage control and low-voltage network wiring in suspended ceilings over occupied spaces shall be installed in raceways, except:

(1) nonmetallic-sheathed cables or metallic-armored cables may be installed as permitted by NFPA 70.

(2) plenum rated cable in suspended ceilings over occupied spaces may be run without raceways.

3.3.15 Copper Tubing

Copper tubing shall be hard-drawn in exposed areas and either hard-drawn or annealed in concealed areas. Only tool-made bends shall be used. Fittings for copper tubing shall be brass or copper solder joint type except at connections to apparatus, where fittings shall be brass compression type.

3.3.16 Plastic Tubing

Plastic tubing shall be run within covered raceways or conduit except when otherwise specified. Plastic tubing shall not be used for applications

where the tubing could be subjected to a temperature exceeding 130 degrees F. Fittings for plastic tubing shall be for instrument service and shall be brass or acetal resin of the compression or barbed push-on type. Except in walls and exposed locations, plastic multitube instrument tubing bundle without conduit or raceway protection may be used where a number of air lines run to the same points, provided the multitube bundle is enclosed in a protective sheath, is run parallel to the building lines and is adequately supported as specified.

3.4 HVAC SYSTEMS OPERATION
SEQUENCES OF OPERATION ARE LOCATED ON DRAWINGS

3.4.1 Alarm Handling

Install and configure DDC Hardware to provide alarm handling functionality for critical alarms as specified and shown, either in a piece of DDC Hardware dedicated to this function or in DDC Hardware performing other functions. The DDC Hardware providing alarm handling functionality shall provide the following capabilities as required:

a. Dial to a pager: The node shall be able to dial a paging service and leave a numeric message.

d. Provide network access: The node shall be capable of receiving a connection via the modem to allow a remote computer access to the control network.

3.5 CONTROLLER TUNING

Tune each controller in a manner consistent with that described in the ASHRAE FUN IP. Tuning shall consist of adjustment of the proportional, integral, and where applicable, the derivative (PID) settings to provide stable closed-loop control. Each loop shall be tuned while the system or plant is operating at a high gain (worst case) condition, where high gain can generally be defined as a low-flow or low-load condition. Upon final adjustment of the PID settings, in response to a change in controller setpoint, the controlled variable shall settle out at the new setpoint with no more than two (2) oscillations above and below setpoint. Upon settling out at the new setpoint the controller output shall be steady. With the exception of naturally slow processes such as zone temperature control, the controller shall settle out at the new setpoint within five (5) minutes. Return the controller to its original setpoint and shall record and submit the final PID configuration settings with the O&M Instructions and on the associated Points Schedule.

3.6 START-UP AND START-UP TEST

Perform the following startup tests for each control system to ensure that the described control system components are installed and functioning in accordance with this specification.

a. General: Adjust, calibrate, measure, program, configure, set the time schedules, set alarms, and otherwise perform all necessary actions to ensure that the systems function as specified and shown in the sequence of operation and other contract documents.

b. Systems Check: An item-by-item check shall be performed for each HVAC system;

(1) Step 1 - System Inspection: With the system shut down, it shall be verified that power and main air are available where required and that all output devices are in their failsafe and normal positions. Each local display panel and each M&C Client shall be inspected to verify that all displays indicate shutdown conditions.

(2) Step 2 - Calibration Accuracy Check: A two-point accuracy check of the calibration of each HVAC control system sensing element and transmitter shall be performed by comparing the SNVT output from the DDC Hardware the sensor is connected to the actual value of the variable measured at the sensing element. Digital indicating test instruments shall be used, such as digital thermometers, motor-driven psychrometers, and tachometers. The test instruments shall be at least twice as accurate as the specified sensor accuracy. The calibration of the test instruments shall be traceable to National Institute Of Standards And Technology standards. The first check point shall be with the HVAC system in the shutdown condition, and the second check point shall be with the HVAC system in an operational condition. Calibration checks shall verify that the sensing element-to-DDC system readout accuracies at two points are within the specified product accuracy tolerances. If not, the device shall be recalibrated or replaced and the calibration check repeated.

(3) Step 3 - Actuator Range Check: With the system running, a signal shall be applied to each actuator through the DDC Hardware controller. Proper operation of the actuators and positioners for all actuated devices shall be verified and the signal levels shall be recorded for the extreme positions of each device. The signal shall be varied from live zero to full range, and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. Where applicable, it shall be verified that all sequenced actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other.

c. Weather Dependent Test: Weather dependent test procedures that cannot be performed by simulation shall be performed in the appropriate climatic season. When simulation is used, the actual results shall be verified in the appropriate season.

d. Test Report: Upon completion of the Start-Up Test, prepare and submit a Start-Up and Start-Up Testing Report documenting the results of the tests performed and certifying that the system is installed and functioning in accordance with this specification, and is ready for the Performance Verification Test (PVT).

3.7 TRAINING

Conduct a training course for 6 operating staff members designated by the Government in the maintenance and operation of the system, including specified hardware and software. The training period, for a total of 16 hours of normal working time, shall be conducted within 30 days after successful completion of the performance verification test. The training course shall be conducted at the project site and the Government reserves the right to videotape the training sessions for later use. Provide audiovisual equipment and 3 sets of all other training materials and

supplies. A training day is defined as 8 hours of classroom instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility.

