State of Utah

JON M. HUNTSMAN, JR.
Governor

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Lieutenant Governor

Department of Administrative Services
D'ARCY DIXON PIGNANELLI
Executive Director

Division of Facilities Construction and Management
F. KEITH STEPAN
Director

ADDENDUM

Date:	14 April 2006	
To:	Contractors	
From:	Matthias Mueller, Project Manager, DFCM	
Reference:	**Camp Williams** **144th Medical Company Readiness Center**	
DFCM Project #:	04043480	
Subject:	**Addendum No. 1**	
Pages:	Addendum	1 pages
	Revised Cost Proposal Form	5 pages
	Architectural Attachment	114 pages
	Total	120 pages

Note: This Addendum shall be included as part of the Contract Documents. Items in this Addendum apply to all drawings and specification sections whether referenced or not involving the portion of the work added, deleted, modified, or otherwise addressed in the Addendum. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

1.1 Schedule changes: Not applicable.

1.2 Delete the Cost Proposal Form included in the RFP and replace it with the attached Revised Cost Proposal Form.

End of Addendum

COST PROPOSAL FORM – REVISED
PER ADDEDUM NO. 1 DATED APRIL 14, 2006

NAME OF BIDDER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the "Request for Proposals" for the **144TH MEDICAL COMPANY READINESS CENTER – CAMP WILLIAMS – UTAH NATIONAL GUARD – RIVERTON, UTAH – DFCM PROJECT NO. 04043480** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda:_____

Reference pages 4 and 5 of this Revised Cost Proposal Form for further descriptions of the itemized cost breakdown.

Item	Description	Quantities by General Contractor	Cost
No. 1	Primary Readiness Center Building		$
No. 2	Site Preparation		$
No.3	Rigid Pavement		$
	a. Access Roads and Aprons		$
	b. Privately Owned Vehicle Parking		$
	c. Equipment Pads		$
		Item # 1 Subtotal	$
No. 5	Flexible Pavement		
	a. Access Roads and Aprons		$

No. 6	Sidewalks and Walkways.		$
No. 7	Security Lighting		$
No. 8	Utility Connections		
	a. Water		$
	b. Gas		$
	c. Sewer		$
	d. Electricity		$
	e. Telecom and Information Systems		$
		Item # 8 Subtotal	$
No. 9	Intrusion Detection System		
	a. Equipment		$
	b. Installation		$
		Item # 9 Subtotal	$
It is the Intent that ALL items for the work on the Drawings and described in the Specifications and Contract Documents are covered in the 9 bid items.			
For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:			
_____DOLLARS ($) (In case of discrepancy, written amount shall govern)			

I/We guarantee that the Work will be Substantially Complete by August 31, 2007 after receipt of the Notice to Proceed, should I/we be the successful proposer, and agree to pay liquidated damages in the amount of $700.00 per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract. The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable l00% Performance and Payment bonds are not delivered within time set forth.

Type of Organization:

_____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

_____

Respectfully submitted,

_____
Name of Proposer

ADDRESS:

_____

_____

_____
Authorized Signature

Description of Bid Items

It is the Intent that ALL items for the work on the Drawings and described in the Specifications and Contract Documents are covered in the 9 bid items.

The following definition of bid items is provided as a guide.

Item No. 1 - Primary Readiness Center Building. All work required in connection with construction of the Readiness Center, including excavation and backfilling for foundation walls and footings, finish shaping, and proof rolling subgrade material, and the gravel drainage fill under the floor slab. Utility work will include the installation of all systems within the building and extend to a point 5'-0" outside the building. Mechanical work will include the installation of all heating equipment, ducting, grilles and vent lines. Electrical work will include installation of all conduit and wiring, fixtures, receptacles and the emergency generator and associated.

Item No. 2 - Site Preparation. All work in connection with the preparation of the project site (within the limits of construction) to bring the subgrade elevations required for the construction of facilities to the elevations specified on the plans, including clearing, grubbing, demolishing and removing existing facilities (other that those removed by the National Guard), relocating existing utilities excavation and embankment earth work, drainage channels/systems, retaining walls, and final grading/compaction of site soils to subgrade levels. The bid will NOT include sodding, sprigging, mulching, plants, planting, nor the grading and preparation of the subgrade.

Item No. 3 - Landscaping. All work in connection with grading of unpaved areas. All work in connection with the furnishing and planting of new trees, shrubs, bushes and vines at locations specified, including fertilizing, mulching, staking, erection of temporary barriers to prevent damage, watering and general maintenance operations required to establish healthy growth after transplant. All work in connection with the furnishing and installing of all stone and gravel material.

Item No. 4 - Rigid Pavement. All work in connection with the furnishing and, placing, and compaction of base and surface courses of pavements for access roads, service and access aprons, pads and parking areas, including the concrete finish shaping and proof rolling of the prepared subgrade. This bid will NOT include the construction of prepared subgrade, drainage structures, nor other items designated as site preparation work. The costs for each type parking are and the pavement designated access road are to be indicated separately as listed.

Item No. 5 - Flexible pavement. All work in connection with the furnishing, placing, and compaction of base and surface courses of asphalt pavements for access roads, service and access aprons, pads and parking areas, including the finish shaping and proof rolling of the prepared subgrade. This bid will NOT include the construction of prepared subgrade, drainage structures, nor other items designated as site preparation work. The costs for each type of parking area and the pavement designated access road are to be indicated separately as listed.

Item No. 6 - Sidewalks and Walkways. All work in connection with the construction of concrete walks, including the finish shaping and proof rolling of the prepared subgrade. This bid will NOT include the construction of the prepared subgrade, drainage structures, nor other items designated as site preparation work.

Item No. 7 - Security Lighting. All work in connection with the furnishing and installation of the exterior pole mounted lighting system, including trenching and backfilling, cable, and accessory items to a point 5'-0" outside building line; complete and ready for service. This bid will NOT include work inside the building (5'-0" line) nor any building-mounted exterior lighting fixtures.

Item No. 8 - Utility Connections. All work in connection with furnishing and installing water, gas, and sanitary sewer service lines from the mains to a point 5'-0" outside the building line and trenching for direct burial electrical and telephone cables, including backfilling and compaction of earth after cables have been installed. This bid will NOT include the construction of any main distribution lines for water, gas, or sanitary sewer systems nor any work for the installation of any primary electric lines and transformers. The cost for each type of utility work is to be indicated separately as listed.

Item No. 9 - Intrusion detection systems (IDS) – All work in connection with the IDS, including coordination with authorities and installation of equipment at the remote notification site selected by the National Guard as required. The cost of purchase for all functioning commercial equipment (e.g. switches, alarms, sensors, and controls) is to be indicated separately from the cost for labor and miscellaneous material required for the complete installation of the IDS equipment bid is not required for Government-furnished J-SIDS equipment.

ajc architects

Bid Addendum #1

144th Readiness Center
Camp WG Williams

date:	April 14, 2006
time:	10:03 AM
DFCM Project #	04043480
ajc project #	0470

Architectural Items:

Specifications:

Item 1: See attached copy of Soils Report.

Item 2: Deleted.

Item: 3: Specification Section 10520 has been amended to exclude Portable Fire Extinguishers see attached revised specification section 10520.

Item 4: See revised Code Analysis indicating listing number for all rated walls on attached supplemental drawing AD1.1.

Item 5: Paint striping to be provided at Drive up / Drop-off area and "NO PARKING" signage will be painted on the asphalt paving as indicated on attached supplemental drawing AD1.2.

Item 6: The location of the access control gate at the training bay access road has been revised to place the gate closer to the road to prohibit unauthorized vehicles from parking on the access road as indicated on attached supplemental drawing AD1.3.

Item 7: (1) additional barrier added to area at main entrance to Readiness Center – see attached supplemental drawing AD1.4.

Item 8: The swing of the vault door has been revised to swing outward into the Unit Storage area as indicated on attached supplemental drawings AD1.5.

Item 9: Clarification: The vault door (Door #25) to be defined as a Class V vault door see attached supplemental drawing AD1.6.

703 east 1700 south
salt lake city, utah 84105
ph: 801.466.8818
fx: 801.466.4411
ajc@ajcarchitects.com

Item 10: Guardrail to be provided below STAIR 103 as indicated on attached supplemental drawings AD1.7 and AD1.8.

Item 11: General Contractors to provide minimum 6'-0" high chain link constructions at perimeter of job site.

Mechanical Items:

Item 1: Attached Specification Section 15955 – ELECTRONIC CONTROLS added to Project Manual.

Item 2: Attached Specification Section 15995 – COMMISSIONING OF HVAC added to Project Manual.

Item 3: Provide Proset trap seal primers as indicated on attached supplemental drawing labeled TYPICAL FLOOR DRAIN DETAIL.

Item 4: See attached list of approved manufacturers.

Electrical Items:
See attached electrical items.

End of Addenda

ajc architects

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February 22, 2005
Job No. 5-817-004993

AJC Architects
703 East 1700 South
Salt Lake City, Utah 84105

Attention: Ms. Jill Jones

Ladies and Gentlemen:

Re: Report
Detailed Geotechnical Study
Utah National Guard Readiness Center
Between Nevada and Wyoming Avenues and West of 2nd Street
Camp Williams, Utah

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our detailed geotechnical study of the proposed Utah National Guard Readiness Center site at Camp Williams, Utah. A preliminary study of the site was presented in our November 3, 2004[1] report. The general location of the site with respect to major topographic features and existing facilities, as of 1999, is presented on Figure 1, Vicinity Map. The location of the site with respect to existing buildings and roadways at Camp Williams is presented on Figure 2, Area Map. A detailed layout of the proposed addition, on a photographic base, is presented on Figure 3, Site Plan. The locations of the borings drilled in conjunction with this study and our study dated November 3, 2004 are also presented on Figure 3.

1.2 OBJECTIVES AND SCOPE

The objectives and scope of our study were planned in discussions between Ms. Jill Jones of AJC Architects, and Mr. Bill Gordon of AMEC Earth & Environmental, Inc. (AMEC).

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[1] "Report, Preliminary Geotechnical Study, Proposed 117th/120th Armory Between Nevada and Wyoming Avenues and West of 2nd Street Camp Williams, Utah, Project: 28024-04233480" Job No. 4-817-004947.

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In general, the objectives of this study were to:

1. Further define and evaluate subsurface soil and groundwater conditions.

2. Provide appropriate foundation, earthwork, and pavement recommendations to be utilized in the design and construction of the proposed facilities.

In accomplishing these objectives, our scope has included the following:

1. A field program consisting of the drilling, logging, and sampling of two borings to depths ranging from seven and one-half to nine and one-half feet.

2. A laboratory testing program.

3. An office program consisting of the correlation of available data, engineering analyses, and the preparation of this summary report.

1.3 AUTHORIZATION

Authorization was provided by returning a signed copy of our Proposal No. PL04-1221 revised dated December 22, 2004.

1.4 PROFESSIONAL STATEMENTS

Supporting data upon which our recommendations are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils encountered in the exploration borings, projected groundwater conditions, and the layout and design data discussed in Section 2., Proposed Construction, of this report and our preliminary report dated November 3, 2004. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, AMEC must be informed so that our recommendations can be reviewed and amended, if necessary.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices at this time.

2. PROPOSED CONSTRUCTION

A one to two-level slab-on-grade structure is to be constructed. The structure will be of reinforced CMU and light steel-frame construction with structural loads being transmitted down to the footings through columns and bearing walls. Maximum column and wall loads are projected to be 40 to 60 kips and 3 to 4 kips per lineal foot, respectively.

Site development will require removal of existing structures and portions of the asphalt pavements and a minimal amount of earthwork generally with cuts and fills of one to one and two feet.

New pavements in the area will be for parking. Traffic is projected to consist of a light volume of automobiles and light trucks, occasional medium-weight trucks, but no heavy-weight trucks.

3. SITE INVESTIGATIONS

3.1 FIELD PROGRAM

In order to further define and evaluate the subsurface soil and groundwater conditions across the site, two borings were explored to depths ranging from seven and one-half to nine and one-half feet with a truck-mounted drill rig equipped with hollow-stem augers. The depth of the borings was limited due to cemented soils encountered at depths ranging from seven and one-half to nine and one-half feet. Locations of the borings drilled in conjunction with this study and our November 3, 2004 report are presented on Figure 3.

The field portion of our study was under the direct control and continual supervision of an experienced member of our geotechnical staff. During the course of the drilling operations, a continuous log of the subsurface conditions encountered was maintained. In addition, relatively undisturbed and small disturbed bulk samples of the typical soils encountered were obtained for subsequent laboratory testing and examination. The soils were classified in the field based upon visual and textural examination. These classifications have been supplemented by subsequent inspection and testing in our laboratory. Detailed graphical representation of the subsurface conditions encountered is presented on Figures 4A and 4B, Log of Borings (This Study) and Figures 5A and 5B, Log of Borings (Previous Study). Soils were classified in accordance with the nomenclature described on Figure 6, Unified Soil Classification System. A 3.25-inch outside diameter, 2.42-inch inside diameter drive sampler (Dames & Moore) was utilized in the subsurface sampling at the site. The blow-counts recorded on the boring logs were then required to drive the sampler 12 inches with a 140-pound hammer dropping 30 inches.

3.2 LABORATORY TESTING

3.2.1 General

In order to provide data necessary for our engineering analyses, a laboratory testing program was performed. The program included moisture and density, slaking, Atterberg limits, and chemical tests. Because of the granular and cemented nature of the soils, undisturbed samples for more sophisticated testing could not be obtained. The following paragraphs describe the tests and summarize the test data.

3.2.2 Moisture and Density Tests

To aid in classifying the soils and to help correlate other test data, moisture and density tests were performed on selected undisturbed samples. The results of these tests are presented on the boring logs, Figures 4A and 4B and Figures 5A and 5B.

3.2.3 Slaking Test

To aid in determining the type and degree of sample cementation, a simple slacking test was performed on samples obtained from zero to nine and one-half feet in Borings B-1A and B-2A. The slaking test involved two cycles of saturating and drying samples of the cemented soils. The test results showed that the cemented soils exhibited minor breakdown.

3.2.4 Atterberg Limits Test

Atterberg limits tests were performed to aid in classifying the finer-grained soils and to provide index parameters to aid in projecting swell potential. The test results are tabulated below:

Boring No.	Depth (feet)	Liquid Limit (percent)	Plastic Limit (percent)	Plasticity Index (percent)	Soil Classification
B-1A	2.0	33	26	7	ML
B-1A	5.0-9.0	43	23	20	CL

3.2.5 Chemical Tests

To determine if the site soils will react detrimentally with concrete, chemical tests were performed on a representative sample of the silty clay soils. Field tests showed the soil samples had a moderate reaction to hydrochloric acid (HCl). This indicates that some of the water soluble solids are carbonate. The results of the pH and sulfate tests performed in conjunction with our November 3, 2004 study are presented below:

Boring No.	Depth (feet)	pH	Total Water Soluble Sulfate (ppm)
B-1	2.0	8.3	14

4. SITE CONDITIONS

4.1 SURFACE

The site of the proposed facility is located between Wyoming and Nevada Avenues and in an area that has a series of small one-level wood-frame structures designated as Rows 3150 and 3170. Portions of the site ground surface are covered by an asphalt concrete-paved parking lot, which is relatively flat and in poor condition. In other areas the site is covered by silty sand and gravel road base.

4.2 SUBSURFACE SOIL AND GROUNDWATER

Soils encountered at the borings drilled in conjunction with this study and our November 3, 2004 study are relatively consistent.

Except at Boring B-2A, a pavement consisting of two to three inches of asphalt concrete was encountered. The asphalt concrete does not appear to be underlain by an aggregate base course. At Boring B-2A a six-inch layer of silty gravel fill was encountered.

In Borings B-1 and B-2, possible fills consisting of silty clay with some fine to coarse sand and fine gravel were encountered beneath the asphalt concrete and extends to depths of three and one-half to four feet.

Beneath the possible fill in Boring B-2, the asphalt concrete in Boring B-1A and the surface fill in Boring B-2A, hard silty clay, clayey silt, and sandy and gravelly silt were encountered to six and one-half feet in Boring B-2 and to the depths penetrated by Borings B-1A and B-2A.

In Boring B-1, the possible fill and in Boring B-2 the silty clay are underlain by silty and clayey fine to coarse sand and fine and coarse gravels which extended to the depths penetrated, six and one-half and eight feet. These soils are believed to be the drilling remnants of the deeper massive cemented soils.

All borings met refusal upon highly cemented soil/ash.

All of the natural soils will exhibit very high strength and low compressibility characteristics.

Groundwater was not encountered to the depths penetrated and is projected to be at least 25 to 30 feet below grade.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

By far, the most significant geotechnical aspects of this site are the possible fills, which extend to depths of three and one-half to four feet at two of the boring locations, and the very hard cemented natural soil.

The proposed structure may be supported upon conventional spread and continuous wall foundations established upon suitable natural soils and/or structural fill extending to suitable soils. Under no circumstances should the footings be established over the possible fills.

At-grade slabs and adjoining pavement areas may be supported over the possible fills if the upper portion of the fills are properly prepared.

In the following sections, detailed discussions pertaining to earthwork, foundations, lateral resistance, floor slabs, pavements, and the geoseismic setting of the site are provided.

5.2 EARTHWORK

5.2.1 Site Preparation

Preparation of the site will consist of the removal of the series of small one-level wood-frame structures, associated floor slabs, foundations, and asphalt concrete pavements. Additional preparation of the site will consist of the relocation or abandonment of utilities which may pass through the site. This would be followed by the removal of any other deleterious materials from an area extending out three feet from the perimeter of the proposed structure. The broken-up asphalt may be stockpiled for subsequent utilization as structural site grading fill. Deleterious materials should be removed from the site.

Subsequent to the above operations, general site grading may be initiated. At this time we do not anticipate that site grading will require any significant cuts. Prior to the placement of structural site grading fill, floor slabs, and pavements, exposed subgrade should be scrapped of all loose and disturbed soils. This should be followed by running moderate-weight rubber tire-mounted construction equipment over the surface at least three times. If any soft or otherwise unsuitable soils are encountered, they must be removed to a maximum depth of two feet below floor slab and pavements and entirely from beneath footings. The over-excavation will be backfilled with granular structural fill.

5.2.2 Excavations

Temporary construction excavations into the very hard soil up to eight feet in depth may be constructed with near-vertical sideslopes. Excavation much more than four feet may be very

difficult due to the hard cemented nature of the soils. At boring refusal depth, a hammer was necessary to breakdown cobble-sized particles.

All excavations must be inspected periodically by qualified personnel. If any signs of instability are noted, immediate remedial action must be initiated.

5.2.3 Structural Fill

Structural fill will be required as site grading fill, as backfill over foundations and utilities, and possibly as replacement fill below footings. All structural fill must be free of sod, rubbish, frozen soil, and other deleterious materials. The maximum particle size within structural site grading fill should generally not exceed four inches; although, occasional particles up to six to eight inches may be incorporated provided that they do not result in "honeycombing" or preclude the obtainment of the desired degree of compaction. Structural site grading fill is defined as fill placed over fairly large open areas to raise the overall grade. In confined areas, the maximum particle size should generally be restricted to two and one-half inches.

Most of the on-site soils removed from the excavations can be re-utilized as structural site grading fill. It is preferred that the more granular soils be utilized in confined areas. Imported material should consist of fairly well-graded mixtures of sands or sands and gravels generally containing no more than 18 percent fines; that is, material passing the No. 200 sieve.

5.2.4 Fill Placement and Compaction

All structural fill should be placed in lifts not exceeding eight inches in loose lift thickness. Structural fills placed beneath the footprint of the building should be compacted to at least 95 percent of the maximum dry density as determined by the AASHTO[2] T-180 (ASTM[3] D-1557) compaction criteria. In proposed pavement areas, the structural fill can be compacted to 90 percent of the above-defined criteria.

Prior to placement of structural fills, the subgrade should be prepared as discussed in Section 5.2.1, Site Preparation, of this report. In confined areas, subgrade preparation should consist of the removal of all loose or disturbed soils.

5.2.5 Utility Trenches

All utility trench backfill material below structurally loaded facilities (flatwork, floor slabs, roads, etc.) should be placed at the same density requirements established for structural fill. If the surface of the backfill becomes disturbed during the course of construction, the backfill should be proofrolled and/or properly compacted prior to the construction of any exterior flatwork over a backfilled trench. Proofrolling may be performed by passing moderately loaded rubber tire-

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2 American Association of State Highway and Transportation Officials

3 American Society for Testing and Materials

mounted construction equipment uniformly over the surface at least twice. If excessively loose or soft areas are encountered during proofrolling, they should be removed to a maximum depth of two feet below design finish grade and replaced with structural fill.

Most utility companies and City-County governments are now requiring that Type A-1 or A-1a (AASHTO Designation – basically granular soils with limited fines) soils be used as backfill over utilities. These organizations are also requiring that in public roadways the backfill over major utilities be compacted over the full depth of fill to at least 96 percent of the maximum dry density as determined by the AASHTO T-180 (ASTM D-1557) method of compaction. We recommend that as the major utilities continue onto the site that these compaction specifications are followed.

The natural fine-grained cohesive soils are not recommended for use as trench backfill.

5.3 SPREAD AND CONTINUOUS WALL FOUNDATIONS

5.3.1 Design Data

The proposed structure may be supported upon conventional spread and continuous wall foundations. The foundations may be established upon suitable undisturbed natural soils and/or structural fill extending to suitable soils. Parameters which can be utilized in design are as follows:

Minimum Recommended Depth of Embedment for Frost Protection	- 30 inches
Minimum Recommended Depth of Embedment for Non-frost Conditions	- 15 inches
Recommended Minimum Width for Continuous Wall Footings	- 18 inches
Minimum Recommended Width for Isolated Spread Footings	- 24 inches
Recommended Net Bearing Pressure for Real Load Conditions	- 3,000 pounds per square foot*
Bearing Pressure Increase for Seismic Loading	- 50 percent

* This bearing pressure is controlled by granular structural fill. The undisturbed cemented natural soils are capable of supporting higher bearing pressures.

The term "net bearing pressure" refers to the pressure imposed by the portion of the structure located above lowest adjacent final grade. Therefore, the weight of the footing and backfill to lowest adjacent final grade need not be considered. Real loads are defined as the total of all dead plus frequently applied live loads. Total load includes all dead and live loads, including seismic and wind.

5.3.2 Installation

Under no circumstances should the footings be installed upon non-engineered fills, loose or disturbed soils, sod, rubbish, frozen soil, construction debris, or other deleterious materials. If unsuitable soils are encountered, they must be removed and replaced with compacted granular fill.

The width of replacement fill should be equal to the footing plus one foot for each foot of fill thickness.

5.3.3 Settlements

Settlements of foundations designed and installed in accordance with the above recommendations and supporting maximum anticipated loads should generally not exceed three-eighths of an inch.

Settlements will occur rapidly with approximately 50 to 60 percent of the quoted settlements occurring during construction.

5.4 LATERAL RESISTANCE

Lateral loads imposed upon foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footings and the supporting soils. In determining frictional resistance, a coefficient of 0.40 should be utilized. Passive resistance provided by properly placed and compacted granular structural fill above the water table may be considered equivalent to a fluid with a density of 300 pounds per cubic foot. Below the water table, this granular soil should be considered equivalent to a fluid with a density of 150 pounds per cubic foot.

A combination of passive earth resistance and friction may be utilized provided that the friction component of the total is divided by 1.5.

5.5 FLOOR SLABS

Because of the depth to water table and the very "hard" impermeable nature of the subgrade, it is our recommendation that the at-grade floor slabs should be underlain by four inches of aggregate base. The aggregate base may be placed directly upon suitable natural soils, and/or

structural fill extending to suitable soils. Settlements of at-grade floor slabs is projected to be negligible.

5.6 PAVEMENTS

Some new pavements are anticipated to be associated with the proposed facility. It is our understanding that the pavements will be subjected to a light volume of automobiles and light trucks, occasional medium-weight trucks, but no heavy-weight trucks. For this loading and the subgrade conditions, the following pavement section is recommended:

2.5 inches	Asphalt concrete
7.0 inches	Granular aggregate base
Over	Properly prepared subgrade

If roadways subjected to heavier volumes and heavier equipment are proposed, a thicker pavement section will be required. This can be developed once more specific traffic data becomes available.

In loading/unloading dock and dumpster areas, we recommend that a six-inch non-reinforced Portland cement concrete slab over four inches of aggregate base, over properly prepared subgrade be utilized.

Construction of the rigid concrete slabs should be in sections 10 to 12 feet in width with construction or expansion joints or one-quarter depth saw-cuts on no more than 12-foot centers. Saw-cuts must be completed within 24 hours of the "initial set" of the concrete and should be performed under the direction of the concrete paving contractor. The concrete should have a minimum 28-day unconfined compressive strength of 4,000 pounds per square inch and contain 6 percent ±1 percent air-entrainment.

5.7 GEOSEISMIC SETTING

5.7.1 General

Utah municipalities have adopted the International Building Code (IBC) 2003. The IBC 2003 code determines the seismic hazard for a site based upon regional mapping of bedrock accelerations prepared by the United States Geologic Survey (USGS) and the soil site class (formerly soil profile type). The USGS values are presented on maps incorporated into the IBC code and are also available based on latitude and longitude coordinates (grid points). In comparison, the former UBC (Uniform Building Code) generally placed the entire Wasatch front into a single seismic zone (Seismic Zone 3).

The structure must be designed in accordance with the procedure presented in Chapter 16 of the IBC 2003 edition.

5.7.2 Faulting

Based on our review of available literature, no active faults pass through or immediately adjacent to the site.

5.7.3 Liquefaction

Although the borings were limited in depth, our knowledge in the area indicates that the soils to depths of at least 30 to 40 feet are non-saturated. Therefore, the potential for liquefaction is extremely low.

5.7.4 Soil Class

For dynamic structural analysis, the Site Class "D" as defined in Table 1615.1.1, Site Class Definition of the IBC 2003 can be utilized.

We appreciate the opportunity of providing this service for you. If you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

AMEC Earth & Environmental, Inc.

Joshua M Whitney, EIT
Staff Engineer

Reviewed by:

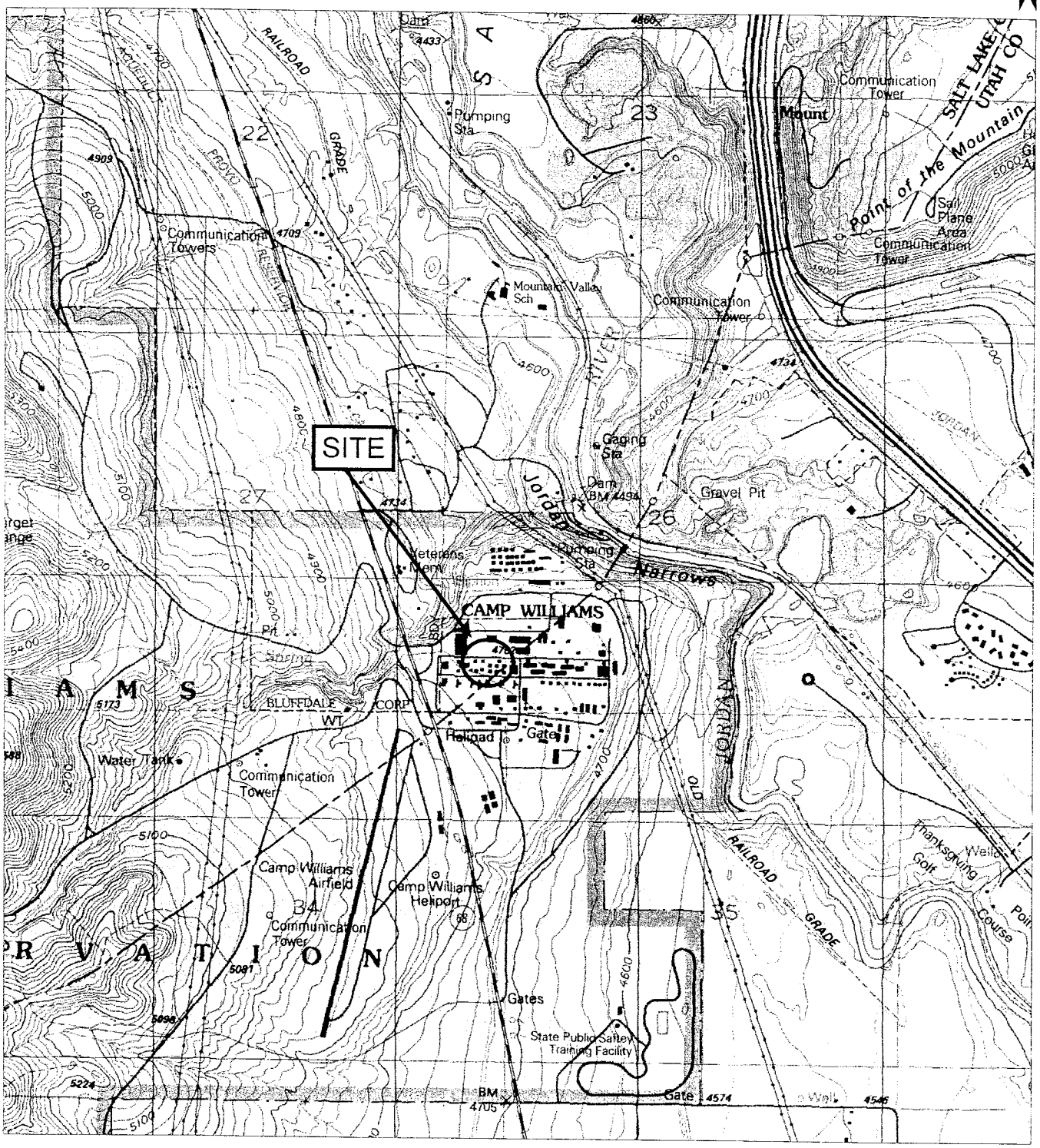
William J. Gordon, State of Utah No. 146417
Professional Engineer

JMW/WJG:sn

Encl. Figure 1, Vicinity Map
Figure 2, Area Map
Figure 3, Site Plan
Figures 4A and 4B, Log of Borings (This Study)
Figures 5A and 5B, Log of Borings (Previous Study)
Figure 6, Unified Soil Classification System

Addressee (3)

AJC ARCHITECTS
JOB NO. 5-817-004993



SCALE IN FEET

1000 0 1000 2000

FIGURE 1
VICINITY MAP

REFERENCE:
USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAP
TITLED "JORDAN NARROWS, UTAH"
DATED 1999

amec

REPORT
DETAILED GEOTECHNICAL STUDY
UTAH NATIONAL GUARD READINESS CENTER
BETWEEN NEVADA AND WYOMING AVENUES
AND WEST OF 2ND STREET
CAMP WILLIAMS, UTAH

Submitted To:

AJC Architects
703 East 1700 South
Salt Lake City, Utah 84105

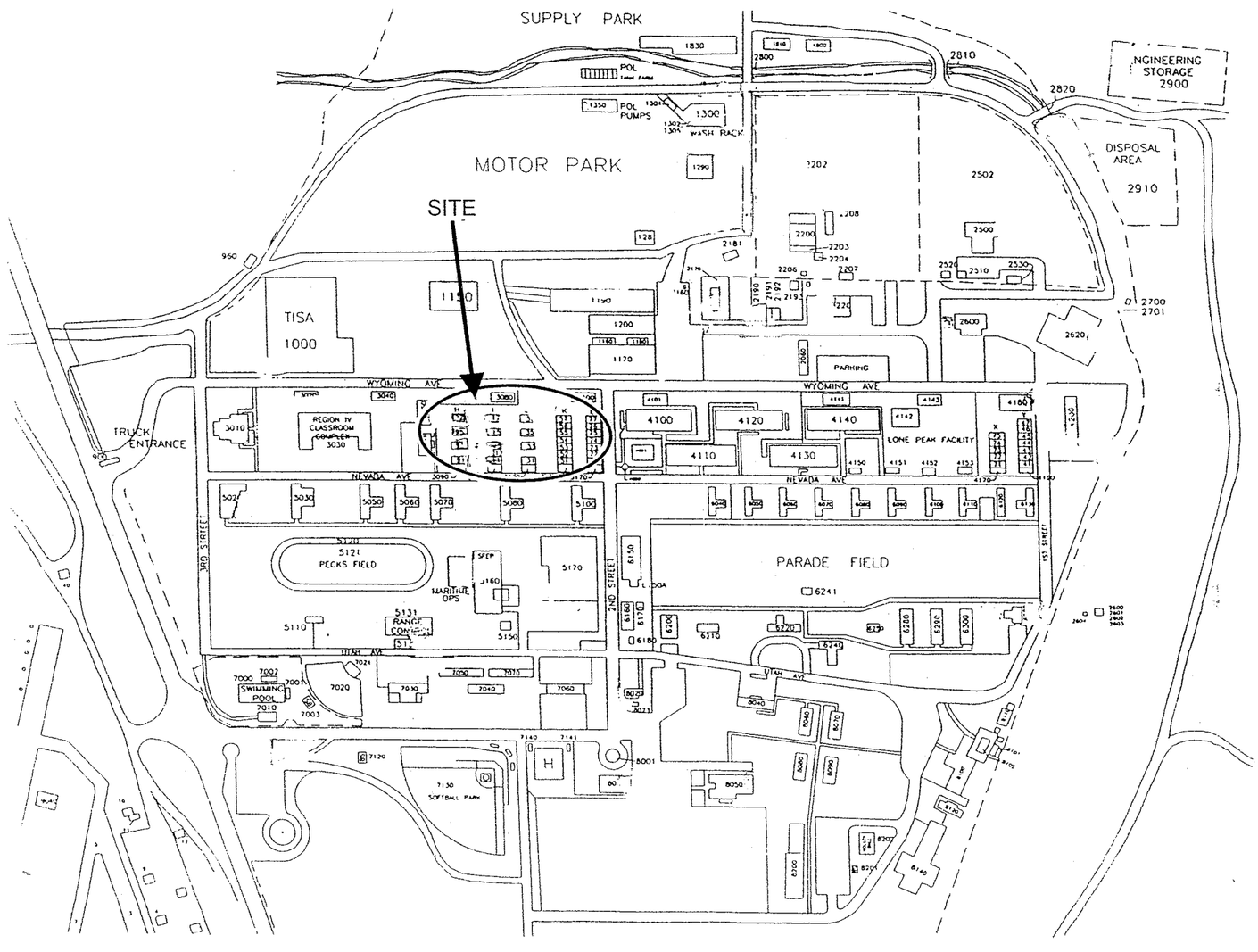
Submitted By:

AMEC Earth & Environmental, Inc.
Salt Lake City, Utah

February 22, 2005

Job No. 5-817-004993

AJC ARCHITECTS
JOB NO. 5-817-004993



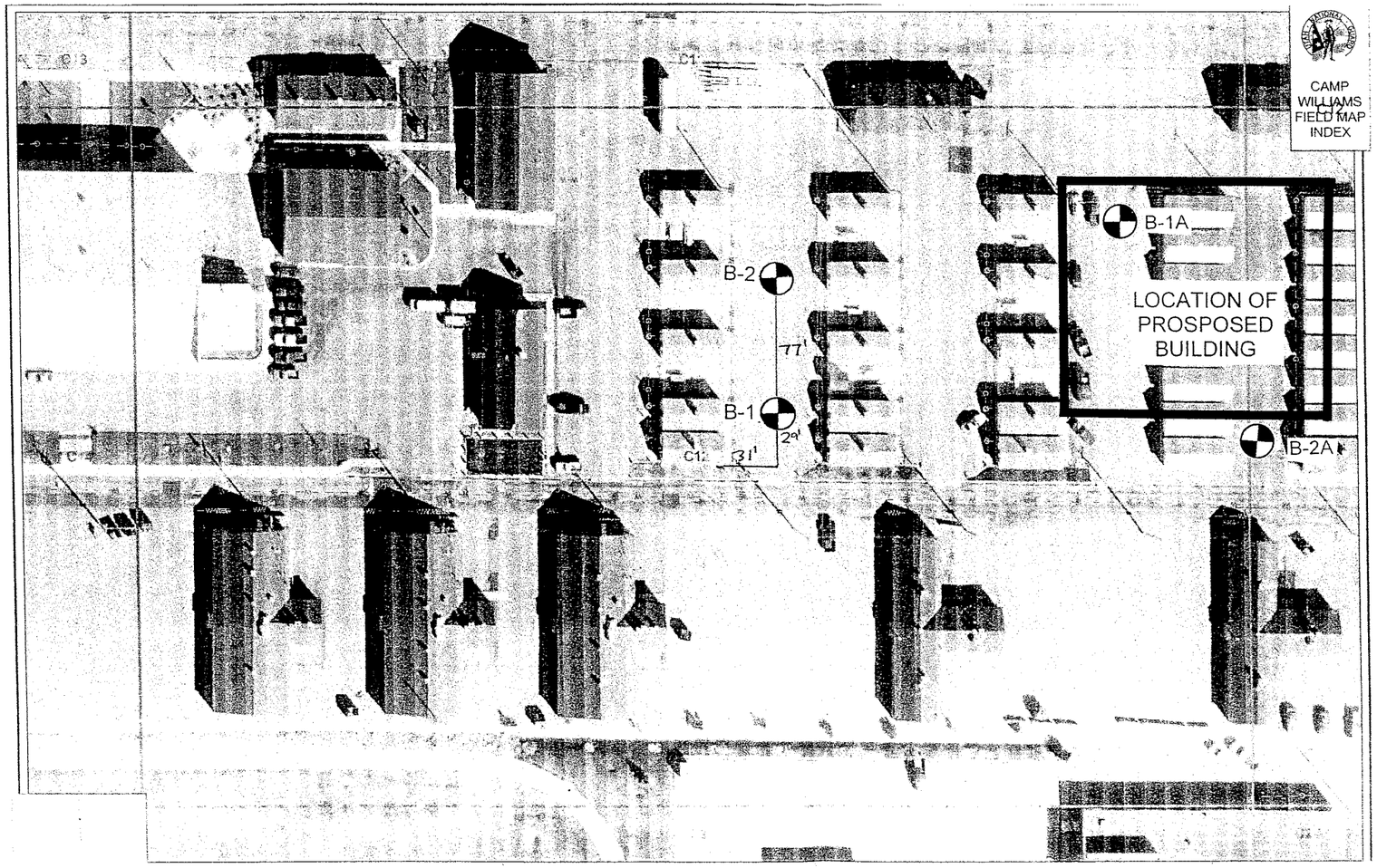
NOT TO SCALE

FIGURE 2
AREA MAP

REFERENCE:
ADAPTED FROM DRAWING PROVIDED BY CLIENT

N117726

AJC ARCHITECTS
JOB NO. 5-817-004993



KEY	
B-#A	This Study
B-#	Previous Study

80 40 0 80

SCALE IN FEET

FIGURE 3
SITE PLAN

REFERENCE:
ADAPTED FROM AERIAL PHOTOGRAPH PROVIDED BY CLIENT

N117726

PROJECT UNG Readiness Center (117th/120th Armory)
Camp Williams, Utah

LOG OF TEST BORING NO. B-1A

JOB NO. 5-817-004993 DATE 01-20-05

RIG TYPE CME 750
BORING TYPE 3-3/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0										2" ASPHALT CONCRETE
								ML	slightly moist hard	**CLAYEY SILT** with some fine to coarse sand and fine gravel; white/brown (not cemented)
				D	100/3"					
5				D	100/3"		27.6			grades light gray/white
								CL	slightly moist hard	**SILTY CLAY** with some fine to coarse sand; light brownish-gray (moderately cemented)
				D	100/.5"					
10										Drilling refusal at 9.0'.
										Stopped sampling at 9.5'.
										Installed 1-1/4" diameter slotted PVC pipe to 9.0'.
										* Groundwater not encountered.
15										
20										The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE
A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 4A

amec

PROJECT UNG Readiness Center (117th/120th Armory)
Camp Williams, Utah

LOG OF TEST BORING NO. B-2A

JOB NO. 5-817-004993 DATE 01-20-05

RIG TYPE CME 750
BORING TYPE 3-3/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot" 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								GM	dry hard	**SILTY GRAVEL**; fine and coarse gravel; gray, FILL
								ML		
				D	100/5"		20.1		slightly moist hard	**SANDY AND GRAVELLY SILT**; fine to coarse sand; fine and coarse gravel; white with oxidation mottling and brown (moderately cemented)
5				D	100/3"	67	23.8			
								CL	slightly moist hard	**SILTY CLAY** with some fine to coarse sand; white light brown (moderately cemented)
				D	100/2"		18.7			
10										Drilling refusal at 7.0'. Stopped sampling at 7.5'. * Groundwater not encountered.
15										
20										The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 4B

amec

PROJECT 117th/120th Armory
Camp Williams, Utah

LOG OF TEST BORING NO. B-1

JOB NO. 4-817-004947 DATE 10-26-04

RIG TYPE CME 750
BORING TYPE 4.25" Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0										3" ASPHALT CONCRETE
								CL FILL?	moist "very stiff"	**SILTY CLAY** with some fine to coarse sand and fine gravel; dark brown, FILL?
				D	100/4"					
								GM/ SM	moist very dense	**SILTY FINE TO COARSE SAND AND FINE AND COARSE GRAVEL**; brown (pieces of cemented soil/ash)
5				D	100/2"					
				D	100/0"					Drilling refusal at 6.5'.
										Stopped sampling at 6.5'.
										* Groundwater not encountered.
10										
15										
20										The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 5A

amec

PROJECT 117th/120th Armory
Camp Williams, Utah

LOG OF TEST BORING NO. B-2

JOB NO. 4-817-004947 DATE 10-26-04

RIG TYPE CME 750
BORING TYPE 4.25" Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot" 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0										2" ASPHALT CONCRETE
								CL FILL?	moist "hard"	**SILTY CLAY** with some fine to coarse sand and fine gravel; brown, FILL?
				D	100/5"					
								CL	slightly moist hard	**SILTY CLAY** with some fine to coarse sand; light brown with some brown streaks
5				D	100/5"	97	23.1			
								SP/ GP	moist very dense	**FINE AND COARSE GRAVEL** with cobbles; brown (pieces of cemented soil/ash)
				D	100/.5"					
										Drilling refusal at 8.0'.
10										Stopped sampling at 8.0'.
										* Groundwater not encountered.
15										
20										The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 5B

amec

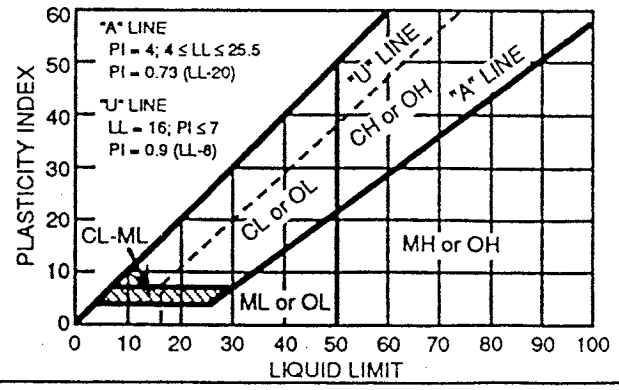
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified for engineering purposes by the Unified Soil Classification System. Grain-size analyses and Atterberg Limits tests often are performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. Graphic symbols are used on boring logs presented in this report. For a more detailed description of the system, see "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" ASTM Designation: 2488-84 and "Standard Test Method for Classification of Soils for Engineering Purposes" ASTM Designation: 2487-85.

MAJOR DIVISIONS				GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
					GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)			SW	Well graded sands, gravelly sands
					SP	Poorly graded sands, gravelly sands
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS Limits plot below "A" line & hatched zone on plasticity chart	SILTS OF LOW PLASTICITY (Liquid Limit less than 50)			ML	Inorganic silts, clayey silts of low to medium plasticity
		SILTS OF HIGH PLASTICITY (Liquid Limit 50 or more)			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts
	CLAYS Limits plot above "A" line & hatched zone on plasticity chart	CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)			CL	Inorganic clays of low to medium plasticity, gravelly, sandy, and silty clays
		CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)			CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity
	ORGANIC SILTS AND CLAYS	ORGANIC SILTS AND CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)			OL	Organic silts and clays of low to medium plasticity, sandy organic silts and clays
		ORGANIC SILTS AND CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)			OH	Organic silts and clays of high plasticity, sandy organic silts and clays
ORGANIC SOILS		PRIMARILY ORGANIC MATTER (dark in color and organic odor)			PT	Peat

NOTE: Coarse-grained soils with between 5% and 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone on the plasticity chart have dual classifications.

PLASTICITY CHART



DEFINITION OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Boulders	Above 12 in.
Cobbles	12 in. to 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 sieve
Sand	No. 4 to No. 200 sieve
Coarse sand	No. 4 to No. 10 sieve
Medium sand	No. 10 to No. 40 sieve
Fine sand	No. 40 to No. 200 sieve
Fines (silt and clay)	Less than No. 200 sieve

FIGURE 6

amec

NOTES

SECTION 10520 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fire-protection cabinets for the following:

a. Portable fire extinguishers, furnished by Owner.

3. Mounting brackets for fire extinguishers.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.

1. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Samples for Verification: For each type of exposed cabinet finish required, prepared on Samples of size indicated below and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Size: 6-by-6-inch- (150-by-150-mm-) square Samples.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguisher cabinets through one source from a single manufacturer.

B. Fire Extinguishers: Furnished by Owner, installed by Contractor.

1.5 COORDINATION

A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers indicated and provided by Owner under separate Contract are accommodated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Fire-Protection Cabinets:

a. Filtrine Manufacturing Company.
b. Fire-End & Croker Corporation.
c. General Accessory Manufacturing Co.
d. J.L. Industries, Inc.
e. Larsen's Manufacturing Company.
f. Modern Metal Products; Div. of Technico.
g. Moon/American, Inc.
h. Potter-Roemer; Div. of Smith Industries, Inc.
i. Samson Products, Inc.
j. Thomas Enterprises.
k. Watrous; Div. of American Specialties, Inc.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

2.3 FIRE-PROTECTION CABINETS

A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

2. Cabinet Metal: Enameled-steel sheet.

B. Cabinet Type: Suitable for the following:

1. Fire extinguishers furnished by Owner.

C. Cabinet Mounting: Suitable for the following mounting conditions:

1. Surface Mounted: Cabinet box fully exposed and mounted directly on wall.

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

1. Trimless: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet.

a. Provide recessed flange, of same material as box, attached to box to act as plaster stop.

E. Cabinet Trim Material: Manufacturer's standard, as follows:

1. Steel sheet.

F. Door Material: Manufacturer's standard, as follows:

1. Steel sheet.

G. Door Glazing: Manufacturer's standard, as follows:

1. Break Glass: Clear float glass, ASTM C 1036, Type I, Class 1, Quality q3, 1.5 mm, single strength.

H. Door Style: Manufacturer's standard design, as follows:

1. Fully glazed panel with frame.

I. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

1. Provide minimum 1/2-inch- (13-mm-) thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.

2. Provide inside latch and lock for break-glass panels.

J. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.5 ACCESSORIES

A. Break-Glass Strike: Provide manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.

B. Lettered Door Handle: Provide one-piece, cast-iron door handle with the word "FIRE" embossed into face.

C. Door Locks: Provide cylinder lock, with all cabinets keyed alike.

D. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.

2.6 COLORS AND TEXTURES

A. Colors and Textures: As selected by Architect from manufacturer's full range for these characteristics.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Cabinet and Door Finishes: Provide manufacturer's standard baked-enamel paint for the following:

1. Exterior of cabinets and doors, except for those surfaces indicated to receive another finish.
2. Interior of cabinets and doors.

2.8 STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

B. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.

1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.9 MOUNTING BRACKETS

A. Available Manufacturers:

1. Amerex Corporation.
2. Ansul Incorporated.
3. Badger Fire Protection.
4. Buckeye Fire Equipment Company.

5. Fire End & Croker Corporation.
6. General Fire Extinguisher Corporation.
7. JL Industries, Inc.
8. Larsen's Manufacturing Company.
9. Potter Roemer; Div. of Smith Industries, Inc.

B. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

1. Color: Black.

C. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Owner furnished fire extinguishers for proper fit with Contractor furnished cabinets.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10520

CODE SUMMARY

BASED ON THE 2003 IBC

	OCCUPANCY TYPES	PROPOSED OCCUPANCY	
• OCCUPANCY CLASSIFICATION	TRAINING FACILITY	A-3 - NON SEPARATED PER 302.3.1	SECTION 302
• CONSTRUCTION TYPE	TYPE III-B	FIRE SPRINKLERS PROVIDED	SECTION 601
• ALLOWABLE AREA / HEIGHT	BASIC: 9,500 SF / 2 STORY / 55 FT. ACTUAL SF = 17,547 (2) STORY ALLOWABLE INCREASE WITH SPRINKLER = 200%		TABLE 503
• OCCUPANCY SEPARATION	NOT REQUIRED		TABLE 302.3.3

• FIRE RATINGS IN HOURS — TABLE 601

STRUCTURAL FRAME	0 HR.
BEARING WALLS	0 HR.
*EXTERIOR WALLS	2 HR.
INTERIOR WALLS	0 HR.
FLOOR CONSTRUCTION	0 HR.
ROOF CONSTRUCTION	0 HR.

*EXTERIOR WALLS 0 HR. > 30 FT. — TABLE 602

• OCCUPANT LOAD EXIT REQUIREMENTS

MAIN LEVEL 260 OCCUPANTS
UPPER LEVEL 111 OCCUPANTS
TOTAL OCCUPANT LOAD = 371 — TABLE 1004.1.2.

TRAVEL DISTANCE MAX. ALLOWABLE = 250' W/ SPRINKLER SYSTEM — TABLE 1015.1

STAIR WIDTH REQUIRED = 23" (111x.2) MIN. REQUIRED
50" PROVIDED — TABLE 1005.1

EXIT WIDTH REQUIRED = 39" (260x..15) MIN. REQUIRED
62" PROVIDED

• PLUMBING FIXTURE REQUIREMENTS

TOILET FIXTURES REQUIRED; WATER CLOSETS
MALE: 2 REQUIRED, 9 PROVIDED
FEMALE: 1 REQUIRED, 5 PROVIDED
LAVATORIES
MALE: 2 REQUIRED, 5 PROVIDED
FEMALE: 2 REQUIRED, 5 PROVIDED
1 DRINKING FOUNTAIN PROVIDED AND 1 MOP SINK PROVIDED

• INCIDENTAL USE AREAS

VEHICLE TRAINING BAY TOTAL S.F. = 1072 SF

REQUIRES 1 HOUR SEPARATION FOR PARKING GARAGE IN FULLY SPRINKLERED BUILDING. — TABLE 302.1.1

• RATED WALLS

SHAFT WALL AT STAIR - U477

(1) HOUR RATED WALL AT VEHICLE TRAINING BAY - U906

703 east 1700 south
salt lake city, utah 84105
ajc@ajcarchitects.com

ajc architects

ph: 801.466.8818
fx: 801.466.4411

144TH READINESS CENTER

CODE ANALYSIS

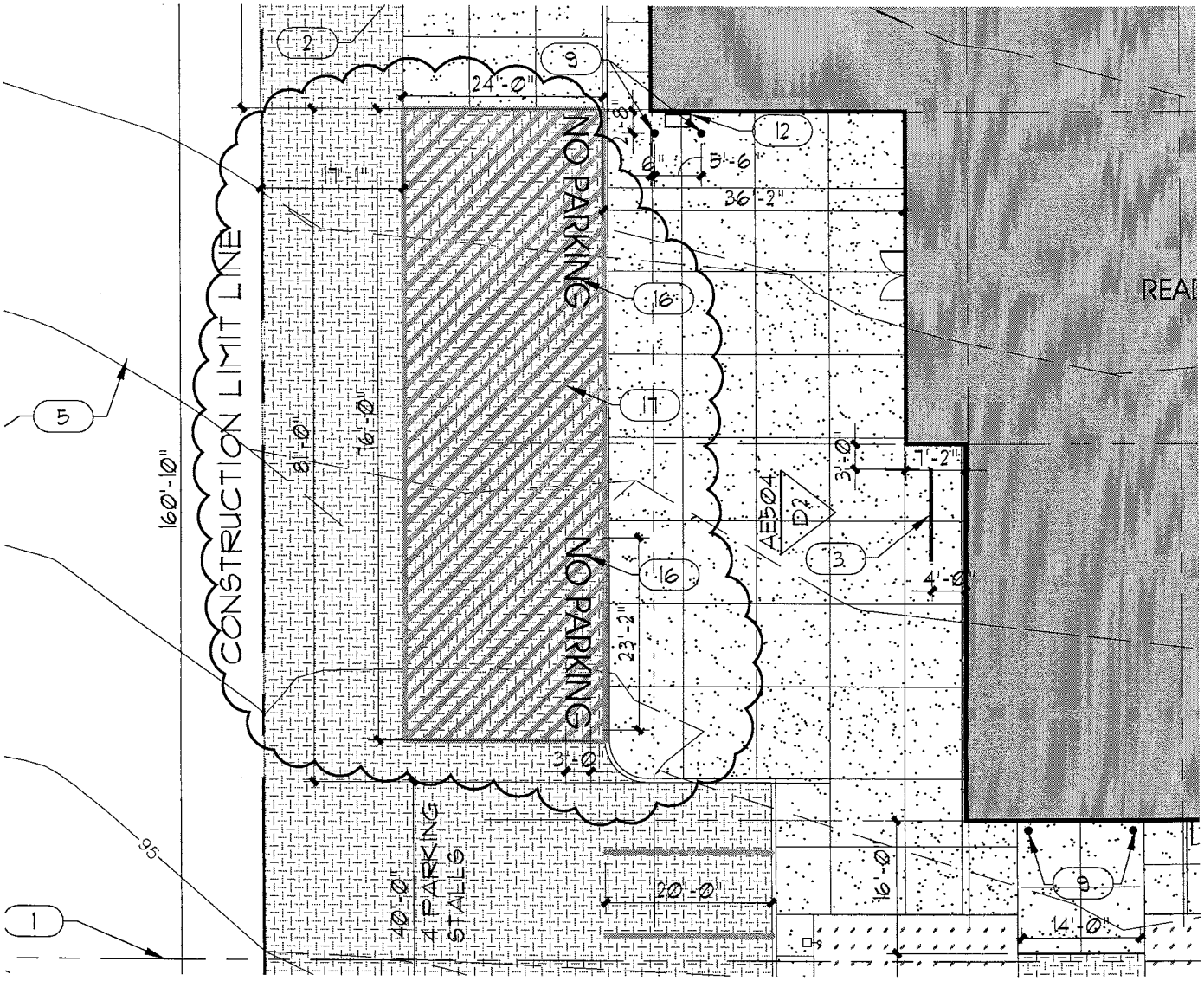
BID ADDENDA 1

ARCHITECTURAL ITEMS

0470
04 12 06

AD1.1

RE: ITEM 4



16 NO PARKING SIGNAGE

17 DIAGONAL STRIPING THIS AREA

PARTIAL SITE PLAN

SCALE: 1" = 20'-0"

703 east 1700 south
salt lake city, utah 84105
ajc@ajcarchitects.com

ajc architects

ph: 801.466.8818
fx: 801.466.4411

144TH READINESS CENTER

PARTIAL SITE PLAN

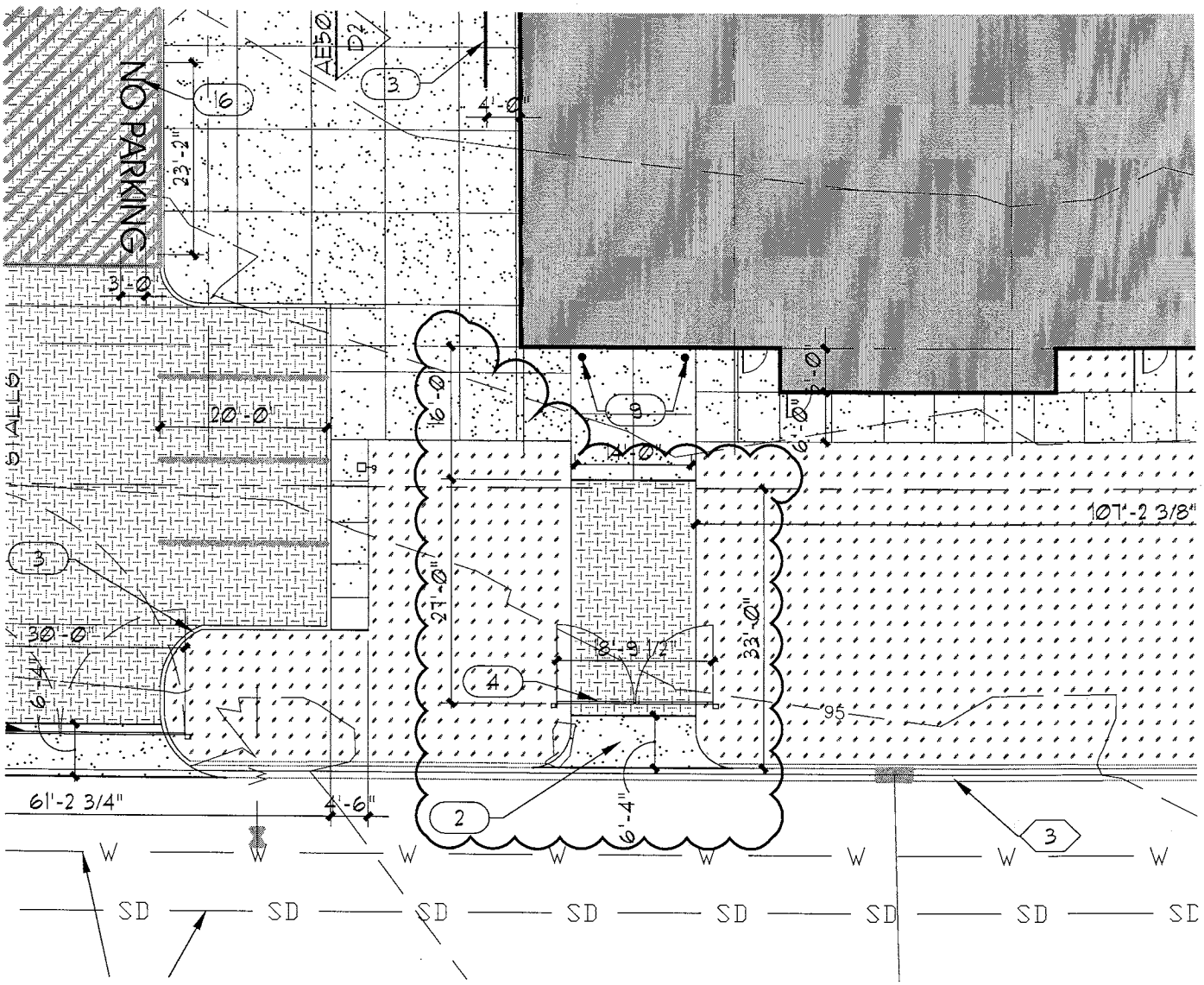
BID ADDENDA 1

ARCHITECTURAL ITEMS

0470
04 12 06

AD1.2

RE: ITEM 5



PARTIAL SITE PLAN

SCALE: 1" = 20'-0"

703 east 1700 south
salt lake city, utah 84105
ajc@ajcarchitects.com

ajc architects

ph: 801.466.8818
fx: 801.466.4411

144TH READINESS CENTER

PARTIAL SITE PLAN

BID ADDENDA 1

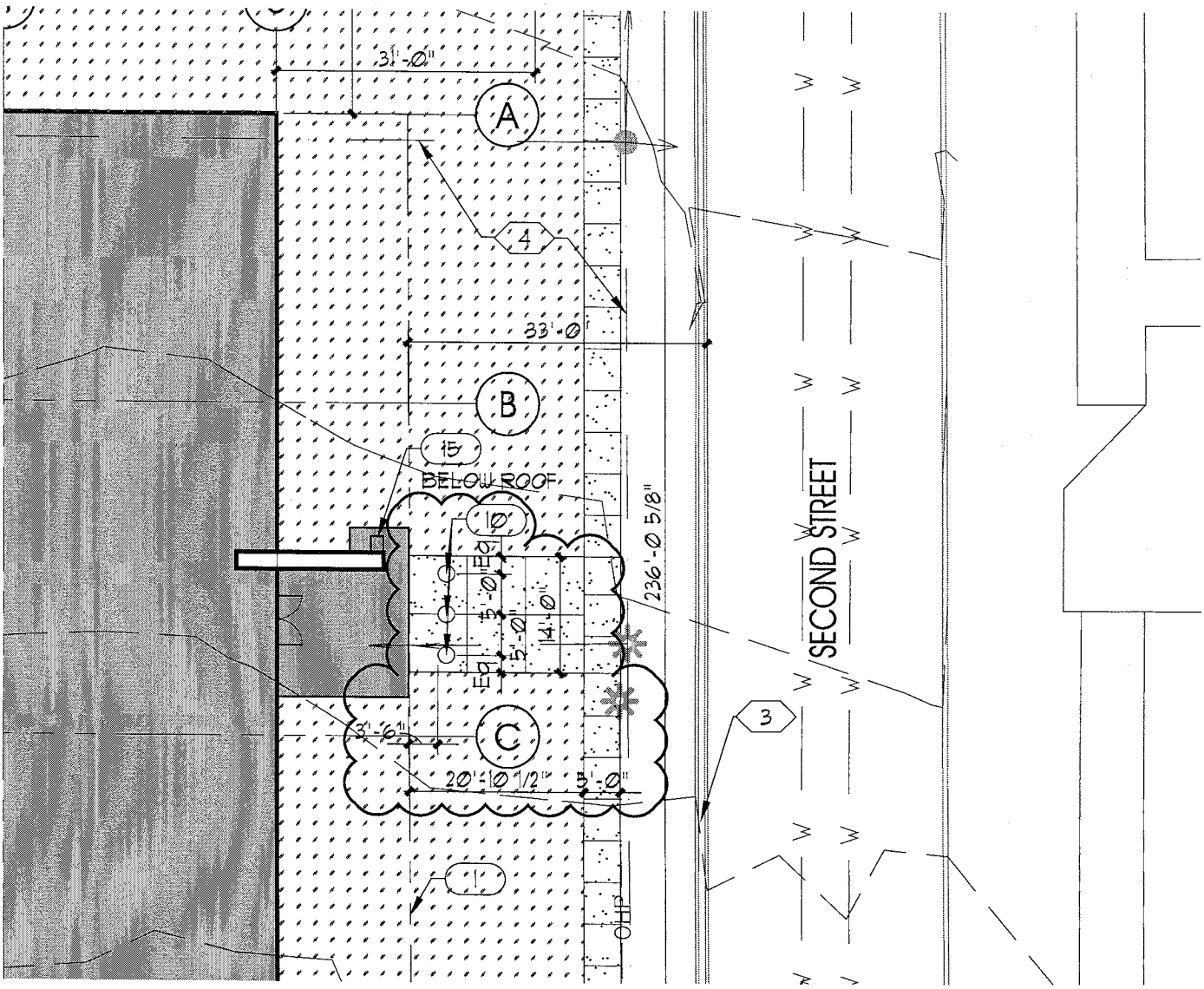
ARCHITECTURAL ITEMS

0470

04 12 06

AD1.3

RE: ITEM 6



PARTIAL SITE PLAN

SCALE: 1" = 20'-0"

703 east 1700 south
salt lake city, utah 84105
ajc@ajcarchitects.com

ajc architects

ph: 801.466.8818
fx: 801.466.4411

144TH READINESS CENTER

PARTIAL SITE PLAN

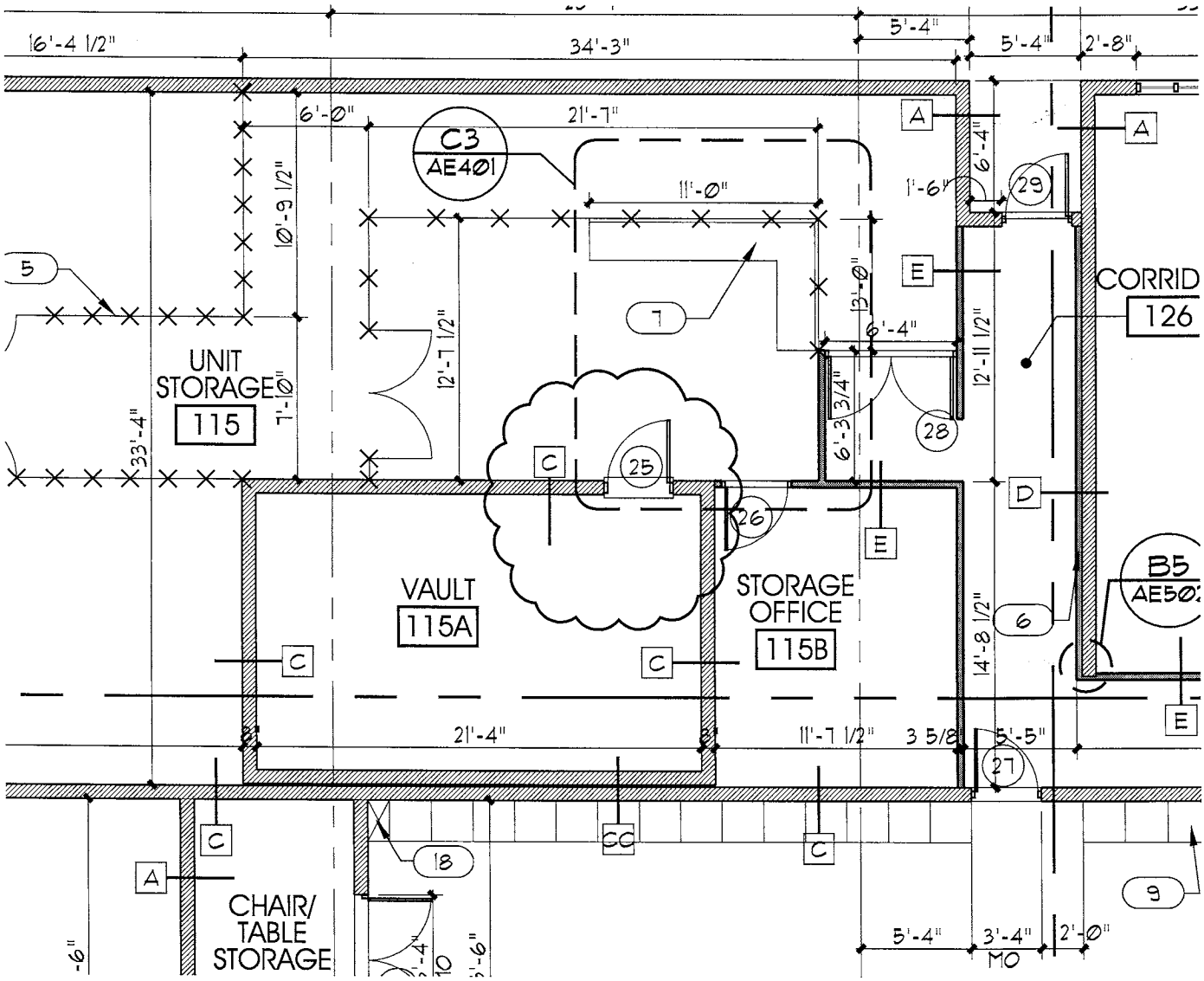
BID ADDENDA 1

ARCHITECTURAL ITEMS

0470
04 12 06

AD1.4

RE: ITEM 7



PARTIAL FLOOR PLAN

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

703 east 1700 south
salt lake city, utah 84105
ajc@ajcarchitects.com

ajc architects

ph: 801.466.8818
fx: 801.466.4411

144TH READINESS CENTER

0470
04 12 06

PARTIAL SITE PLAN

BID ADDENDA 1

ARCHITECTURAL ITEMS

AD1.5

RE: ITEM 8

DOOR SCHEDULE

DOOR NO.	DOOR SIZE	FIRE RATING (MIN.)	DOOR			FRAME		SEE DOOR TYPICAL DETAI FOR NON-TY	
			TYPE	MATERIAL	FINISH	TYPE	FINISH	HEAD	JAMB
MAIN LEVEL									
1	(2) 3'-0" x 7'-0"	-	F	AL	AN	-	AN	-	-
2	(2) 3'-0" x 7'-0"	-	F	AL	AN	-	AN	-	-
24	3'-0" x 7'-0"	-	-	-	4				
25	3'-0" x 7'-0"								
26	3'-0" x 7'-0"	-	-	-	5				
27	3'-0" x 7'-0"	-	-	-	9				