3.7.1 Training Documentation

Prepare training documentation consisting of:

a. Course Attendee List: A List of course attendees which shall be developed in coordination with and signed by the Controls,HVAC,Electrical shop supervisor.

b. Training Manuals: Training manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson. Where the Contractor presents portions of the course material by audiovisuals, copies of those audiovisuals shall be delivered to the Government as a part of the printed training manuals. Training manuals shall be delivered for each trainee with two additional copies delivered for archival at the project site.

3.7.2 Training Course Content

For guidance in planning the required instruction, assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the Operating and Maintenance Instructions, the layout and location of each controller enclosure, the layout of one of each type of unitary equipment and the locations of each, the location of each control device external to the panels, the location of the compressed air station, preventive maintenance, troubleshooting, diagnostics, calibration, adjustment, commissioning, tuning, repair procedures, use of LNS Plug-ins, and use of the GPPC Programming software. Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. The results of the performance verification test and the Start-Up and Start-Up Testing Report shall be presented as benchmarks of HVAC control system performance by which to measure operation and maintenance effectiveness.

3.8 PERFORMANCE VERIFICATION TEST (PVT)

3.8.1 PVT Procedures

The performance verification test procedures shall explain, step-by-step, the actions and expected results that will demonstrate that the control system performs in accordance with the sequences of operation, and other contract documents. The PVT shall include a one-point accuracy check of each sensor. The PVT shall include inlet and outlet air temperature measurements for all AHU-dependent terminal units. The PVT Procedure shall describe a methodology to measure and trend the network bandwidth usage on the network backbone and compare it to the Bandwidth Usage Calculation submittal. A control system performance verification test equipment list shall be included that lists the equipment to be used during performance verification testing. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

3.8.2 PVT Execution

Demonstrate compliance of the control system with the contract documents.

Using test plans and procedures approved by the Government, demonstrate all physical and functional requirements of the project. The performance verification test shall show, step-by-step, the actions and results demonstrating that the control systems perform in accordance with the sequences of operation. The performance verification test shall measure and trend the Network Bandwidth Usage and compare it to the Bandwidth Usage Calculation submittal. The performance verification test shall not be started until after receipt of written permission by the Government, based on Government approval of the Start-Up and Start-Up Testing Report and completion of balancing. The tests shall not be conducted during scheduled seasonal off periods of base heating and cooling systems.

3.8.3 PVT Report

Prepare a PVT report documenting all tests performed during the PVT and their results. The PVT report shall include all tests in the PVT Procedures and any other testing performed during the PVT. Failures and repairs shall be documented with test results.

3.9 APPENDIX A

APPENDIX A

QC CHECKLIST

This checklist is not all-inclusive of the requirements of this specification and should not be interpreted as such.

This checklist is for (check one:)

Pre-Construction QC Checklist Submittal (Items 1-5) |____|

Post-Construction QC Checklist Submittal (Items 1-12) |____|

Close-out QC Checklist Submittal (Items 1-19) |____|

Initial each item in the space provided (|____|) verifying that requirement has been met.

Items verified for Pre-Construction, Post-Construction and Closeout QC Checklists Submittal:

1 Network bandwidth calculations have been performed, and the backbone type (Ethernet or TP/FT-10) has been determined based on these calculations. |____|

2 All DDC Hardware (nodes) are numbered on Control System Schematic Drawings. |____|

3 Signal lines on Control System Schematic are labeled with the signal type. |____|

4 Local Display Panel (LDP) Locations are shown on Control System Schematic drawings. |____|

5 Points Schedule drawings have been sub-divided by device (DDC Hardware), including DDC Hardware node numbers. |____|

Items verified for Post-Construction and Closeout QC Checklist Submittal:

6 All DDC Hardware is installed on a TP/FT-10 local control bus. |____|

7 All Application Specific Controllers (ASCs) are LonMark certified. |____|

8 Communication between DDC Hardware is only via CEA-709.1B using SNVTs. Other protocols and network variables other than SNVTs have not been used. |____|

9 Explicit messaging has not been used. |____|

10 System Scheduler functionality has been installed for all HVAC systems and default schedules have been configured at each System Scheduler. |____|

11 All sequences are performed as specified using DDC Hardware. |____|

12 Training schedule and course attendee list has been developed and coordinated with shops and submitted. |____|

QC CHECKLIST

Items verified for Closeout QC Checklists Submittal:

13	Final As-built Drawings, including the Points Schedule drawings accurately represent the final installed system.	|____|
14	LonWorks Network Services (LNS) Database is up-to-date and accurately represents the final installed system.	|____|
15	LNS Plug-ins have been submitted for all ASCs.	|____|
16	Programming software has been submitted for all General Purpose Programmable Controllers (GPPCs).	|____|
17	All software has been licensed to the Government	|____|
18	O&M Instructions have been completed and submitted.	|____|
19	Training course has been completed.	|____|

_____

(QC Representative Signature) (Date)

-- End of Section --