1

FINAL CORES

1 CLASS 5 VAULT DOOR W/O GATE MUST MEET AR 190-11 REQUIREMENTS

703 east 1700 south
salt lake city, utah 84105
ajc@ajcarchitects.com

ajc architects

ph: 801.466.8818
fx: 801.466.4411

144TH READINESS CENTER

PARTIAL SITE PLAN

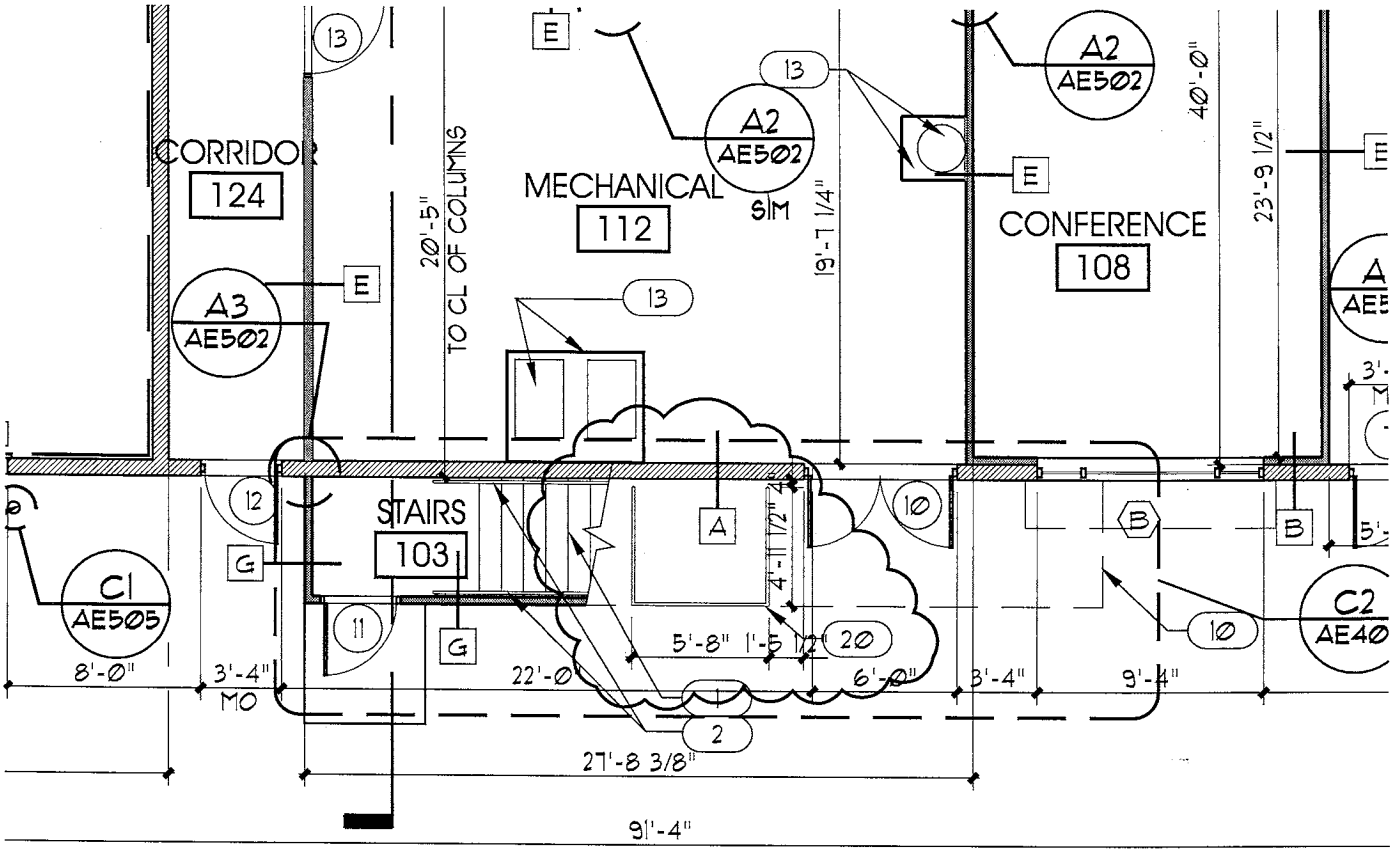
BID ADDENDA 1

ARCHITECTURAL ITEMS

0470
04 12 06

AD1.6

RE: ITEM 9



20 PROVIDE 1 ½" OD STEEL PIPE GUARD RAIL UNDER STAIRS AS INDICATED.

PARTIAL FLOOR PLAN

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

703 east 1700 south
salt lake city, utah 84105
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ajc architects

ph: 801.466.8818
fx: 801.466.4411

144TH READINESS CENTER

0470
04 12 06

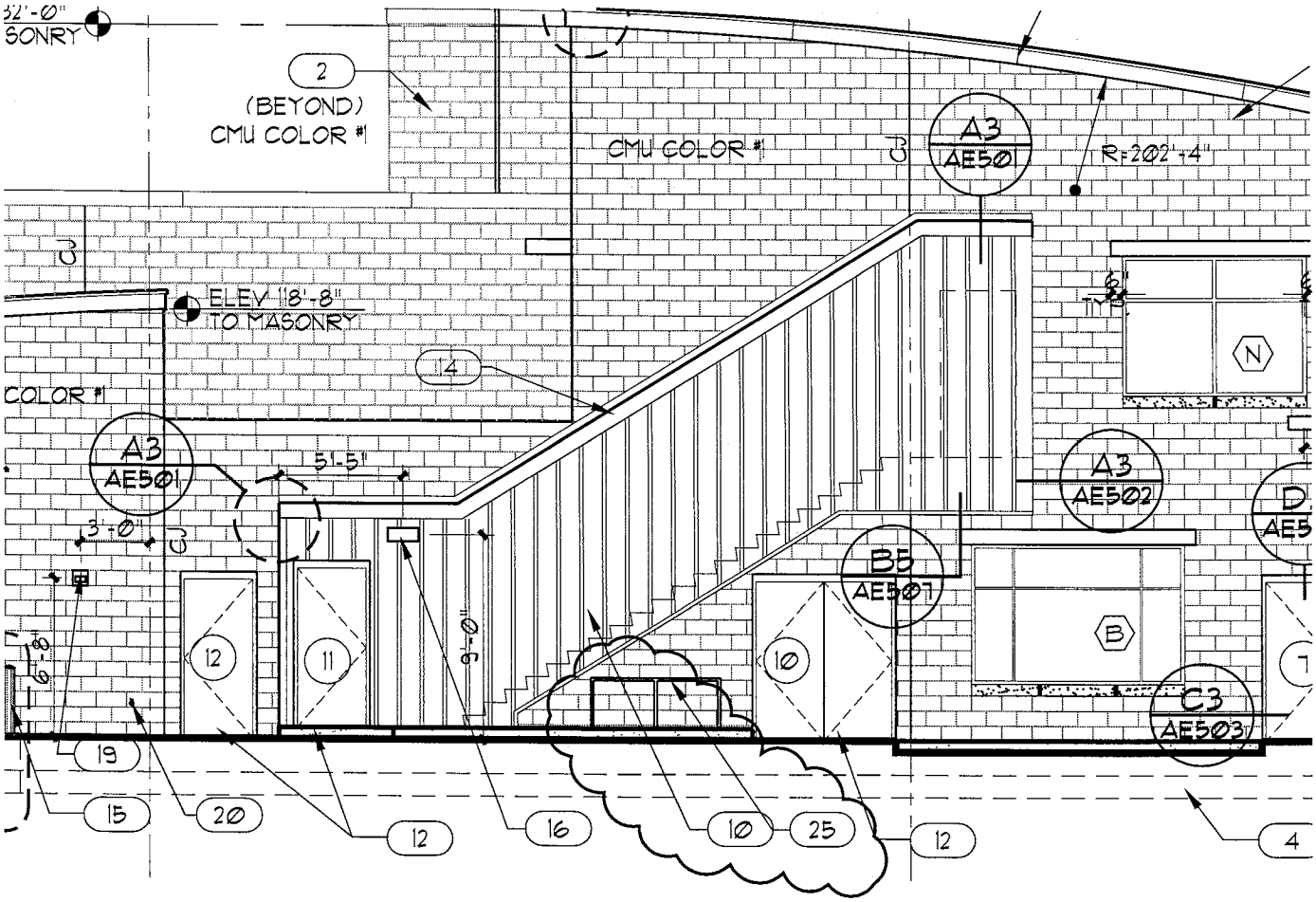
PARTIAL SITE PLAN

BID ADDENDA 1

ARCHITECTURAL ITEMS

AD1.7

RE: ITEM 10



25 1 ½" OD PIPE RAILING GUARD. TOP OF GUARD TO BE 27" ABOVE ADJACENT GRADE. CORE DRILL CONCRETE FOR RAILING AND SECURE WITH POUR ROCK.

PARTIAL ELEVATION

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

703 east 1700 south
salt lake city, utah 84105
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ajc architects

ph: 801.466.8818
fx: 801.466.4411

144TH READINESS CENTER

0470
04 12 06

PARTIAL SITE PLAN

BID ADDENDA 1

ARCHITECTURAL ITEMS

AD1.8

RE: ITEM 10

Utah National Guard
Camp Williams Medical Unit Readiness Center
Riverton, Utah
Project No. 04043480

SECTION 15955 – ELECTRONIC CONTROLS

PART 1 - GENERAL

1.1 RELATED WORK

A. The General Conditions, Supplementary Conditions and Division 1,General Requirements apply to this Section, and Contractor shall review and adhere to all requirements of these documents.

B. Related work specified in other Sections:

Section 15010 - Basic Mechanical Requirements
Section 15050 - Basic Mechanical Materials and Methods
Section 15240 - Mechanical Sound and Vibration Control
Section 15250 - Mechanical Insulation
Section 15511 - HVAC Piping & Specialties
Section 15540 - HVAC Pumps
Section 15555 - Boilers
Section 15850 - Air Handling Fans
Section 15851 - Air Handling Systems on Roof
Section 15880 - Air Distribution
Section 15990 - Testing, Adjusting and Balancing
Section 15995 - Commissioning of HVAC

1.2 SYSTEM DESCRIPTION

A. The work includes but is not limited to the following:

1. The automatic control system shall be direct digital controls (DDC). PID (Proportional Integral, Derivative) control algorithms shall be applied on all temperature, indoor air quality, and pressure applications as called for hereinafter in the control sequences.
2. Central building automation system with web-based stand-alone master controller, unit controllers for all controlled devices to communicate with master controller. The master controller shall be capable of trend logging all indoor air quality sensors on an hourly basis for a period of one year, and any other measured variables for a period of at least 3 months. Central BAS system shall be compatible with the existing Camp Williams systems by CSI Controls and shall be provided with a router for connection to the Camp Williams DDC network.
3. All control devices, valves and automatic dampers, wire, conduit, etc., as specified and required and connected so as to perform all functions and operate according to the specified sequences.

1.3 QUALITY ASSURANCE

A. Manufacturing and Installation Qualifications:

1. The Controls Subcontractor firm executing the work of this section shall have 10 years experience in work of similar scope and nature to that specified.

B. This work includes all material, equipment and appurtenant accessories necessary for or incidental to the installation of a complete DDC system of Automatic Temperature Controls.

C. All device controllers shall be application specific controllers (ASC) by the same manufacturer and shall be compatible with the existing Camp Williams systems by CSI Controls.

D. Master Controller (see section

1.4 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings and manufacturer's data for the following items in accordance with the General Conditions of the Contract:

1. Sensors.
2. PI & PID Controllers
3. Automatic control valves, schedule and wiring.
4. Thermostats.
5. Thermometers.
6. Gauges.
7. Control diagrams
8. Wiring diagrams
9. Control panels.

B. Operating Instructions and Maintenance Data: Submit printed Operating Instructions and Maintenance Data for the following items in accordance with Operating and Maintenance Data paragraph in Section 15010.

1. Controls and instrumentation.

C. Certificate: ATC Contractor shall submit a letter certifying completion of the control system in accordance with the Contract Documents.

D. Commissioning: Submit completed Commissioning Checklist FC-7, Controls.

PART 2 - PRODUCTS

2.1 SENSORS

A. Temperature sensors shall be of the thermistor (NTC) type with a high resistance change versus temperature change to insure good resolution and accuracy. Sensors shall be available for room, duct or well mounting. Sensors shall connect to remote controller by means of a two-wire unshielded cable. Room type sensors shall be available with built-in setpoint potentiometer. Sensors shall be available in various ranges to properly suit the application.

B. Carbon Dioxide Sensor and Transmitter: Carbon Dioxide (CO_2) sensors shall be Vaisala Model GM, or approved equal. Wall-mounted sensors shall be Model GMW21. Duct-mounted sensors shall be Model GMD20. Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output, for wall mounting.

C. Zone dampening sensor element shall be suitable for duct mounting and capable of dampening an individual zone sensor by electronically paralleling the zone sensor's signal. Sensor shall connect to controller by means of a two-wire unshielded cable. Sensor shall be of the thermistor (NTC) type.

D. Strap-on type sensor shall vary its resistance over its entire range of sensed water temperature from 50°F to 230°F in a pipe 3/4" to 2-1/2" in diameter without requiring immersion or well mounting. Sensor shall connect to controller by means of a two-wire unshielded cable. Sensor shall be of the thermistor (NTC) type.

E. Duct-mounted averaging type temperature sensor shall utilize a nickel resistance sensing element incorporated in a copper capillary of 27 feet. The sensor shall vary the output voltage with a change in temperature. Sensor shall connect to the remote controller by means of a three-wire unshielded cable. Temperature sensors utilized for freezestat purposes shall be mounted within 6" of bottom of an air handler floor.

F. Differential pressure sensor shall vary the output voltage with a change in differential pressure. The sensor shall connect to the remote controller by means of a three-wire unshielded cable.

G. Air velocity sensor shall be capable of linear indication of the velocity of air in a duct from 0 to 3000 FPM, and shall vary its output voltage with a change in air velocity. The sensor shall connect to the controller by means of a four-wire unshielded cable.

H. Outdoor air sensor shall be of the thermistor (NTC) type with a high resistance change versus temperature change. Sensor shall be available for outdoor or duct mounting. Sensor shall connect to remote controller by means of a two-wire unshielded cable. Outdoor type sensor shall be available with integral wind sensor which changes its output voltage with a change in wind velocity. Combination sensor shall connect to controller by means of five-wire unshielded cable.

I. Duct sensor/adaptor shall be of the thermistor (NTC) type and suitable for mounting directly to the back of the integral sensor/controller making it capable of duct temperature sensing as a single unit.

2.2 PRIMARY HVAC CONTROLLERS

A. Temperature/humidity/pressure controllers shall be plug-in proportional type with integrated circuits. Controllers shall be capable of having up to three separate outputs. Each output shall have separate zero and proportional band adjustments such that a single controller may operate heating and cooling with an adjustable dead band to meet D.O.E. requirements. Indicating lamps shall be provided for each output which will vary in intensity to indicate amount of output. Controller shall be available with either 0 - 20 VDC proportional output, two position, or any combination. Controller shall have internal switches for each output to change the output signal to either direct or reverse.

Controller shall be available with integral electronic circuit for absolute high or low limit control.

B. Three-in-one controllers shall be a single unit capable of producing a discreet 0-20 VDC proportional output, one for each of three separate sensors. The three outputs shall have individual setpoint, zero adjustment and proportional band. Each output shall be provided with output lamps that vary in intensity to indicate the amount of output.

C. Three mode rate reset controller shall be of the proportional/ on-off type with adjustable integral and derivative actions. The controller shall be available with one or two outputs. Each output shall have individual zero adjust and output lamps which varies in intensity as the output varies. Each output shall be field selectable for direct or reverse action, and 0-20 VDC proportional or 0/20 VDC binary output. The controller shall be supplied with a switch to eliminate the integral and derivative functions for calibration purposes.

D. The sequencing controller shall be capable of receiving a proportional signal from a controller and outputting two discreet sequenced signals with individual zero and steepness adjust for each. Controller shall be supplied with a switch to select a direct or reverse-acting output. Each output shall have individual indicating lamps which vary in intensity at output varies.

E. Averaging controller shall be capable of receiving up to ten (10) 0-20 VDC signals from controllers and outputting two separate control signals, one the average of the cooling demands and the other the average of the heating demands. Each shall have individual steepness adjust and individual indicating lamps which vary in intensity as output varies. Controller shall be supplied with switches to select direct or reverse-acting output signals.

2.3 TERMINAL UNIT CONTROLS (VAV)

A. Each smart variable air volume controller shall be based on a minimum 8 bit microprocessor with control algorithms and default set points embedded in non-volatile memory and shall regulate zone temperature by regulating the volume of air supplied to the zone. This is accomplished by controlling zone air velocity at an appropriate setpoint which is reset by the space temperature. A PID type control algorithm shall reduce offset and overshoot. Proportional control shall not be acceptable. Each controller shall be stand-alone and have the following independently adjustable setpoints:

1. Heating Temperature
2. Cooling Temperature
3. Maximum Cooling Velocity
4. Minimum Velocity
5. Maximum Heating Velocity
6. Space CO2 / Outside air differential

B. Each controller shall be remotely addressable over a twisted/shielded multidrop pair of wires by a higher level computing device. Remote communications shall enable the following capabilities:

1. Reset all Setpoints
2. Read all Setpoints

3. Read Zone Temperatures
4. Read Duct Velocity
5. Initiate Zone Morning Warmup Mode
6. Initiate Zone Night Setback

C. Control, communication, and power circuits for each controller shall be electrically isolated to protect against transients and steady state pick-up.

D. Controller setup shall be simplified by function switches on the controller which command damper open or closed, go to minimum or maximum velocity, and exercise heat assist outputs. Under normal operation, these function switches shall be used to create an address, unique to each individual controller. Any address between 01 and 31 shall be possible.

E. All controllers shall be suitable for indefinite operation with or without communication to a higher level computer system.

1.	Transmission rate:	19200 baud
2.	Word Length:	32 bits
3.	Operation:	Asynchronous Half-Duplex Two Wire
4.	Format:	Binary

2.4 INTEGRAL SENSOR/CONTROLLER

A. Controllers shall be available with one or two outputs of either the two position or 0-20 VDC proportional type. Each output shall have individual dead band and proportional band adjustments. Time proportioned three point floating type output controller shall have single output with PID characteristics such that sustained system offset is eliminated, and shall have time adjustment to coordinate damper stroke time with controller output, controllers shall have lamps to appropriately indicate controller output. Outputs shall be individually field adjustable for direct or reverse action. Controller shall be supplied with equipment necessary to effect adjustable night setback from a contact closure or adjustable low limit control from a sensor signal. Control shall be available as integral duct sensor/controller, or shall be capable of remote sensor and/or setpoint mounting. Two output controllers shall have adjustable dead band capable of meeting D.O.E. requirements.

2.5 HOT WATER CONTROLLERS

A. Weather dependent changeover controller shall be capable of binary switching based on outdoor temperature, and shall be available with one or two independent switches with individual setpoint differential, and switch for reverse or direct action switching. Controller shall be capable of receiving a varying electronic signal from a solar sensor for automatic reset of control point due to solar load. Output lamps shall be provided to indicate individual contact status. Controller shall be capable of fully adjustable night set-back or setup.

B. Constant temperature controller shall be of the proportional type with integral reset action to eliminate sustained system offset. The controller shall have a switch for selecting long or short integral reset times. Controller shall have an indicating lamp that will vary in intensity with controller output.

C. Hot water reset temperature controller with limits shall be of the time proportioned 3 point floating type with PDPT characteristics, or the 0-20 VCD proportional type with PI characteristics, such that the reset function eliminates sustained system offset. Controller shall be capable of resetting its control point automatically due to outdoor air temperature, and wind and/or solar loss/gain information transmitted from appropriate sensors. Controller shall be capable of adjustable night setback from contact closure. Reset schedule shall be fully adjustable with regards to outdoor air temperature, and solar and/or wind loss/gain influence. Output lamps shall be provided to indicated controller output status, on-off or varying as appropriate. Switch shall be provided on proportional controller to eliminate reset functions for calibration purposes. Limit adjustments shall be provided for maximum and minimum allowable hot water temperatures.

D. Hot water reset temperature controller shall be of the time proportioned 3 point floating type with PDPI characteristics, or the 0-20 VDC proportional type with PI characteristics, such that the reset function eliminates sustained system offset. Controller shall be capable of resetting its control point automatically due to outdoor air temperature and wind and/or solar loss/gain information transmitted from appropriate sensors. Controller shall be capable of adjustable night setback from contact closure. Reset schedule shall be fully adjustable with regards to outdoor air temperature, and solar and/or wind loss/gain influence. Output lamps shall be provided to indicate controller output status, on-off or varying as appropriate. Switch shall be provided on proportional controller to eliminate reset functions for calibration purposes. Lamps shall be provided to indicate an adjustable below/above freezing change-over temperature. Controller shall be capable of receiving a signal from a room compensation sensor and adjusting its control point to coincide accordingly.

E. Return water boiler controller with low limit shall be available with on 0-20 VDC proportional output and either one or two on-off outputs. It shall be capable of controlling up to three boilers based on return water temperature. Each cut-in point shall be individually adjustable. The controller shall have a 200 second switch-on time delay and shall be compatible with a return water low limit sensor to close the mixing valve if the water temperature decreases to the extent that boiler shock would result. Output lamps shall indicate controller output status, on-off or modulating as appropriate.

F. Return water sensor/controller shall be compatible with the boiler controller to throttle closed the secondary system mixing valve should the primary return water temperature drop below its adjustable setpoint.

2.6 CONTROL VALVES

A. Drive and valve for low volume heating water shall be for the modulating magnetic type with two-way screwed fittings. Valve shall spring return to its normal position in the absence of control power. Valve body shall be nickel plated brass, seat shall be brass, and inner valve material shall be ethylenepropylene rubber.

B. Valves for control of refrigerants shall be of the two-way or three-way modulating magnetic type. Valve body shall be of high pressure brass with solder connections and have a seat and inner valve of chrome nickel steel. The valve shall spring return to its normal position in the absence of control power.

C. Valves used for control of hot water shall be of the modulating magnetic type with a rangeability of at least 500 to 1. Valve body shall be cast iron, seat and inner valve material shall be chrome nickel steel. Valve sizes 2" and smaller shall be screwed and supplied with union fittings. Valve 2-1/2" and larger shall be flanged. Valves shall be of the three-way or straight-thru type as required by the sequence or shown on the mechanical drawings. Valve shall be equipped with hand wheel to allow manual position of valve in the absence of control power. Valves shall be of the spring return type that will return to their normal position in the absence of control power.

D. Valves used for fan coil or terminal reheat shall be of the modulating magnetic type with a rangeability of at least 100 to 1. Valve body and seat material shall be bronze. The inner valve and stem material shall be stainless steel. The valve shall be of the three-way type with 4 connections and an integral bypass. Valves shall be of the spring return type that will return to their normal position in the absence of control power.

2.7 DAMPER ACTUATORS

A. Actuators shall be of the push-pull type for either modulating or two-positioning control. Actuators shall stroke by a rotating motion of an overload-proof synchronous motor. Control voltage shall be either 24 VAC or 0-20 VDC as required by the application. Actuators shall be available with spring return to the fully extended position upon power failure. Three (3) point floating actuator shall be available with adjustable end switches. Minimum/maximum manual positioners shall be available for proportional motors.

B. Mixing box actuators shall be of the rotary or linear drive type as required, capable of permanent stall operation without damage. Rotary drive actuators shall have adjustable stop pins for stroke limit and shall fit directly over the damper shaft. Gears shall be nickel steel. Gears and bearings shall be oil impregnated for lifetime lubrication.

2.8 RESET TRANSMITTERS

A. The reset transmitter shall be used for both summer and winter compensation in conjunction with controllers for the gradual increase in temperature as a function of outdoor air temperature. The transmitter shall be suitable for connection to up to 100 controllers while using only one outside air sensor. Transmitter shall have the capability to interface with a solar sensor for adjustable solar compensation.

B. The reset transmitter shall be used for both summer and winter compensation in conjunction with controllers for the gradual increase in temperature as a function of outdoor air temperature. The transmitter shall be suitable for connection to up to 100 controllers while using only one sensor. The transmitter shall have cut-in point and summer and winter reset slope adjustments.

C. The universal reset transmitter shall be capable of receiving a signal from any one of a number of different sensors (temperature, pressure, humidity, etc.) and resetting the setpoint of up to five controllers based on a field adjustable reset schedule. The reset schedule may be either direct or reverse with high and low reset limits.

2.9 INDICATORS

A. Remote indicator shall interface with sensor/controller to indicate measured value at the sensors. Indicator shall be capable of indicating temperature, pressure or humidity.

B. Multiple indicator shall interface with up to six sensor/controllers to indicate measured value at the sensors. A selector switch on the face of the indicator shall determine which variable is being measured. Indicator shall be capable of indicating temperature and humidity.

C. Industrial digital indicator shall be of the precision electronics and component type accurate to ± .05% of measured variable indicator shall be adjustable for indicating various ranges of temperature, humidity and pressure from different voltage, current, or resistance inputs.

D. Industrial analog indicator shall be high precision electronics and component type accurate to ± 1% of scale range, indicator shall be suitable for indicating various ranges and shall be available as a one or two unit indicator.

2.10 ALARM UNITS

A. The alarm indicator shall be capable of indicating a minimum of six alarms per module. When an alarm condition exists the appropriate lamp shall flash. The lamp shall continue to flash until the alarm unit has been reset regardless of whether the alarm condition has returned to normal. When the reset button is pushed and the alarm conditions still exist, the lamp shall go to a steady lit condition until the alarm has cleared. The unit shall be equipped with a lamp test button.

B. The status indicator shall be capable of indicating a minimum of six statuses per module. The unit shall be equipped with a lamp test button.

C. Floating alarm unit shall interface with a controller to sense setpoint and measured value. The upper and lower alarm limits shall be adjustable on the face of the alarm unit and defined as an offset from the controller setpoint. The unit shall have indicating lamps to indicate which limit has been exceeded and "dry" SPDT contracts for remote alarm. Unit shall be available as single or dual alarm unit.

D. Stand alone alarm unit shall connect to remote temperature and/or humidity sensor and alarm when the upper or lower limits set on the face of the unit are exceeded. The unit shall have indicating lamps to indicate which limit has been exceeded and "dry" SPDT contacts for remote alarm. Unit shall be available as single or dual alarm unit.

2.11 TRANSDUCER AND INTERFACES

A. The electronic transducer shall be of the one or two input/output type suitable for interfacing a sensor and a recorder. Start point and steepness shall be fully adjustable for various ranges. Accuracy shall be ± 1% of final value.

2.12 TIME CLOCKS AND OPTIMIZER

A. Time clock shall have separate 7-day and 24-hour dials, skip-a-day feature, and 12-hour spring reserve. Clock shall have selection switch for manual day, manual night and automatic operation. Clock shall be available with adjustable morning boost and shall have manual time correction adjustment.

B. Time clock for optimizer shall have a separate 7-day and 24-hour dials, skip-a-day feature, quartz movement with interconnecting outputs, and 72-hour spring reserve. Clock shall have selection switch for manual day, manual night and automatic operation.

C. Start time optimizer shall initiate optimum start time computations 9 hours before programmed occupancy and determined latest possible start time to need desired system conditions based on indoor and outdoor air temperature. Clock shall have morning boost capability and be compatible with quartz movement optimizer time clock.

2.13 MISCELLANEOUS

A. High temperature cut-outs (HTCO) shall be designed to be mounted in the return air or exhaust duct system and wired to shutdown fans when air temperature rises above its setpoint. HTCO shall be of the manual reset type and supplied for all fans over 2000 CFM.

B. Smoke detector shall be of the dual chamber ionization type to sense the particles of combustion. Smoke detectors shall be provided for all heating and cooling fans over 200 CFM and wired to shut down the fan on an alarm condition.

C. Low limit thermostats shall be line voltage type and used to detect low temperature conditions in an air stream which could cause freeze-up conditions in water coils. Controller shall be of the liquid-filled type responsive only to the lowest temperature sensed along any one foot length of its 20 foot measuring element. Controller shall be adjustable and of the manual reset type.

D. Flow switches shall be of the paddle type equipped with SPDT contacts to establish proof of flow. Flow switches shall be of the vapor-proof type similar to McDonnell Miller FS8-V.

E. Line voltage to 24 VAC transformer shall be supplied as required to provide adequate control voltage to control system.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of the automatic control system shall be made and supervised by mechanics who are full time employees of the Controls Subcontractor.

F. All installation work shall be scheduled and coordinated with other trades to expedite job progress.

G. The installation shall match erection of slabs and walls such that no damage, cutting or patching will be required.

H. All work shall be installed in accordance with current control industry practices.

I. Only top quality workmanship will be permitted.

J. Any work not properly executed shall be removed and replaced without extra expense to the Owner.

3.2 SENSORS AND GUARDS

A. Temperature controls trades shall verify all wall mounted sensor locations with the General Contractor in order to avoid interference with wall mounted furnishings.
1. Where interferences require moving the sensor more than two feet, consult with the Engineer for new location.

B. Calibrate each carbon dioxide sensor for site elevation (4500 ft) prior to placing into service.

3.3 FREEZE PROTECTION THERMOSTATS

A. Provide freeze stat on the discharge of each unit to stop the fan and close the outside damper upon sensing any one foot section below 40°F.

3.4 ELECTRIC WIRING

A. All control and interlock wiring shall be as specified in "Electric Wiring" paragraph in Section 15050 - Basic Mechanical Materials and Methods. Provide diagrams and coordinate all work with the Division 16 contractor as required.

B. The ATC Contractor shall furnish and install all required wiring for the following subsystems:

1. Water Treatment System

C. The ATC Contractor shall furnish all necessary equipment and wiring to integrate the following:

1. Boiler
2. Generator
3. Lighting

3.5 SERVICE AND WARRANTY

A. The control system herein specified shall be free from defects and workmanship and material under normal use and service. After completion of the installation the controls contractor shall regulate and adjust all thermostats, control valves, damper motors and other equipment provided under this contract. If within twelve (12) months from the date of completion any of the equipment herein described is proved to be defective in workmanship or materials, it will be replaced or repaired free of charge in accordance with "Warranties" paragraph in Section 15010.

B. The controls contractor shall after completion, provide any service incidental to the proper performance of the control system under guarantees outlined in Division 1 for the period of one year.

C. When all devices are installed, a fully qualified technician shall set, adjust and calibrate all components.

1. A letter certifying completion of the system shall be forwarded to the Engineer's office, prior to acceptance of project by Owner.

3.6 INSTRUCTION AND ADJUSTMENT

A. On completion of the job the controls contractor shall have completely adjusted the entire control system. He shall arrange to instruct the Owner's representative on operation of the control system and supply him with three (3) copies of the control operating and instruction manuals. He shall obtain from the owner's representative a signed receipt that he has received the instruction manuals and complete instructions on the operation of the system.

B. Record Drawing: At completion of the job the controls contractor shall furnish two (2) copies of corrected wiring diagrams, one enclosed in laminated plastic and mounted on wall of the main mechanical room or as directed.

C. Contractor Adjustments: At the completion of the job the controls contractor must submit to the Architect a letter stating that he has made final calibrations and adjustments to the system and that the owner's operating personnel have been instructed in its use.

3.7 SEQUENCE OF OPERATION

A. Rooftop Air Handling Unit RTU-1:

1. Occupied/unoccupied modes of this air handler shall be determined by a four-channel load programmer and override timer located on the Automatic Temperature Control (ATC) panel.

2. Occupied Mode:

a. When the air handler is indexed to the occupied mode, the outside and exhaust dampers shall remain closed until the return air temperature comes up to 68 degrees (adjustable). When the return air rises above 68 degrees, the outside air dampers shall open to a minimum position adjustable at the ATC panel.

b. A discharge three-mode controller with proportional, integral and derivative action shall select the zone calling for thermostat cooling and reset the discharge air temperature from 65 to 53 degrees with adjustable limits. This controller shall sequence the return plenum unit heater, outside air dampers, 2 stages of compressor operation, and modulate the hermetic hot gas valve provided by this contractor to satisfy the reset schedule.

c. A differential controller sensing the outside and the return air temperatures, shall return the outside air dampers to minimum position when the outside air temperature is within 2 degrees of the return temperature. The mechanical cooling shall be locked out below 55 degrees OSA (adjustable).
d. Minimum outside air shall be set at 2700 CFM minimum (adjustable).

2. Unoccupied Mode:

a. The air handler shall be off, the outside air dampers shall be closed, and the cooling locked out. On a fall in space temperature below 60 degrees as sensed by zone temperature controllers, the air handler shall start to satisfy the space heating demand.

3. Zone Control:

a. All zones. A panel-mounted master/submaster controller with separate heating/cooling setpoints sensing the space temperature and zone discharge temperature with remote transmitters shall modulate hot water valve to satisfy the space heating setpoint. The cooling output of the controllers shall reset the main supply fan discharge air temperature.

4. Supply Fan Speed Control:

a. Supply fan VFD shall modulate to maintain a pressure differential between the space and discharge ductwork sufficient to operate all VAV boxes with at least one box in the full open position at any time.

5. Power Exhaust Fan Speed Control:

a. Power exhaust fan VFD shall modulate to maintain a pressure differential between the lobby and outside air.

6. Safeties:

a. Shut down all fans under smoke detector or freezestat alarm.

7. Interlocks:

a. All exhaust fans shall be interlocked to run when the supply fan AHU-1 unit is in operating, economizer mode, and to de-energize with AHU-1.

K. Heating Water System:

1. Upon a call for zone heating or air handler preheat, the lead boiler shall be enabled and the boiler primary pump shall be enabled. The burner controls shall be monitored by the central control system. The lead position shall alternate between each primary pump and boiler to periodically exercise each piece of equipment. Operating status of each pump shall be monitored by adjustable setpoint motor current sensors. Upon pump or motor failure, a failure alarm shall be indicated and the lag or backup pump shall automatically start. Pump failure

alarm shall generate an automatic pager or e-mail notification as directed by Owner. Lag boiler shall be enabled as needed to maintain the primary heating water temperature setpoint (160°F). The primary loop 3-way valve shall modulate to maintain the secondary heating water temperature setpoint. The secondary heating water temperature shall be reset from 150°F to 100°F over the range of outdoor temperature from 10°F to 60°F.

2. Upon a call for heating water from within the secondary zone, the lead secondary heating water pump speed shall modulate to maintain the differential pressure sensor setpoint. Secondary pump speed shall be controlled directly through the VFD integral PID controller. Status of all pumps shall be monitored by adjustable setpoint motor current sensors, upon loss of flow an alarm shall be indicated and the lag or backup pump shall be enabled automatically. Pump failure alarm shall generate an automatic pager or e-mail notification as directed by Owner.

L. VAV Boxes:

1. Occupied Mode:

a. When the space temperature is equal to or greater than the cooling temperature set point the VAV box processor shall enter the cooling mode. The controller shall reset the box CFM set point from the minimum ventilation set point to the cooling maximum set point. A velocity sensor shall measure airflow through the terminal unit and compare this to setpoint. The controller shall modulate the damper through PID control action to maintain volume setpoint. The space temperature sensor resets the volume setpoint to maintain the room temperature at the desired setpoint of 75°F (adjustable). Provide adjustable minimum and maximum volume limits.

b. On a fall in space temperature equal to the heating temperature set point, the controller shall than modulate the reheat coil as well as reset the supply air volume between the ventilation minimum and the heating maximum set point. The heating volume shall be a function of the heating calculation percentage to minimize the amount of reheat. On a 100% call for heat, the VAV box shall control to the maximum heating velocity set point and the control valve shall be wide open. (Reference Paragraph I)

c. Minimum airflow shall modulate from the scheduled control minimum to the scheduled heating maximum to maintain space CO_2 level less than 400 PPM (adjustable) above outside air CO_2 level as measured at the outside air intake of RTU-1. CO_2 differential shall be determined at intervals of not more than 2 minutes using the average readings of the previous period.

2. Unoccupied Mode:

a. No cooling shall be permitted.

b. Heating shall occur in a similar action to the occupied mode except room temperature shall be 60°F (adjustable).

M. Fan Coil Unit FC-1:

1. When space temperature falls below setpoint (adjustable), energize fan and modulate heating water control valve to maintain setpoint.

N. Fan Coil Unit FC-2:

1. Occupied Mode:

a. The fan shall run continuously in the occupied mode, which shall be determined by a wall mounted occupancy sensor with 3-hour occupied override.
b. The fan coil controller shall regulate zone temperature by modulating the heating valve via PID control action to maintain setpoint.
c. Cooling is not provided for this unit.
d. Outside air and return air dampers shall modulate between 0 and 1400 CFM to maintain space CO_2 level less than 400 PPM above outside air CO_2 level as measured at the outside air intake of RTU-1.

2. Unoccupied Mode:

a. No cooling shall be permitted.
b. Outside air shall be closed.
c. Heating shall occur in a similar action to the occupied mode except room temperature shall be 55°F (adjustable).

O. Split System FC-3 matched with CU-1:

1. When space humidity rises above 60% (adjustable), energize dehumidification mode – condensing unit on, fan coil on, modulate hydronic heating control valve to maintain discharge air temperature equal to space temperature. De-energize the system and close the hydronic heating control valve after space humidity falls below 50% (adjustable).

P. Central Control Panels:

1. Provide two steel panels to house the controllers, relays, and similar instruments for each system as described below. Locate one panel in mechanical penthouse and one panel basement vestibule.

a. Central Air Handler Controllers with their setpoints.
b. Space temperature setpoints for each zone of AHU-1 system.
c. Humidity setpoint for each operating room and recovery room.
d. Space temperature readout, setpoint, and velocity operating points for each VAV or fan powered box.
e. Digital outside air, return air, mixed air, and discharge air indication for each handler.
f. Duct and space static pressure indication for 2 VAV systems.
g. Hand-off auto switches for all pumps boilers and air handlers.

END OF SECTION 15955

SECTION 15995 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.
2. Section 15511 - HVAC Piping & Specialties
3. Section 15540 - HVAC Pumps
4. Section 15555 - Boilers
5. Section 15851 - Air Handling Systems on Roof
6. Section 15852 - Vehicle Exhaust System
7. Section 15955 - Electronic Controls
8. Section 15990 - Testing, Adjusting, and Balancing

1.3 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.4 CxA'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.5 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning report:

1. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
2. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
3. Test and inspection reports and certificates.
4. Completed functional checklists.
5. Corrective action documents.
6. Verification of testing, adjusting, and balancing reports.

1.6 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities. Refer to Functional Checklists provided.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 TESTING AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.

1. The CxA will notify testing and balancing Contractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. Tests will be performed using design conditions whenever possible.

E. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

F. The CxA may direct that set points be altered when simulating conditions is not practical.

G. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

H. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

I. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Boiler Testing and Acceptance Procedures: Testing requirements are specified in Division 15 boiler Sections. Provide submittals, test data, inspector record, and boiler certification to the CxA.

B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 15 Sections 15955 - Electronic Controls. Assist the CxA with preparation of testing plans.

C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 15 piping Sections. HVAC&R Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

D. Energy Supply System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of gas, hot-water systems and equipment at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

F. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

3.5 FUNCTIONAL ATTACHMENTS

A. FC-1 Packaged DX Air Conditioning

B. FC-2 Boilers

C. FC-3 Pumps

D. FC-4 Vehicle Exhaust Fan

E. FC-5 Hot Water Piping

F. FC-6 VFD

G. FC-7 Controls (By Division 15995)

H. Mechanical Basis of Design

END OF SECTION 15995

Functional Checklist

Project: Utah National Guard 144th Company Readiness Center

FC-1: Packaged DX Air Conditioning AHU-1

1. Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This functional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ List attached.

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date	Sheet Metal Contractor	Date
TAB Contractor	Date	General Contractor	Date

Functional checklist items are to be completed as part of startup & initial checkout. This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.

- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor, ____ = _____.

Approvals This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Agent	Date	Owner's Representative	Date

Notes:

2. Requested documentation submitted

Check if Okay. Enter comment or note number if deficient.

Check	Equip Tag->						Contr.
Manufacturer's cut sheets							
Performance data (fan curves, coil data, etc.)							
Installation and startup manual and plan							
Sequences and control strategies							
O&M manuals							

Documentation complete as per contract documents for given trade ___ YES ___ NO

3. Model verification

1 = as specified, 2 = as submitted, 3 = as installed. Enter information and check if Okay. Enter note number if deficient.

Equip Tag--->						
Manuf.	1					
	2					
	3					
Model	1					
	2					
	3					
Serial #	3					
Cooling Capacity	1					
	2					
	3					
S Fan Capacity	1					
	2					
	3					
R/E Fan Capacity	1					
	2					
	3					
VFD	1					
	2					
	3					

- ***The equipment installed matches the specifications for given trade.....___ YES ___ NO***

Notes:

4. Installation Checks

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->						Contr.
Cabinet and General Installation						
Permanent labels affixed, including for fans						
Casing condition good: no dents, leaks, door gaskets installed						
Access doors close tightly - no leaks						
Boot between duct and unit tight and in good condition						
Vibration isolation equipment installed & released from shipping locks						
Maintenance access acceptable for unit and components						
Sound attenuation installed						
Thermal insulation properly installed and according to specification						
Instrumentation installed according to specification (thermometers, pressure gages, flow meters, etc.)						
Clean up of equipment completed per contract documents						
Filters installed and replacement type and efficiency permanently affixed to housing						
Piping and Coils						
No leaking apparent around refrigerant fittings						
All coils are clean and fins are in good condition						
All condensate drain pans clean and slope to drain per spec						
OSAT, MAT, SAT, RAT sensors properly located and secure (related OSAT sensor shielded)						
Sensors calibrated (See calibration section below)						
If split system, refrigerant piping in good condition and suction insulated						
P/T plugs and isolation valves installed per drawings						
Fans and Dampers						
Supply fan and motor alignment appear correct						
Supply fan belt tension & condition good						
Supply fan protective shrouds for belts in place and secure						
Supply fan area clean						
Supply fan and motor properly lubricated						
Return/exhaust fan and motor aligned						
Return/exhaust fan belt tension & condition good						
Return/exhaust fan protective shrouds for belts in place and secure						
Return/exhaust fan area clean						
Return/exhaust fan and motor lube lines installed and lubed						
Filters installed and replacement type and efficiency permanently affixed to housing--construction filters removed						

Notes:

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->						Contr.
Filter pressure differential measuring device installed and functional (magnahelic, inclined manometer, etc.)						
Smoke and fire dampers installed properly per contract docs (proper location, access doors, appropriate ratings verified)						
All dampers close tightly						
All damper linkages have minimum play						
Low limit freeze stat sensor located to deal with stratification & bypass						
Motors: premium efficiency verified, if spec'd?						
Compressor and Condenser						
Refrigerant sight glass clear of bubbles (if OSAT > 70F)						
Moisture indicator shows no moisture						
Correct oil level (check site glass during operation)						
Compressors and piping were leak tested, as required						
Crankcase heater on when unit is off						
Condenser coils clean and in good condition (air cooled)						
Adequate clearance for airflow around condenser						
Ducts (preliminary check)						
Sound attenuators installed						
Duct joint sealant properly installed						
No apparent severe duct restrictions						
Turning vanes in square elbows as per drawings						
OSA intakes located away from pollutant sources & exhaust outlets						
Pressure leakage tests completed						
Branch duct control dampers operable						
Balancing dampers installed as per drawings and TAB's site visit						
Electrical and Controls						
Pilot lights are functioning						
Power disconnects in place and labeled						
All electric connections tight						
Proper grounding installed for components and unit						
Safeties in place and operable						
Current overload heaters installed and correct size						
Auxiliary heaters installed						
Sensors calibrated (see section below)						
All building control system interlocks hooked up with packaged controls and functional						
Fire and smoke detectors in place						

Notes:

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->						Contr.
Enthalpy control and sensor properly installed (if applicable)						
Related thermostats are installed						
Related building automation system points are installed						
All control devices, pneumatic tubing and wiring complete						
VFD						
VFD powered (wired to controlled equipment)						
VFD interlocked to control system						
Static pressure or other controlling sensor properly located and per drawings and calibrated (see Section 6)						
Static pressure or other controlling sensor calibrated						
Drive location not subject to excessive temperatures						
Drive location not subject to excessive moisture or dirt						
Drive size matches motor size						
Internal setting designating the model is correct						
Motor FLA setting represents 100% to 105% of motor FLA rating						
Appropriate Volts vs Hz curve is being used						
Accel and decel times are around 10-50 seconds, except for special applications. Actual decel:_____, Accel:_____						
Lower frequency limit at 0 for VAV fans. Actual: _____						
Upper frequency limit set at 100%, unless explained otherwise						
Unit is programmed with full written programming record submitted						
RPM readout in BAS verified with VFD readout						
TAB						
Installation of system and balancing devices will allow balancing to be done per specified NEBB or AABC procedures & contract docs						
Final						
Smoke and fire dampers and unpowered TU's are open?						
Safeties installed and safe operating ranges for this equipment provided to the commissioning agent						
Functional test procedures for this equipment reviewed and approved by installing contractor						
If unit is started and will be running during constructdion: have quality filters on RA grills, etc. to minimize dirt in the ductwork and coils and in any finished areas. Verify moisture migration is not a problem due to improper pressures between spaces.						

- ***The checklist items of Part 4 are all successfully completed for given trade.___ YES ___ NO***

Notes:

5. Operational Checks (These augment mfr's list. This is not the functional performance testing.)

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->						Contr.
Supply fan rotation correct						
Return / exhaust fan rotation correct						
No unusual noise or vibration in supply and exhaust fans						
Condenser fan rotation correct (air cooled)						
Condenser fan acceptable noise and vibration (air cooled)						
Measure line to line voltage imbalance for 1/3 of the compressors: Compressor 1 Phase: (%Imbalance = 100 x (avg. - lowest) / avg.) Record in cell, all three phase voltages. Imbalance less than 2%?						
Compressor 2 Phase: (%Imbalance = 100 x (avg. - lowest) / avg.) Record in cell, all three phase voltages. Imbalance less than 2%?						
Record full load running amps for each compressor. _____rated FL amps x _____srvc factor = _____ (Max amps). Running less than max?						
Record full load running amps for each condenser fan. _____rated FL amps x _____srvc factor = _____ (Max amps). Running less than max?						
Fans > 5 hp Phase Checks: (% impalance = 100 x (avg. - lowest) / avg.) List fan & record all 3 voltages in cell. Imbalance less than 2%?						
Record full load running amps for each fan. _____rated FL amps x _____srvc factor = _____ (Max amps). Running less than max?						
Inlet vanes aligned in housing, actuator spanned, modulate smoothly and proportional to input signal and EMS readout.						
All dampers (OSA, RA, EA, etc.) stroke fully without binding and spans calibrated and BAS reading site verified (follow procedure in Calibration and Leak-by Test Procedures). List dampers checked: _____						
Valves stroke fully and easily and spanning is calibrated (follow procedure in Calibration and Leak-by Test Procedures). List each actuated valve here when spanned: _____						
Valves verified to not be leaking through coils when closed at normal operating pressure (follow procedure in Calibration and Leak-by Test Procedures).						
The HOA switch properly activates and deactivates the unit						
Safeties installed and safe operating ranges for this equipment provided to the commissioning agent						

Notes:

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->						Contr.
Specified sequences of operation and operating schedules have been implemented with all variations documented						
Specified point-to-point checks have been completed and documentation record submitted for this system						
Startup report completed with this checklist attached						

- ***The checklist items of Part 5 are all successfully completed for given trade.___ YES ___ NO***

6. Sensor and Actuator Calibration [ ]

All field-installed temperature, relative humidity, CO, CO_2 and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated using the methods and tolerances given in the Calibration and Leak-by Test Procedures document. All test instruments shall have had a certified calibration within the last 12 months: Y/N_____. Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.

Sensor or Actuator & Location	Loc-ation OK	**1st** Gage or BAS Value	Instr. Meas'd Value	**Final** Gage or BAS Value	Pass Y/N?

Sensor & Location	Loc-ation OK	**1st** Gage or BAS Value	Instr. Meas'd Value	**Final** Gage or BAS Value	Pass Y/N?

Gage reading = reading of the permanent gage on the equipment. BAS = building automation system. Instr. = testing instrument. Visual = actual observation. The Contractor's own sensor check-out sheets may be used in lieu of the above, if the same recording fields are included and the referenced procedures are followed.

- ***All sensors and actuators are calibrated within required tolerances.....___ YES ___ NO***

-- END OF PROCEDURES--

Notes:

Functional Checklist

Project: Utah National Guard 144th Company Readiness Center

FC-2: Condensing Boilers B-1, B-2

1. Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This functional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ List attached.

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date	Sheet Metal Contractor	Date
TAB Contractor	Date	General Contractor	Date

Functional checklist items are to be completed as part of startup & initial checkout. This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.

- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Agent	Date	Owner's Representative	Date

Notes:

2. Requested documentation submitted

Check if Okay. Enter comment or note number if deficient.

Check	Equip Tag->	B-1	B-2				Contr.
Manufacturer's cut sheets							
Performance data (fan curves, coil data, etc.)							
Installation and startup manual and plan							
Sequences and control strategies							
O&M manuals							

- ***Documentation complete as per contract documents*** ..... ___ ***YES*** ___ ***NO***

3. Model verification

[Contr = _____]

1 = as specified, 2 = as submitted, 3 = as installed. Check if Okay. Enter note number if deficient.

Equip Tag--->		B-1	B-2			
Manuf.	1					
	2					
	3					
Model	1					
	2					
	3					
Serial #	3					
Capacity	1					
	2					
	3					
Volts/Ph/A	1					
	2					
	3					
	1					
	2					
	3					

- ***The equipment installed matches the specifications for given trade*** ..... ___ ***YES*** ___ ***NO***

4. Physical Installation Checks

Check if Okay. Enter comment or note number if deficient.

Check	Equip Tag->	B-1	B-2				Contr.
General Installation							
General appearance good, no apparent damage							
Site sufficiently clean for testing							
Equipment labels affixed							
Tube pulling, and access door space adequate							
Required seismic restraints in place							
Flue completely installed and sloped properly							
Combustion air supply complete							
System filled							
Pressure gages installed							
Thermometers installed							

Notes:

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->	B-1	B-2				Contr.
Pressure gages installed						
P/T plugs installed as per drawings						
Multiple boiler interlocks completed						
Piping (Immediately around unit. Full piping in HW Piping Checklist.)						
Gas piping installed and tested (supply is at proper pressure)						
Hydronic piping complete, including makeup water piping and safety reliefs						
Hydronic system flushing complete and strainers cleaned						
Isolation valves and balancing valves installed						
Pipe fittings and accessories complete						
Test ports installed near all control sensors and per spec						
Flow switch installed as required						
Flow meters installed as required						
Piping type and flow direction labeled on piping						
Chemical treatment system or plan installed						
ASME pressure vessel data sheet or certification tag posted and inspection complete for each expansion tank						
Expansion tanks verified to not be air bound and system completely full of water						
Air vents and bleeds at high points of systems functional						
Electrical and Controls						
Power to unit and disconnect installed						
All electrical components grounded						
Sensors calibrated (see below)						
Control system interlocks hooked up and functional						
All control devices, pneumatic tubing and wiring complete						
Motorized valves, dampers and float switches functional						
Fire and smoke sensing components functional						
Final						
Startup report completed with this checklist attached						
Startup report includes written certification from boiler manufacturer that all specified features, controls and safeties have been installed and are functioning properly and that the installation and application comply with the manufacturer's recommendations.						
Safeties installed and safe operating ranges for this equipment provided to the commissioning agent						
Heating water piping and pumps prefunctional checklists completed						

Notes:

- ***The checklist items of Part 4 are all successfully completed for given trade.___ YES ___ NO***

5. Operational Checks (These augment manufacturer's list.)

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->	B-1	B-2				Contr.
Boiler safeties energized and tested						
Startup report includes optimal and actual percent CO_2, CO, O_2, stack temperature; combustion efficiency						
Specified sequences of operation and operating schedules have been implemented with all variations documented						
Specified point-to-point checks have been completed and documentation record submitted for this system						

- ***The checklist items of Part 5 are all successfully completed for given trade.___ YES ___ NO***

6. Sensor and Actuator Calibration

All field-installed temperature, CO, CO_2 and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated using the methods and tolerances given in the Calibration and Leak-by Test Procedures document. All test instruments shall have had a certified calibration within the last 12 months: Y/N_____. Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.

Sensor or Actuator & Location	Loc-ation OK	**1st** Gage or BAS Value	Instr. Meas'd Value	**Final** Gage or BAS Value	Pass Y/N?

Sensor & Location	Loc-ation OK	**1st** Gage or BAS Value	Instr. Meas'd Value	**Final** Gage or BAS Value	Pass Y/N?

Gage reading = reading of the permanent gage on the equipment. BAS = building automation system. Instr. = testing instrument. Visual = actual observation. The Contractor's own sensor check-out sheets may be used in lieu of the above, if the same recording fields are included and the referenced procedures are followed.

- ***All sensors are calibrated within required tolerances .....___ YES ___ NO***

-- END OF CHECKLIST --

Notes:

Functional Checklist

Project: Utah National Guard 144th Company Readiness Center

FC-3: Pumps P-1, P-2, P-3, P-4

1. Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This functional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ List attached.

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date	Sheet Metal Contractor	Date
TAB Contractor	Date	General Contractor	Date

Functional checklist items are to be completed as part of startup & initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Agent	Date	Owner's Representative	Date

Notes:

2. Requested documentation submitted

Check if Okay. Enter comment or note number if deficient.

Check / Equip Tag->	P-1	P-2	P-3	P-4		Contr.
Manufacturer's cut sheets						
Performance data (fan curves, coil data, etc.)						
Installation and startup manual and plan						
Sequences and control strategies						
O&M manuals						

- ***Documentation complete as per contract documents for given trade ....._____ YES _____ NO***

3. Model verification

[Contr = _____]

1 = as specified, 2 = as submitted, 3 = as installed. Check if Okay. Enter note number if deficient.

Equip Tag--->		P-1	P-2	P-3	P-4	
Manuf.	1					
	2					
	3					
Model	1					
	2					
	3					
Serial #	3					
Volts/Ph/A	1					
	2					
	3					
RPM	1					
	2					
	3					
GPM	1					
	2					
	3					
Motor Hp	1					
	2					
	3					
Motor Effic	1					
	2					
	3					
Head	1					
	2					
	3					

- ***The equipment installed matches the specifications for given trade ....._____ YES _____ NO***

Notes:

4. Physical Installation Checks

Check if Okay. Enter comment or note number if deficient.

Check	Equip Tag->	P-1	P-2	P-3	P-4		Contr.
General Installation							
Label permanently affixed							
Pumps in place and properly grouted							
Vibration isolation devices installed and functional							
Factory alignment appears correct							
Field alignment, if required, completed							
Seismic anchoring installed							
Temperature, pressure and flow gages and sensors installed							
Pump lubricated							
Piping (immediately around pump, see full piping checklist)							
Pipe fittings complete and pipes properly supported							
Pipes properly labeled							
Pipes properly insulated							
Strainers in place and clean							
Piping system properly flushed							
Valves properly tagged							
Sensors calibrated (See calibration section below)							
Electrical and Controls							
Power disconnects in place and labeled							
All electric connections tight							
Proper grounding installed for components and unit							
Motor safeties in place and operable							
Control system interlocks hooked up and functional							
All control devices, pneumatic tubing and wiring complete							
VFD							
VFD powered (wired to controlled equipment)							
VFD interlocked to control system							
Pressure or other controlling sensor properly located and per drawings and calibrated							
Drive location not subject to excessive temperatures							
Drive location not subject to excessive moisture or dirt							
Drive size matches motor size							
Internal setting designating the model is correct							
Input of motor FLA represents 100% to 105% of motor FLA rating							
Appropriate Volts vs Hz curve is being used							

Notes:

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->	P-1	P-2	P-3	P-4		Contr.
Accel and decel times are around 10-50 seconds, except for special applications. Actual decel = _____ Actual accel = _____						
Lower frequency limit at around 10-30% Actual = _____						
Upper frequency limit set at 100%, unless explained otherwise						
Unit is programmed with full written programming record on site						
VFD speed at panel matches BAS readout						
TAB						
Installation of system and balancing devices allowed balancing to be completed following specified NEBB or AABC procedures and contract documents						
Final						
Startup report completed with this checklist attached						
Safeties installed and safe operating ranges for this equipment provided to the commissioning agent						

- ***The checklist items of Part 4 are all successfully completed for given trade.___ YES ___ NO***

5. Operational Checks (These augment mfr's list. This is not the functional performance testing.)

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->	P-1	P-2	P-3	P-4		Contr.
The HOA switch properly activates and deactivates the unit						
Pump rotation verified correct						
No unusual noise or vibration						
No leaking apparent around fittings						
Measure line to line voltage phase imbalance for each pump: (%Imbalance = 100 x (avg. - lowest) / avg.) Record imbalance of each pump in cell. Imbalance less than 2%?						
Record full load running amps for each pump. _____rated FL amps x _____srvc factor = _____ (Max amps). Running less than max?						
Specified sequences of operation and operating schedules have been implemented with all variations documented						
Specified point-to-point checks have been completed and documentation record submitted for this system						

- ***The checklist items of Part 5 are all successfully completed for given trade.___ YES ___ NO***

Notes:

6. Sensor and Actuator Calibration

All field-installed temperature and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated using the methods and tolerances given in the Calibration and Leak-by Test Procedures document. All test instruments shall have had a certified calibration within the last 12 months: Y/N_____. Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.

Sensor or Actuator & Location	Loc-ation OK	**1st** Gage or BAS Value	Instr. Meas'd Value	**Final** Gage or BAS Value	Pass Y/N?

Sensor & Location	Loc-ation OK	**1st** Gage or BAS Value	Instr. Meas'd Value	**Final** Gage or BAS Value	Pass Y/N?

Gage reading = reading of the permanent gage on the equipment. BAS = building automation system. Instr. = testing instrument. Visual = actual observation. The Contractor's own sensor check-out sheets may be used in lieu of the above, if the same recording fields are included and the referenced procedures are followed.

- ***All sensors are calibrated within required tolerances*** ..... ___ ***YES*** ___ ***NO***

-- END OF CHECKLIST --

Notes:

Functional Checklist

Project: Utah National Guard 144th Company Readiness Center

FC-4: Vehicle Exhaust Fan VEF-1

1. Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This functional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ List attached.

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date	Sheet Metal Contractor	Date
TAB Contractor	Date	General Contractor	Date

Functional checklist items are to be completed as part of startup & initial checkout. This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.

- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Agent	Date	Owner's Representative	Date

Notes:

2. Requested documentation submitted

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->	VEF-1					Contr.
Manufacturer's cut sheets						
Performance data (fan curves, coil data, etc.)						
Installation and startup manual and plan						
Sequences and control strategies						
O&M manuals						

- ***Documentation complete as per contract documents for given trade ....._____ YES _____ NO***

3. Model verification

[Contr = _____]

1 = as specified, 2 = as submitted, 3 = as installed. Check if Okay. Enter note number if deficient.

Equip Tag--->		VEF-1				
Manuf.	1					
	2					
	3					
Model	1					
	2					
	3					
Serial #	3					
CFM	1					
	2					
	3					
Sound Pwr	1					
Level @ 63,	2					
250; 1K Hz	3					

- ***The equipment installed matches the specifications for given trade....._____ YES _____ NO***

4. Installation Checks

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->	VEF-1					Contr.
Cabinet and General Installation						
Permanent labels affixed						
Casing condition good: no dents, leaks, door gaskets installed						
Mountings checked and shipping bolts removed						
Vibration isolators installed						
Equipment guards installed						
Pulleys aligned						
Belt tension correct						
Plenums clear of debri						
Fans rotate freely						
Fire and balance dampers installed						

Notes:

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->	VEF-1					Contr.
Backdraft dampers installed, per drawings, and operate freely						
Duct system complete						
Electrical						
Electrical connnections complete						
Disconnect switch installed						
Overload heaters in place						
Control connections complete						
Operational Checks						
Fan rotation correct						
Electrical interlocks verified						
Any fan status indicators functioning						
No unusual vibration or and noise						
Record full load running amps for each fan. _____rated FL amps x _____srvc factor = _____ (Max amps). Running less than max?						
Check voltage: Rate = _____ Actual = _____ Within 5%?						
The disconnect switch properly operates						
After 24 hours of operation, recheck belt tension and alignment						

- ***The checklist items of Part 4 are all successfully completed for given trade.___ YES ___ NO***

-- END OF CHECKLIST--

Notes:

Functional Checklist

Project: Utah National Guard 144th Company Readiness Center

PC-5: Hot Water Piping

1. Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This functional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ List attached.

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date	Sheet Metal Contractor	Date
TAB Contractor	Date	General Contractor	Date

Functional checklist items are to be completed as part of startup & initial checkout. This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.

- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Agent	Date	Owner's Representative	Date

Notes:

2. Requested documentation submitted

Check if Okay. Enter comment or note number if deficient.

Check	Y / N	Contr.
Manufacturer's cut sheets		
Performance data		
Flushing and cleaning plan, including staging of multiple floors		
O&M manuals		

- ***Documentation complete as per contract documents for given trade ....._____ YES _____ NO***

3. Physical Installation Checks

Check	Y / N	Contr.	Note
Piping			
Pipe fittings complete and pipes properly supported			
Seismic anchoring installed			
Pipes properly labeled			
Pipes properly insulated			
Strainers in place and clean			
Isolation valves and balancing valves installed			
Test ports (P/T) installed near all control sensors and as per spec			
Flushing and cleaning plan submitted and approved (Minimum flushing velocity in all pipe sections is the greater of 4 ft. per second, or 1.5 times the velocity at design flow)			
Piping system properly flushed and cleaned and temporary piping removed (report attached)			
10% of strainers and Owner-selected low-point drains opened and witnessed by Owner to be clean. (List points checked below).			
Piping pressure tested according to contract documents (report attached)			
Chemical treatment system or plan installed			
Water treatment report submitted according to contract documents			
No leaking apparent around fittings			
ASME pressure vessel data sheet or certification tag posted and inspection complete for each expansion tank			
Expansion tanks verified to not be air bound and system completely full of water. System completely purged of all air.			
Air vents and bleeds at high points of systems functional			
Valves (except coil valve checklists are with the unit checklist)			
Valve labels permanently affixed			
Valves installed in proper direction			
No leaks			
Valves stroke fully and easily and spanning is calibrated (see calibration section below)			

Notes:

Check	Y / N	Contr.	Note
Valves that require a positive shut-off are verified to not be leaking when closed at normal operating pressure per "Calibration and Leak-by Test Procedures" document. List: _____			
Sensors and Gages			
Temperature, pressure and flow gages and sensors installed			
Piping gages, BAS and chiller panel temperature and pressure readouts match (see calibration section below)			
TAB			
Installation of system and balancing devices allowed balancing to be completed following specified NEBB or AABC procedures and contract documents			

- ***The checklist items of Part 3 are all successfully completed for given trade.___ YES ___ NO***

4. Sensor and Actuator Calibration

All field-installed temperature, relative humidity, CO, CO_2 and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated using the methods and tolerances given in the Calibration and Leak-by Test Procedures document. All test instruments shall have had a certified calibration within the last 12 months: Y/N_____. Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.

Sensor or Actuator & Location	Loc-ation OK	**1st** Gage or BAS Value	Instr. Meas'd Value	**Final** Gage or BAS Value	Pass Y/N?

Sensor & Location	Loc-ation OK	**1st** Gage or BAS Value	Instr. Meas'd Value	**Final** Gage or BAS Value	Pass Y/N?

Gage reading = reading of the permanent gage on the equipment. BAS = building automation system. Instr. = testing instrument. Visual = actual observation. The Contractor's own sensor check-out sheets may be used in lieu of the above, if the same recording fields are included and the referenced procedures are followed.

- ***All sensors are calibrated within required tolerances .....___ YES ___ NO***

- END OF CHECKLIST -

Notes:

Functional Checklist

Project: Utah National Guard 144th Company Readiness Center

FC-6: Variable Frequency Drives

1. Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This functional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ List attached.

Mechanical Contractor	Date	Controls Contractor	Date
Electrical Contractor	Date	Sheet Metal Contractor	Date
TAB Contractor	Date	General Contractor	Date

Functional checklist items are to be completed as part of startup & initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Agent	Date	Owner's Representative	Date

Notes

2. Requested documentation submitted

Check if Okay. Enter comment or note number if deficient.

Check	Equip Tag->						Contr.
Manufacturer's cut sheets							
Performance data (fan curves, coil data, etc.)							
Installation and startup manual and plan							
Sequences and control strategies							
O&M manuals							

- ***Documentation complete as per contract documents for given trade ....._____ YES _____ NO***

3. Model verification

[Contr = _____]

1 = as specified, 2 = as submitted, 3 = as installed. Check if Okay. Enter note number if deficient.

Equip Tag--->						
Manuf.	1					
	2					
	3					
Model	1					
	2					
	3					
Serial #	3					
Capacity	1					
	2					
	3					

- ***The equipment installed matches the specifications for given trade ....._____ YES _____ NO***

4. Installation Checks

Check if Okay. Enter comment or note number if deficient.

Check	Equip Tag->						Contr.
General Installation							
Permanent label affixed							
Securely mounted							
Drive location not subject to excessive temperatures							
Drive location not subject to excessive moisture or dirt							
Drive size matches motor size							
Pilot lights functioning							
VFD wired to controlled equipment							
Programming and Controls							
Internal setting designating the model is correct							
Input of motor FLA represents 100% to 105% of motor FLA rating							
Appropriate Volts vs Hz curve is being used							

Notes

Check if Okay. Enter comment or note number if deficient.

Check Equip Tag->						Contr.
Accel and decel times are around 10-50 seconds, except for special applications. Record actual for each unit.						
Lower frequency limit at 0 for VAV fans and around 10-30% for chilled water pumps. Record actual for each unit.						
Upper frequency limit set at 100%, unless explained otherwise						
VFD interlocked to control system						
Static or differential pressure sensor or other controlling sensor properly located and per drawings						
Controlling sensor calibrated						
Unit is programmed with full written programming record submitted						
RPM readout in BAS verified with VFD readout						
All control devices, pneumatic tubing and wiring complete						
Specified sequences of operation and operating schedules have been implemented with all variations documented						
Specified point-to-point checks have been completed and documentation record submitted for this system						
Final						
Startup report completed with this checklist attached						
Safeties installed and safe operating ranges for this equipment provided to the commissioning agent						

- ***The checklist items of Part 4 are all successfully completed for given trade.___ YES ___ NO***

-- END OF CHECKLIST --

Notes

Functional Checklist

Project: Utah National Guard 144th Company Readiness Center

FC-7: Direct Digital Controls

1. Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This functional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed. ___ List attached.

Mechanical Contractor	Date	Controls Contractor	Date
TAB Contractor	Date	General Contractor	Date

Functional checklist items are to be completed as part of startup & initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Commissioning Agent	Date	Owner's Representative	Date

Notes

2. Requested documentation submitted

Check	
Manufacturer's cut sheets	
Sequences and control strategies	
O&M manuals	

- ***Documentation complete as per contract documents for given trade ....._____ YES _____ NO***

3. Sequence Checks

Check	
AHU -1	
Occupied Mode	
Outside and exhaust dampers remain closed until return air temperature reaches 68°	
When outside air temperature reaches 68°, outside air dampers open to minimum position	
Supply air temperature resets from 65° to 53° based on thermostat call	
Economizer operates when outside air temperature is within 2° of supply air temperature set point	
Minimum outside air volume is 2,700 cfm over range of supply air volumes	
Unoccupied Mode	
Air handler is off, outside air dampers are closed, cooling is locked out, heating set point is 60° and cooling set point is 78°	
Air handler starts to maintain minimum set point	
Zone Control	
Heating output from each zone controller modulates heating water valve position	
Cooling output from zone controller resets supply air discharge set point	
Supply Fan Speed Control	
Fan speed modulates to maintain duct static set point	
Duct static set point is reduced to the lowest required to meet peak box demand, and has been reduced from the TAB setting	
Exhaust Fan Speed Control	
Fan speed modulates to maintain building static pressure set point	
Building static pressure set point is raised to maximum required to provide neutral pressure at building entrance	
Safeties	
Fans shut down on smoke alarm	
Fans shut down on freeze stat	
Boilers	
Boiler is enabled when called by controller	
Boiler controls are monitored by DDC	
Lead/lag boiler and boiler pump alternation occurs	
Pump status is reported through motor current sensors	
Pump failure generates alarm that dials out.	

Notes

Check	
Pump failure alarm is properly received	
Alternate pump starts on lead pump failure	
Boiler maintains set point	
Three way valve modulates to maintain secondary loop set point	
Secondary loop set point resets	
Secondary loop pumps starts on call	
Secondary loop pump speed modulates from loop differential pressure controller	
Loop differential pressure set point is minimum required to provide flow at hydraulically remote valve	
Secondary loop pump status is reported through motor current sensors	
Secondary loop alarms on failure, and alarm dial out	
Pump failure alarm is properly received	
VAV Boxes	
Box controller measures and reports actual airflow	
Box maintains minimum set point	
Box modulates through full range to maximum flow set point	
Box controller modulates heating water valve in response to heating demand	
CO_2 sensor is calibrated	
CO_2 sensor effects VAV box control	
VAV box closes during unoccupied mode	
Fan Coil Unit FC-1	
Fan starts and heating water valve modulates when space temperature falls below set point	
Fan Coil Unit FC-2	
Fan operates continuously in occupied mode	
Occupied override switch is operational, and provides three hour override	
Heating valve modulates in response to call for heating	
Outside air dampers modulate in response to CO_2 sensor output	
CO_2 sensor controls to maintain CO_2 differential	
Fan Coil Unit FC-3	
Unit operates in response to humidity sensor	
Humidity sensor is calibrated	

- ***The checklist items of Part 3 are all successfully completed for given trade.___ YES ___ NO***

-- END OF CHECKLIST --

Notes

MECHANICAL BASIS OF DESIGN

1. Heating/Air Conditioning:
    a. Assembly Hall: Hydronic heat-only fan coil with outside air controlled via CO_2 sensor.
    b. Unit storage: Heat-only fan coil unit with fixed minimum outside air.
    c. Vehicle training bay: High-intensity gas fired radiant heater.
    d. All other areas excluding restrooms and corridors: rooftop VAV air handler with DX cooling and hydronic emergency heat.

2. Air Distribution: Overhead mixing-type diffusers with plenum return

3. Heat Generation: Gas-fired hot water boiler, condensing type, low temperature water for energy efficiency and control simplicity. Hot water will be distributed to air handler pre-heat coil and zone reheat coils through a constant volume primary, variable volume secondary system. Hot water temperature will be reset on outdoor air temperature in order to provide better comfort through more consistent heating

4. Ventilation:
    a. Assembly Hall: Outside air controlled via CO_2 sensor and provided via roof hood.
    b. Unit storage: Fixed minimum outside air provided via roof hood.
    c. Vehicle training bay: dedicated vehicle exhaust system that connects to the exhaust pipe.
    d. All other areas excluding restrooms and corridors: Demand Controlled Ventilation (DCV) through zone CO_2 sensors to set VAV box minimum position and air handler outside air damper position. The above system will be sequenced with100% economizer control.
    e. Toilets and janitor closets will be separately ventilated. No exhaust air heat recovery is planned.

5. Refrigeration: Ozone friendly refrigerant R-134a or R-407c

6. Plumbing: Water service at mechanical room, with two-stage pressure reducing station, for distribution through building. Copper piping throughout. Cast iron sanitary sewer above ground, PVC buried waste piping to site sewer system. Flush valve fixtures, automatic on urinals and manual on water closets Hot water for showers/locker rooms generated by a high efficiency condensing water heater located close to the locker rooms, in order to minimize or eliminate re-circulation piping and controls. Electric resistance point of use water heaters at lavatories and sinks remote to the water heater. Low pressure gas piping to boiler and water heater. Primary roof drains to site storm drain system, secondary drains to surface.

7. Controls: Direct Digital Control for central control and monitoring of air handler, VAV boxes, boilers and lighting.

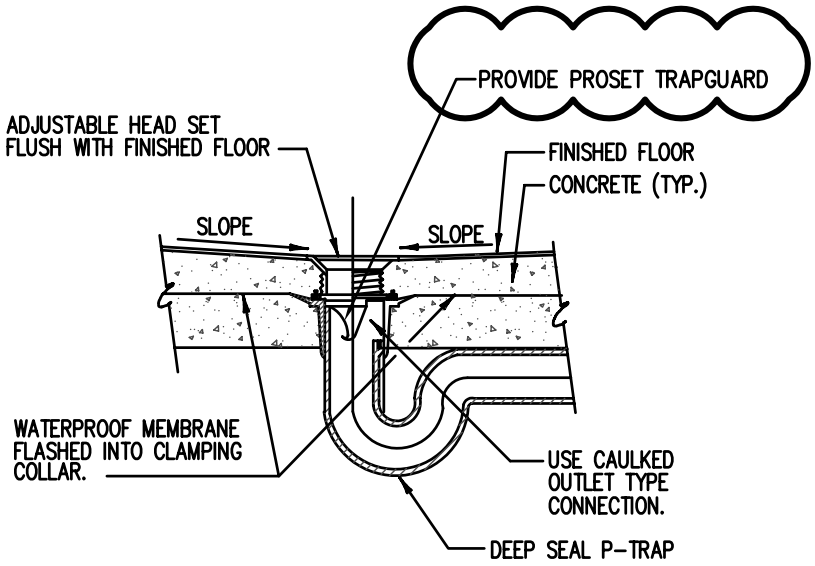
8. Fire Protection: Building is sprinkled throughout, typically light hazard.

9. Energy Conservation: As a DFCM project, this building will meet the currently adopted DFCM Energy Standard for New Construction

10. SpiRiT. The program goal is SpiRiT Gold.

Mechanical Zone Requirements

Zone	Rooms	Temperature	Humidity	Ventilation	Noise (RC Mark II)	Comments
A	Lobby Offices, Classrooms, Distribution, Conference Room, Break Room, Library/Classroom	Occupied: 72° – 75° Unoccupied: 65° – 80°	Minimum: no control Maximum: 55%	20 cfm/person	25 – 35	VAV reheat with zone level CO_2 sensors for ventilation control.
B	Toilet Rooms Locker Rooms	As controlled by exhaust made up via building air.	n/a	Greater of: 0.50 cfm/ft^2 or 75 cfm/ wc or urinal + 50 cfm/shower head	45	Heating/Cooling is not allowed.
C	Assembly Hall	Occupied: 72° minimum Unoccupied: 65° minimum	No control	15 cfm/person	45	Exposed ductwork, heating only.
D	Fitness Room	65° – 72°	n/a	25 cfm/person	45	Design air system to overcool space for comfort
E	Telecom/Data Room Electrical Room	72° +/- 2°	30% - 60%	0.1 cfm/ft^2	n/a	VAV - cooling only
F	Elevator Equipment	60° – 85°	10% - 90%	1 cfm/ft^2 for odor control	n/a	Cool by transferring ventilation air from adjoining space – no dedicated cooling
G	Unit Storage	Heating: 65° Cooling: no control	No control	None	n/a	Heating only, no cooling, exhaust for odor control
H	Vehicle Training Bay	Heating: 55° Cooling: no control	No control	Dedicated Vehicle Exhaust	n/a	Overhead radiant heating only.
I	Mechanical Room	55° – 85°	No control	None	n/a	VAV - cooling only
J	Storage	No control	No control	None	n/a	HVAC is not allowed



A2

TYPICAL FLOOR DRAIN DETAIL

NO SCALE

Project: UNG 144TH READINESS CTR	Sheet Title: MECH. SUPPLEMENTAL INSTRUCTIONS #1 TRAP SEAL MAINTENANCE	Date: 5 APR 06	ARCH REF: –
		By: KTK	
Original Sheet No: PL501	Colvin Engineering Associates, Inc. 244 West, 300 North, Suite 200 / Salt Lake City, Utah 84103-1108 (801) 322-2400 / Fax (801) 322-2416	Scale: NO SCALE	MSI 1.01
		Job No: 2004-087.00	

Colvin Engineering Associates, Inc.
HIGH PERFORMANCE DESIGN

MECHANICAL ADDENDUM NO. 1

144th Readiness Center
Camp Williams

CEA PROJECT NO. 2004-087.00

April 13, 2006

PRODUCT SUBSTITUTIONS / PRIOR APPROVALS

Item No.	Specification Section	Product Type	Alternate Manufacturers
1	15050	Check Valves, Strainers	Metraflex
2	15430	Gauges, thermometers	Miljoco
3	15511	Air separators, glycol fill systems	Wessels
4	15511	Air separators, flow measuring, Venturis	Bell & Gossett
5	15910	Variable Frequency Drives	Mitsubishi

The above named alternate equipment manufacturers stand approved in name only. Approval here in no way relieves the supplier from complying with all other engineering, weight spatial, and quality requirements of equipment indicated in the contract documents. Contractors using products from the above named alternate manufacturers shall refer to Specification Section 15010 for detailed contractor responsibilities related to the use of alternate brands not used as the Basis of Design.

END OF ADDENDUM NO. 1

HVAC / Energy Efficient Solutions / CFD Modeling / Air Pollution Control
244 West 300 North, Suite 200 / Salt Lake City, Utah 84103-1147 / 801.322.2400 / FAX 801.322.2416

The following is a description of Electrical Addendum changes to the electrical construction documents for Utah National Guard 144th Company Readiness Center:

SPECIFICATIONS

1. Section 16610.2.1.A:
   Add Generac to list of approved manufacturers for engine generator sets.

2. Section 16610.2.1.B:
   Add Generac to list of approved manufacturers for transfer switches.

3. Add new specification 16810: Electrical Commissioning Requirements. Refer to attached.

ELECTRICAL DRAWINGS

Refer to attached 8-1/2 x 11" sheets for changes described below.

SHEET E101:
1. Add siren to access control symbols.

SHEET E102:
1. Add light fixture type SW3D.

SHEET 202:
1. Change requirements for site telephone/data conduit and cabling.

SHEET E301:
1. Reverse face direction of exit sign in Corridor 127.
2. Change light fixture type for Vehicle Training Bay 113 to Type SW3D.

SHEET E302:
1. Add exit signs for classroom per code review comments by Enzo Calfa dated April 1, 2006.

SHEET E401:
1. Add telephone/data outlet in Unit Storage 115 outside vault door.
2. Change telephone outlet to telephone/data outlet in Vault 115A.

SHEET E501:
1. Add fire alarm pull stations in Assembly Hall 114 and Stairs 103.
2. Add several devices for IDS system in Unit Storage 115, Vault 115A and Corridor 128 areas for compliance to program. Add new keyed notes 2, 3, and 4.

SHEET E502:
1. Add (3) smoke detectors in Hall 210.

SHEET E702: Intrusion Detection System Riser:
1. Add several devices to reflect changes made to Sheet E501 above.
2. Revise notes to indicate IDS devices and the cabling for this system are furnished by owner. The installation is specified to be provided by Division 16.

End of Addendum

SECTION 16810 - ELECTRICAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. OPR and BoD documentation prepared by Owner and Architect contains requirements that apply to this Section.

1.2 ELECTRICAL SYSTEM COMMISSIONING SUMMARY

A. Verify and ensure that electrical elements and systems are designed, installed, programmed, calibrated, and tested to operate as intended. These systems include, but are not necessarily limited to, the following systems:

1. Lighting and associated controls.
2. Emergency electrical systems.
3. Fire alarm system.
4. Intrusion detection system.
5. Audio visual system.

B. Additionally, the commissioning authority shall commission each system in accordance with all manufacturer's written instructions and recommendations.

C. Requirements of commissioning include, but are not necessarily limited to, the following:

1. Engage a commissioning authority.
2. Confirm design intent and basis of design documentation
3. Develop and utilize a commissioning plan.
4. Verify installation, functional performance, training, and documentation.
5. Complete a commissioning report.

1.3 DEFINITIONS

A. BoD: Basis of Design.

B. CxA: Commissioning Authority.

C. OPR: Owner's Project Requirements.

D. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor: Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

1.5 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and Contractor for use in developing the commissioning plan; systems manual; operation and maintenance training plan; and testing plans and checklists.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:

1. Coordination meetings.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Testing meetings.
4. Demonstration of operation of systems, subsystems, and equipment.

C. Provide the BoD documents, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on behalf of the Contractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Participate in construction-phase coordination meetings.
2. Participate in maintenance orientation and inspection.
3. Participate in operation and maintenance training sessions.
4. Participate in final review at acceptance meeting.
5. Certify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
6. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
7. Review and approve final commissioning documentation.

B. Subcontractors shall assign representatives with expertise and authority to act on behalf of subcontractors and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Participate in construction-phase coordination meetings.
2. Participate in maintenance orientation and inspection.
3. Participate in procedures meeting for testing.

4. Participate in final review at acceptance meeting.
5. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to CxA for incorporation into the commissioning plan. Update schedule on a weekly basis throughout the construction period.
6. Provide information to the CxA for developing construction-phase commissioning plan.
7. Participate in training sessions for Owner's operation and maintenance personnel.
8. Provide updated Project Record Documents to the CxA on a daily basis.
9. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the CxA, as specified in Division 1 Section "Operation and Maintenance Data."
10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures and participate in testing of installed systems, subsystems, and equipment.

1.7 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Prepare a construction-phase commissioning plan. Collaborate with Contractor and with subcontractors to develop test and inspection procedures. Include design changes and scheduled commissioning activities coordinated with overall Project schedule. Identify commissioning team member responsibilities, by name, firm, and trade specialty, for performance of each commissioning task.

C. Review and comment on submittals from Contractor for compliance with the OPR, BoD, Contract Documents, and construction-phase commissioning plan. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the OPR and BoD.

D. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss progress of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The CxA shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.

E. At the beginning of the construction phase, conduct an initial construction-phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; and Project completion.

F. Observe and inspect construction and report progress and deficiencies. In addition to compliance with the OPR, BoD, and Contract Documents, inspect systems and equipment installation for adequate accessibility for maintenance and component replacement or repair.

G. Prepare Project-specific test and inspection procedures and checklists.

H. Schedule, direct, witness, and document tests, inspections, and systems startup.

I. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.

J. Certify date of acceptance and startup for each item of equipment for start of warranty periods.

K. Review Project Record Documents for accuracy. Request revisions from Contractor to achieve accuracy. Project Record Documents requirements are specified in Division 1 Section "Project Record Documents."

L. Review and comment on operation and maintenance documentation and systems manual outline for compliance with the OPR, BoD, and Contract Documents. Operation and maintenance documentation requirements are specified in Division 1 Section "Operation and Maintenance Data."

M. Prepare operation and maintenance training program and provide qualified instructors to conduct operation and maintenance training. Operation and maintenance training is specified in Division 1 Section "Demonstration and Training."

N. Prepare commissioning reports.

O. Assemble the final commissioning documentation, including the commissioning report and Project Record Documents.

1.8 COMMISSIONING DOCUMENTATION

A. Index of Commissioning Documents: CxA shall prepare an index to include storage location of each document.

B. OPR: A written document, prepared by Owner, that details the functional requirements of Project and expectations of how it will be used and operated. This document includes Project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

C. BoD Document: A document, prepared by Architect, that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

D. Commissioning Plan: A document, prepared by CxA, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited to the following:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.

3. Identification of systems and equipment to be commissioned.
4. Description of schedules for testing procedures along with identification of parties involved in performing and verifying tests.
5. Identification of items that must be completed before the next operation can proceed.
6. Description of responsibilities of commissioning team members.
7. Description of observations to be made.
8. Description of requirements for operation and maintenance training, including required training materials.
9. Description of expected performance for systems, subsystems, equipment, and controls.
10. Schedule for commissioning activities with specific dates coordinated with overall construction schedule.
11. Identification of installed systems, subsystems, and equipment, including design changes that occurred during the construction phase.
12. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
13. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
14. Step-by-step procedures for testing systems, subsystems, and equipment with descriptions for methods of verifying relevant data, recording the results obtained, and listing parties involved in performing and verifying tests.

E. Test Checklists: CxA shall develop test checklists for each system, subsystem, or equipment including interfaces and interlocks, and include a separate entry, with space for comments, for each item to be tested. Prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. Provide space for testing personnel to sign off on each checklist. Each checklist, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:

1. Name and identification code of tested item.
2. Test number.
3. Time and date of test.
4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
5. Dated signatures of the person performing test and of the witness, if applicable.
6. Individuals present for test.
7. Deficiencies.
8. Issue number, if any, generated as the result of test.

F. Certificate of Readiness: Certificate of Readiness shall be signed by Contractor, Subcontractor(s), Installer(s), and CxA certifying that systems, subsystems, equipment, and associated controls are ready for testing. Completed test checklists signed by the responsible parties shall accompany this certificate.

G. Test and Inspection Reports: CxA shall record test data, observations, and measurements on test checklists. Photographs, forms, and other means appropriate for the application shall be included with data. CxA shall compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

H. Corrective Action Documents: CxA shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Retest systems and equipment requiring corrective action and document retest results.

I. Issues Log: CxA shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the OPR, BoD, and Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.

1. Creating an Issues Log Entry:

   a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
   b. Assign a descriptive title of the issue.
   c. Identify date and time of the issue.
   d. Identify test number of test being performed at the time of the observation, if applicable, for cross-reference.
   e. Identify system, subsystem, and equipment to which the issue applies.
   f. Identify location of system, subsystem, and equipment.
   g. Include information that may be helpful in diagnosing or evaluating the issue.
   h. Note recommended corrective action.
   i. Identify commissioning team member responsible for corrective action.
   j. Identify expected date of correction.
   k. Identify person documenting the issue.

2. Documenting Issue Resolution:

   a. Log date correction is completed or the issue is resolved.
   b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
   c. Identify changes to the OPR, BoD, or Contract Documents that may require action.
   d. State that correction was completed and system, subsystem, and equipment is ready for retest, if applicable.
   e. Identify person(s) who corrected or resolved the issue.
   f. Identify person(s) documenting the issue resolution.

3. Issues Log Report: On a periodic basis, but not less than for each commissioning team meeting, CxA shall prepare a written narrative for review of outstanding issues and a status update of the issues log. As a minimum, CxA shall include the following information in the issues log and expand it in the narrative:

   a. Issue number and title.
   b. Date of the identification of the issue.
   c. Name of the commissioning team member assigned responsibility for resolution.
   d. Expected date of correction.

J. Commissioning Report: CxA shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall indicate whether systems, subsystems, and equipment have

been completed and are performing according to the OPR, BoD, and Contract Documents. The commissioning report shall include, but is not limited to, the following:

1. Lists and explanations of substitutions; compromises; variances in the OPR, BoD, and Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. This report shall be used to evaluate systems, subsystems, and equipment and shall serve as a future reference document during Owner occupancy and operation. It shall describe components and performance that exceed requirements of the OPR, BoD, and Contract Documents and those that do not meet requirements of the OPR, BoD, and Contract Documents. It may also include a recommendation for accepting or rejecting systems, subsystems, and equipment.
2. OPR and BoD documentation.
3. Commissioning plan.
4. Testing plans and reports.
5. Corrective modification documentation.
6. Issues log.
7. Completed test checklists.
8. Listing of off-season test(s) not performed and a schedule for their completion.

K. Systems Manual: CxA shall gather required information and compile systems manual. Systems manual shall include, but is not limited to, the following:

1. OPR and BoD, including system narratives, schematics, and changes made throughout the Project.
2. Project Record Documents as specified in Division 1 Section "Project Record Documents."
3. Final commissioning plan.
4. Commissioning report.
5. Operation and maintenance data as specified in Division 1 Section "Operation and Maintenance Data."

1.9 SUBMITTALS

A. Commissioning Plan Prefinal Submittal: CxA shall submit four hard copies of prefinal commissioning plan. Deliver one copy to Contractor, one to Owner, and one to Architect. Present submittal in sufficient detail to evaluate data collection and arrangement process. One copy, with review comments, will be returned to the CxA for preparation of the final construction-phase commissioning plan.

B. Commissioning Plan Final Submittal: CxA shall submit four hard copies and two sets of electronically formatted information of final commissioning plan. Deliver one hard copy and one set of discs to Owner, and one copy to Architect. The final submittal must address previous review comments. The final submittal shall include a copy of the prefinal submittal review comments along with a response to each item.

C. Test Checklists and Report Forms: CxA shall submit sample checklists and forms to Contractor quality-control manager and subcontractors for review and comment. Submit four copies of each checklist and report form.

D. Certificates of Readiness: CxA shall submit Certificates of Readiness.

E. Test and Inspection Reports: CxA shall submit test and inspection reports.

F. Corrective Action Documents: CxA shall submit corrective action documents.

G. Prefinal Commissioning Report Submittal: CxA shall submit four hard copies of the prefinal commissioning report. Include a copy of the preliminary submittal review comments along with CxA's response to each item. CxA shall deliver one copy to Owner and one copy to Architect. One copy, with review comments, will be returned to the CxA for preparation of final submittal.

H. Final Commissioning Report Submittal: CxA shall submit four hard copies and four sets of electronically formatted information of the final commissioning report. CxA shall deliver one hard copy and one set of discs to Owner, and one copy to Architect. The final submittal must address previous review comments and shall include a copy of the prefinal submittal review comments along with a response to each item.

1.10 QUALITY ASSURANCE

A. Instructor Qualifications: Factory-authorized service representatives, experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.

B. Test Equipment Calibration: Comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

1.11 COORDINATION

A. Coordinating Meetings: CxA shall conduct monthly coordination meetings of the commissioning team to review progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

B. Pretesting Meetings: CxA shall conduct pretest meetings of the commissioning team to review startup reports, pretest inspection results, testing procedures, testing personnel and instrumentation requirements, and manufacturers' authorized service representative services for each system, subsystem, equipment, and component to be tested.

C. Testing Coordination: CxA shall coordinate sequence of testing activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

D. Manufacturers' Field Services: CxA shall coordinate services of manufacturers' field services.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. Training Preparation Conference: Before operation and maintenance training, CxA shall convene a training preparation conference to include Owner's operation and maintenance personnel, Contractor, and subcontractors. In addition to requirements specified in Division 1 Section "Demonstration and Training," perform the following:

1. Review the OPR and BoD.
2. Review installed systems, subsystems, and equipment.
3. Review instructor qualifications.
4. Review instructional methods and procedures.
5. Review training module outlines and contents.
6. Review course materials (including operation and maintenance manuals).
7. Inspect and discuss locations and other facilities required for instruction.
8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

B. Training Modules: Develop an instruction program that includes individual training modules for each system, subsystem, and equipment as specified in Division 1 Section "Demonstration and Training."

END OF SECTION 01810

ACCESS CONTROL SYMBOLS

SYMBOL	DESCRIPTION	MOUNTING	REMARKS
REX	REQUEST-TO-EXIT MOTION DETECTOR	CEILING	
S	ELECTROMAGNETIC DOOR STRIKE	DOOR	
D	MAGNETIC DOOR CONTACT SWITCH	DOOR	
M	MAGNETIC LOCK	DOOR	
K	KEYPAD	+48"	
PK	PROXIMITY CARD READER / KEYPAD	+48"	
MK	MAGNETIC STRIP CARD READER / KEYPAD	+48"	
PR	PROXIMITY CARD READER	+48"	
MR	MAGNETIC STRIP CARD READER	+48"	
A	AUDIBLE ALARM HORN	+74"	
S	SEISMIC SENSORS	CEILING	
U	ULTRASONIC SENSOR WITH PROCESSOR		
PU	PASSIVE ULTRASONIC SENSOR WITH PROCESSOR		
SK	SIREN	+74"	

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ABBREVIATION SCHEDULE

NOTE: NOT ALL ABBREVIATIONS MAY BE USED.

E101

			COLOR SELECTED BY ARCHITECT			
AWI	MCPHILBEN	101	WALL MOUNTED AREA LIGHT MEDIUM THROW DISTRIBUTION IES FULL CUT OFF W/ PHOTOCELL COLOR SELECTED BY ARCHITECT	208	216	WALL
AWIE	MCPHILBEN	101	WALL MOUNTED AREA LIGHT MEDIUM THROW DISTRIBUTION IES FULL CUT OFF W/ PHOTOCELL COLOR SELECTED BY ARCHITECT	208	216	WALL
C42	METALUX	SS SERIES	COMMERCIAL WIDE STRIP LIGHT 48" LONG X 4" WIDE X 4" DEEP (1) ELECTRONIC BALLAST	120	64	SURFAC
C43D	METALUX	EIM SERIES	INDUSTRIAL WIDE STRIP LIGHT 48" LONG X 13" WIDE X 6-7/8" DEEP (1) ELECTRONIC DIMMING BALLAST	120	96	SURFAC
DF1	PORTFOLIO	PD6 SERIES	COMPACT FLUORESCENT DOWNLIGHT 6" DIAMETER CLEAR ALZAK REFLECTOR 13" LONG X 11" WIDE X 9" DEEP VERTICAL LAMP ORIENTATION DAMP LOCATION RATED (UNDER CANOPY) (1) ELECTRONIC BALLAST	120	32	RECESSE
DF2	PORTFOLIO	H2F SERIES	COMPACT FLUORESCENT SHOWER LIGHT 10" CEILING OPENING WITH GLASS DROP OPAL SPLAT 14" LONG X 13" WIDE X 6" DEEP HORIZONTAL LAMP ORIENTATION WET LOCATION RATED (SHOWER) (1) ELECTRONIC BALLAST	120	52	RECESSE
DH	PORFOLIO	MT800T-630	HIGH PRESSURE SODIUM DOWNLIGHT	120	90	RECESSE

WALL	1	HIGH PRESSURE SODIUM	150	2100	21	
WALL	1	HIGH PRESSURE SODIUM	150	2100	21	
SURFACE	2	48" LINEAR T8 FLUORESCENT	32	3500	82	
SURFACE	3	48" LINEAR T8 FLUORESCENT	32	3500	82	
RECESSED	1	COMPACT FLUORESCENT 4-PIN SOCKET AMALGAM	32	3500	82	
RECESSED	2	COMPACT FLUORESCENT 4-PIN SOCKET AMALGAM	26	3500	82	
RECESSED	1	HIGH PRESSURE SODIUM	70	2100	21	

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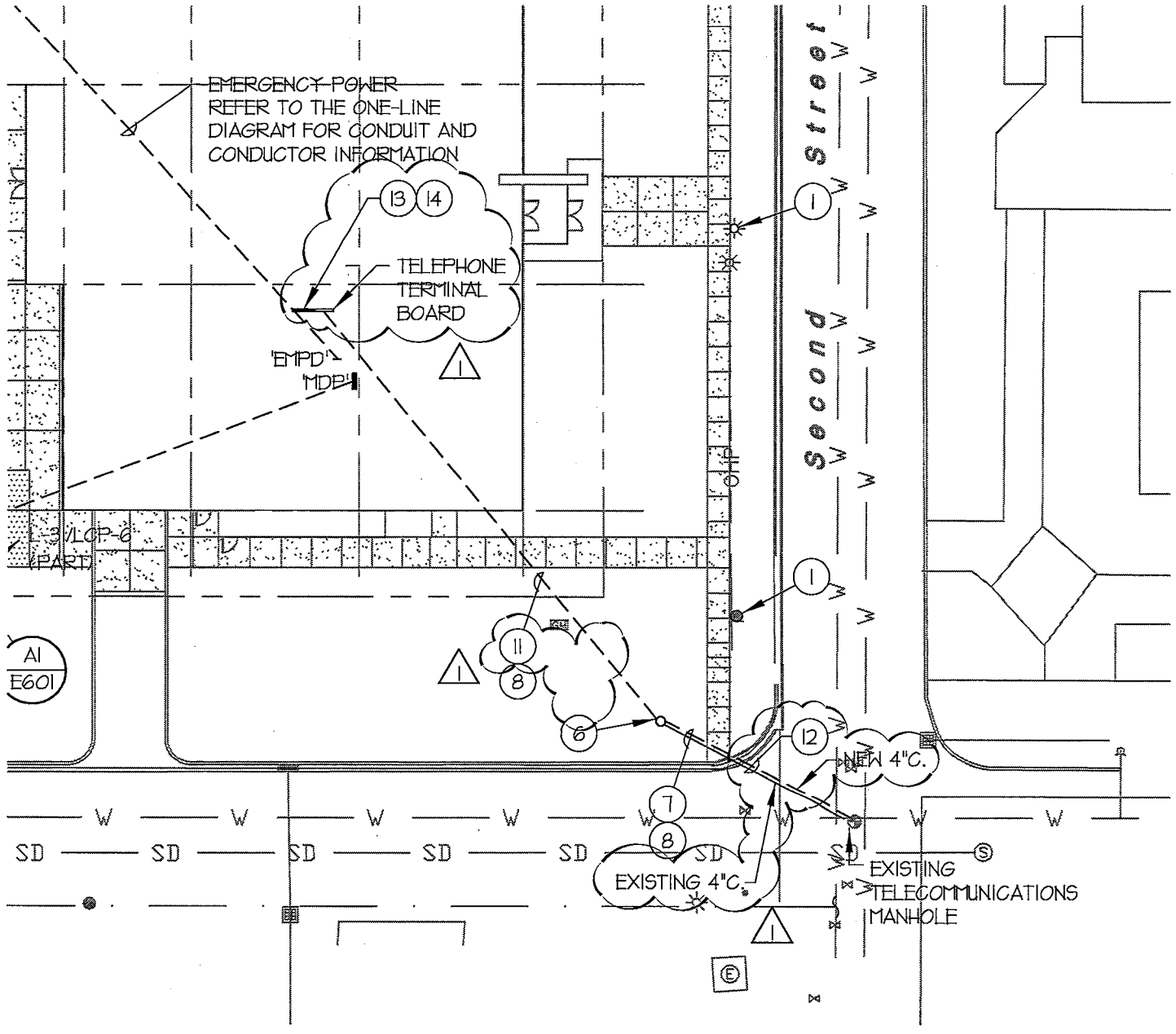
E102B


EMERGENCY POWER
REFER TO THE ONE-LINE
DIAGRAM FOR CONDUIT AND
CONDUCTOR INFORMATION
13
14
TELEPHONE
TERMINAL
BOARD
1
'EMPD'
MDP
Second Street
1
1
L-3/LCP-6
(PART)
A1
E601
11
8
1
6
12
NEW 4"C.
7
8
EXISTING 4"C.
EXISTING
TELECOMMUNICATIONS
MANHOLE
1
E
W
SD
S

E202A

E202B

OF UTILITY POLES. STUB UP AND CAP SPARE CONDUIT 6" ABOVE FINISHED GRADE.

6 EXISTING 4" CONDUIT STUB UP LOCATION. REMOVE ELBOW AND EXTEND SAME SIZE CONDUIT. REFER TO KEYED NOTE 11.

7 PROVIDE (4) 1" INNER DUCTS FROM EXISTING TELECOMMUNICATIONS MANHOLE INDICATED IN BOTH NEW AND EXISTING CONDUITS. PROVIDE 1/4" PULL ROPE IN ALL INNER DUCTS FOR FUTURE USE.

8 IN (1) 4" CONDUIT EXTEND (1) 100 PAIR COPPER TELEPHONE, (1) 4 PAIR COPPER TELEPHONE, AND (1) 12 STRAND 50/125 MULTIMODE FIBER CABLES TO COMMUNICATIONS BUILDING 6170 VIA (3) INNER DUCTS (INDICATED BY KEYED NOTE 7) TO EXISTING MANHOLE SHOWN AND VIA OTHER TELECOMMUNICATIONS MANHOLES ON SECOND STREET. CABLES SHALL BE WEATHER RESISTANT. THE 4 PAIR COPPER CABLE SHALL BE ROUTED TO THE GUARD SHACK. VERIFY LOCATION WITH THE GUARD.

9 CIRCUITS FOR ENGINE BLOCK HEATER AND CHARGER. 1

10 ELECTRICAL SERVICE CONDUITS; REFER TO THE ONE-LINE DIAGRAM FOR CONDUIT AND CONDUCTOR REQUIREMENTS.

11 PROVIDE (2) NEW 4" CONDUITS TO TELEPHONE TERMINAL BOARD. (ONE OF THESE CONDUITS IS A CONTINUATION OF AN EXISTING 4" CONDUIT. SEE KEYED NOTE 6.) EACH CONDUIT SHALL HAVE (4) 1" INNER DUCTS. ALL UNUSED INNER DUCTS SHALL CONTAIN PULL ROPES.

12 SAWCUT EXISTING PAVED ROAD TO ROUTE ADDED 4" CONDUIT. TRENCH, BACKFILL, PATCH AND REPAIR HARD SURFACE USING ARCHITECT APPROVED MATERIALS AND METHODS. PROVIDE REQUIRED CORE DRILLING IN EXISTING MANHOLE TO INSTALL CONDUIT. NEW CONDUIT SHALL BE CONCRETE ENCASED PER UNG STANDARDS.

13 THE 100 PAIR COPPER TELEPHONE CABLE SHALL BE TERMINATED ON A 100 PAIR FUSE PROTECTED BREAKOUT BLOCK IN THE NEW BUILDING AND BUILDING 6170. CONFIRM EXACT LOCATIONS WITH THE OWNER PRIOR TO WORK. REFER TO COMMUNICATIONS RISER DIAGRAM SHEET E702.

14 FIBER CABLE IN NEW BUILDING SHALL BE TERMINATED IN DATA RACK MOUNTED CABINET PROVIDED BY THE ELECTRICAL CONTRACTOR.

1

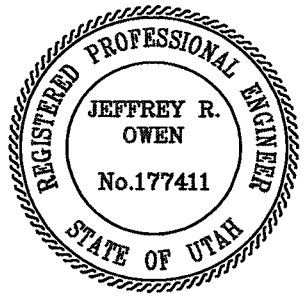
CATIONS
6170

AN A4
30'-0" E202 n

NOTE:
ALL SITE WORK RELATING TO COMMUNICATIONS CONDUIT AND CABLING SHALL BE COORDINATED WITH THE OWNER.
CONTACT: MIKE HANSEN
TELEPHONE: 801-523-4118

OTHER SITE WORK SHALL BE COORDINATED WITH THE OWNER MAINTENANCE SUPERVISOR.
CONTACT: JAMES FORSYTH
TELEPHONE: 801-404-1473 OR 801-253-5523

1



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ISSUE DATA

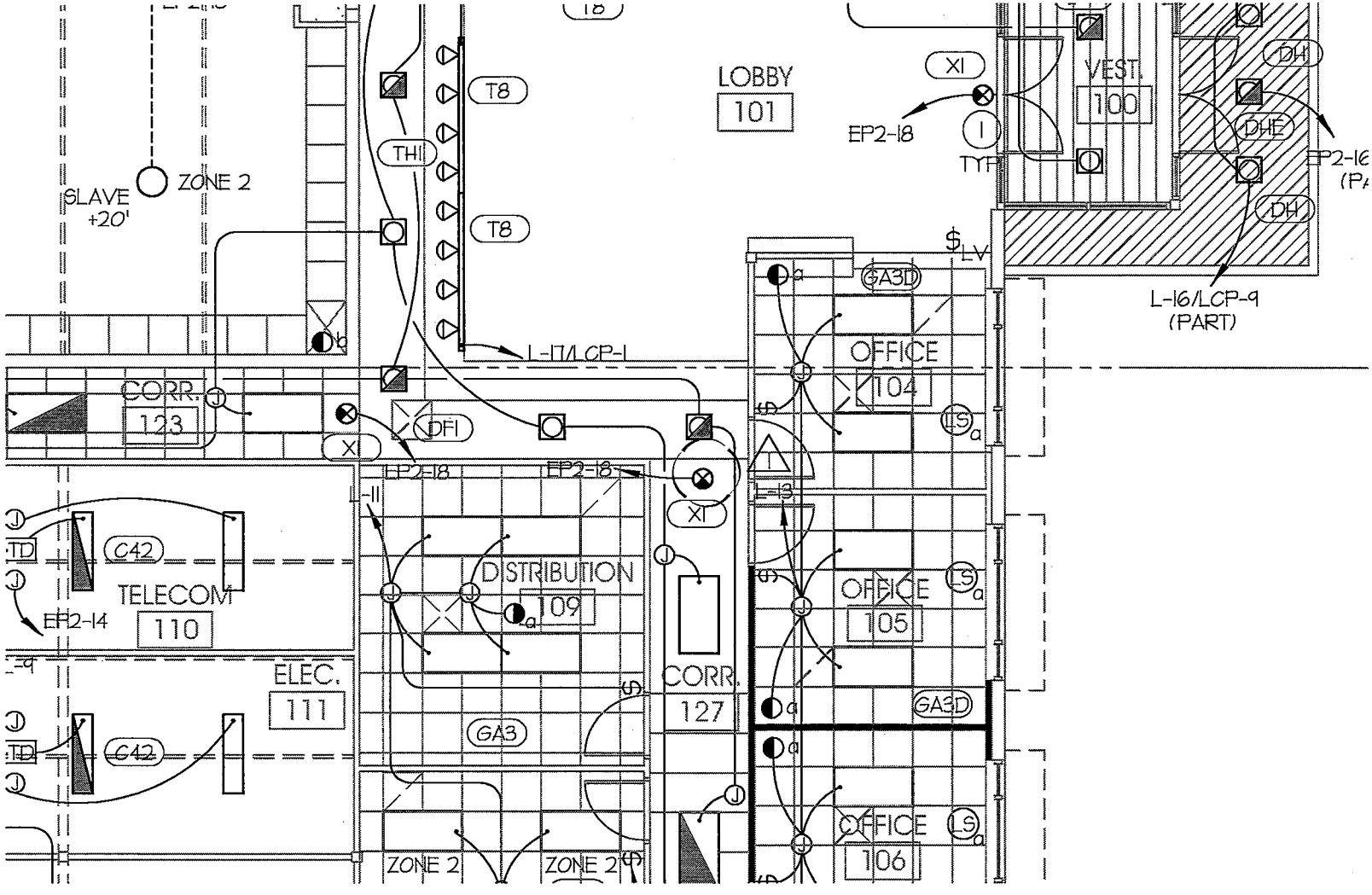
ISSUE DATE: D
ISSUE TYPE: C
DRAWN BY:
CHECKED BY:

DFCM PROJECT #

COPYRIGHT: S

E202

E202c


LOBBY
101
VEST.
100
XI
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TYP
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DHE
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THI
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L-17/LCP-1
L-16/LCP-9
(PART)
$LV
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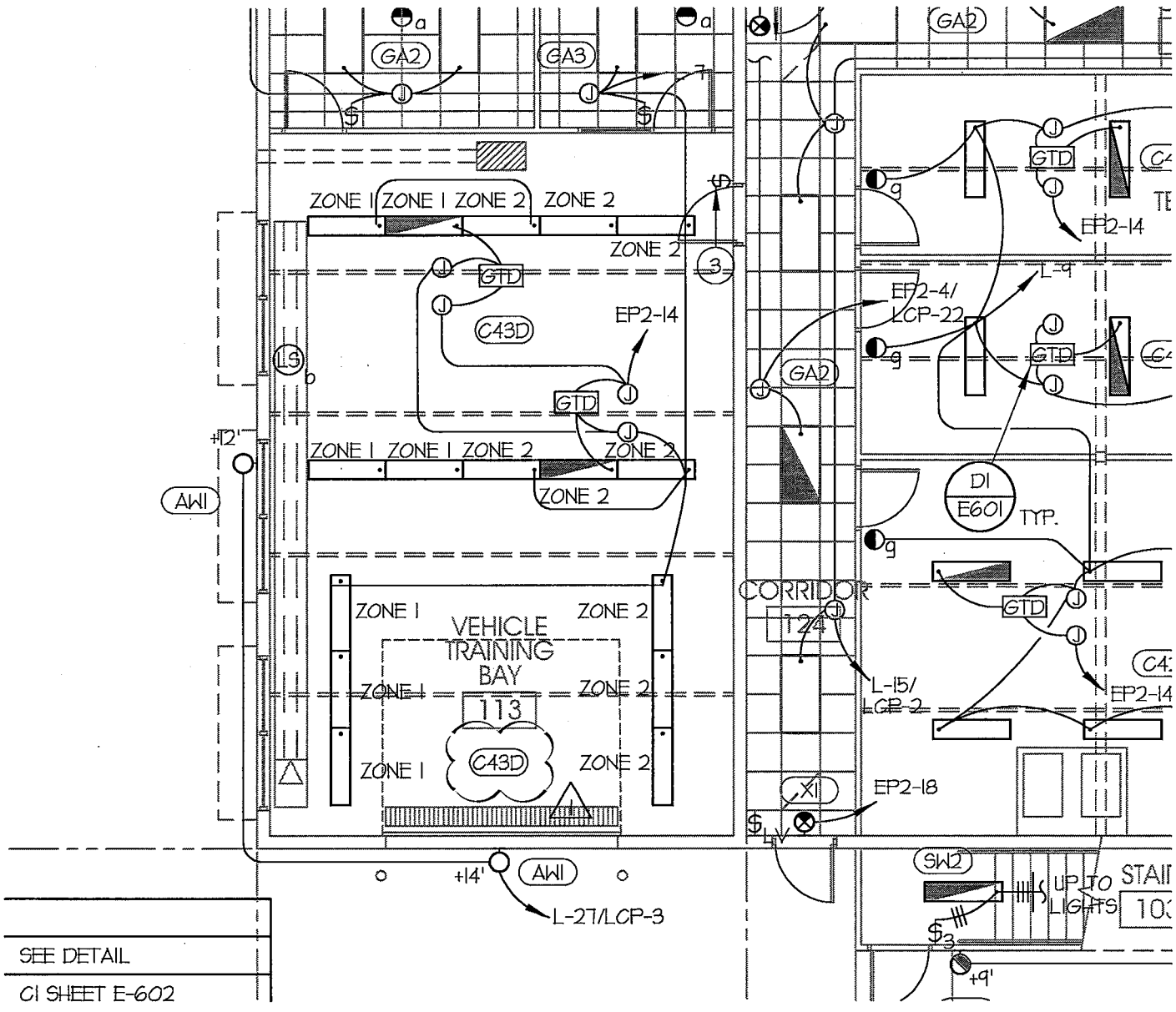
104
LS
CORR.
123
DFI
X
EP2-18
EP2-18
L-11
L-13
XI
TD
C42
TELECOM
110
EP2-14
DISTRIBUTION
109
OFFICE
105
ELEC.
111
CORR.
127
GA3
GA3D
TD
C42
OFFICE
106
ZONE 2
ZONE 2

E 301A


GA2
GA3
ZONE 1
ZONE 1
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ZONE 2
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GTD
C43D
EP2-14
LS
+12'
AW1
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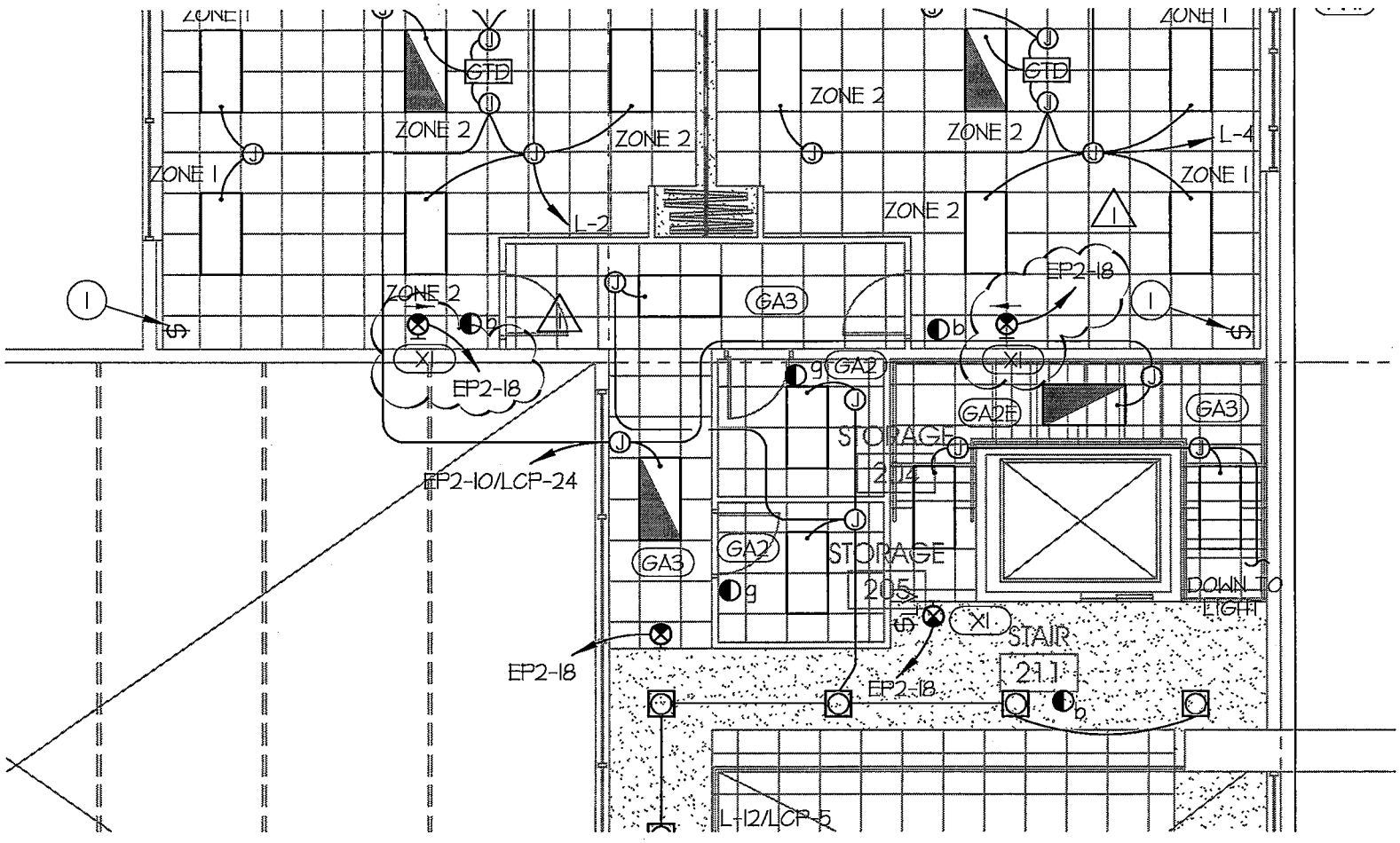
ZONE 2
ZONE 2
ZONE 1
VEHICLE TRAINING BAY
113
ZONE 2
ZONE 1
ZONE 2
C43D
ZONE 1
ZONE 2
+14'
AW1
L-27/LCP-3
SEE DETAIL
C1 SHEET E-602
GA2
GTD
EP2-14
EP2-4/
LCP-22
L-9
GA2
D1
E601
TYP.
CORRIDOR
124
GTD
L-15/
LCP-2
EP2-14
XI
EP2-18
SW2
UP TO
LIGHTS
+9'

E301B


ZONE 1
GTD
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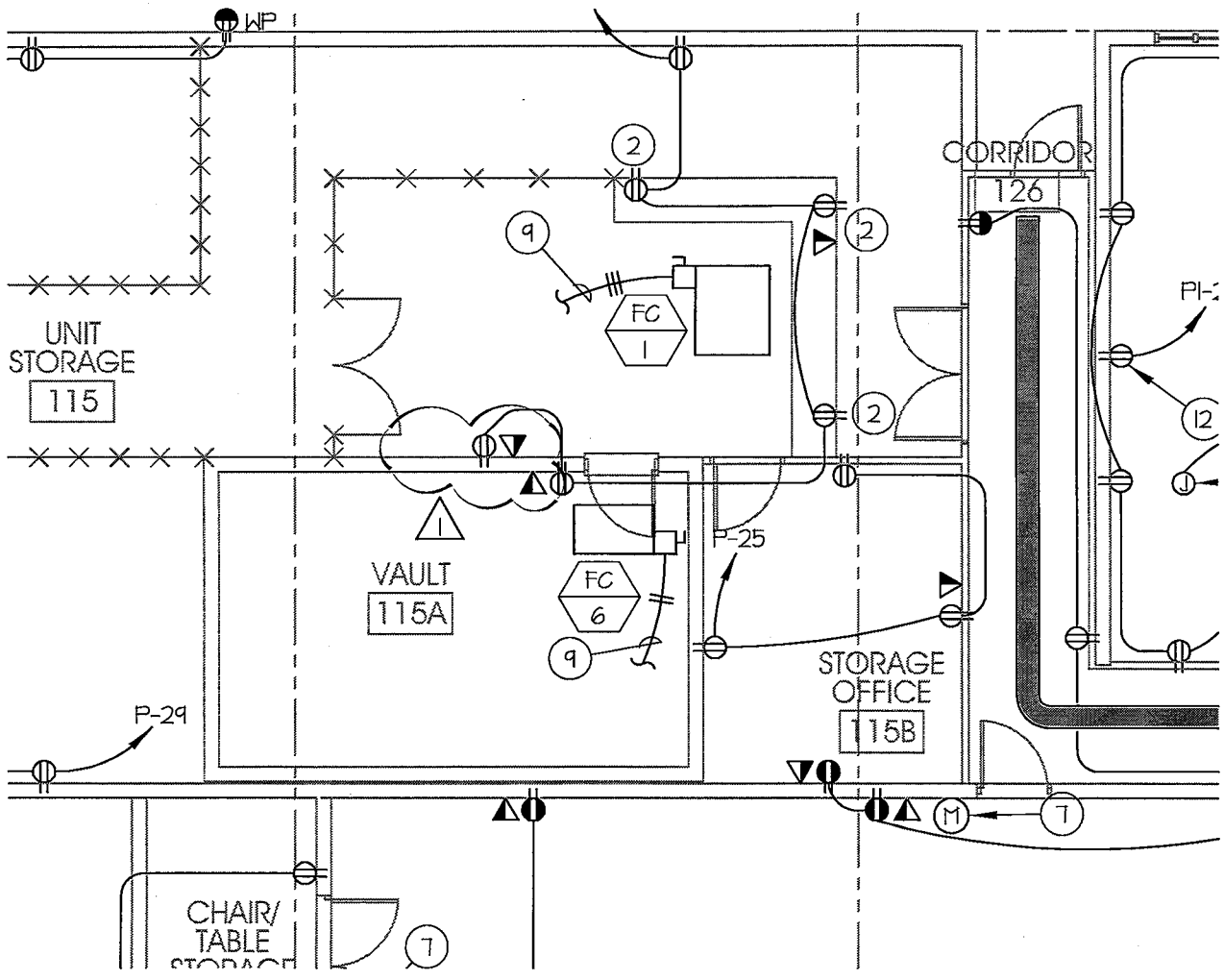
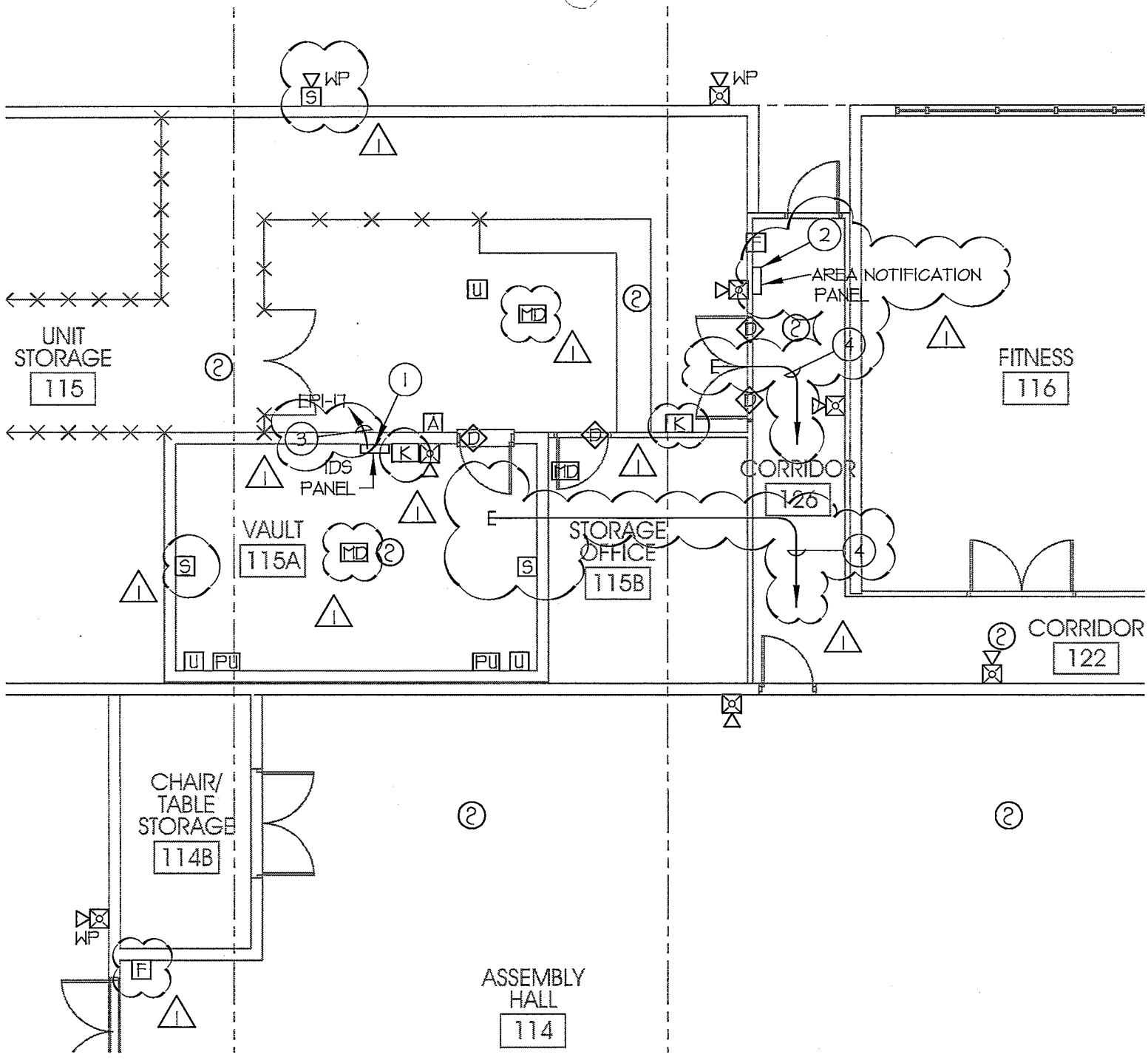
ZONE 2
ZONE 2
L-4
ZONE 1
ZONE 1
L-2
ZONE 2
EP2-18
GA3
XI
EP2-18
GA2
GA2F
GA3
STORAGE
214
EP2-10/LCP-24
GA3
GA2
STORAGE
205
DOWN LIGHT
XI
STAIR
211
EP2-18
EP2-18
L-12/LCP-5

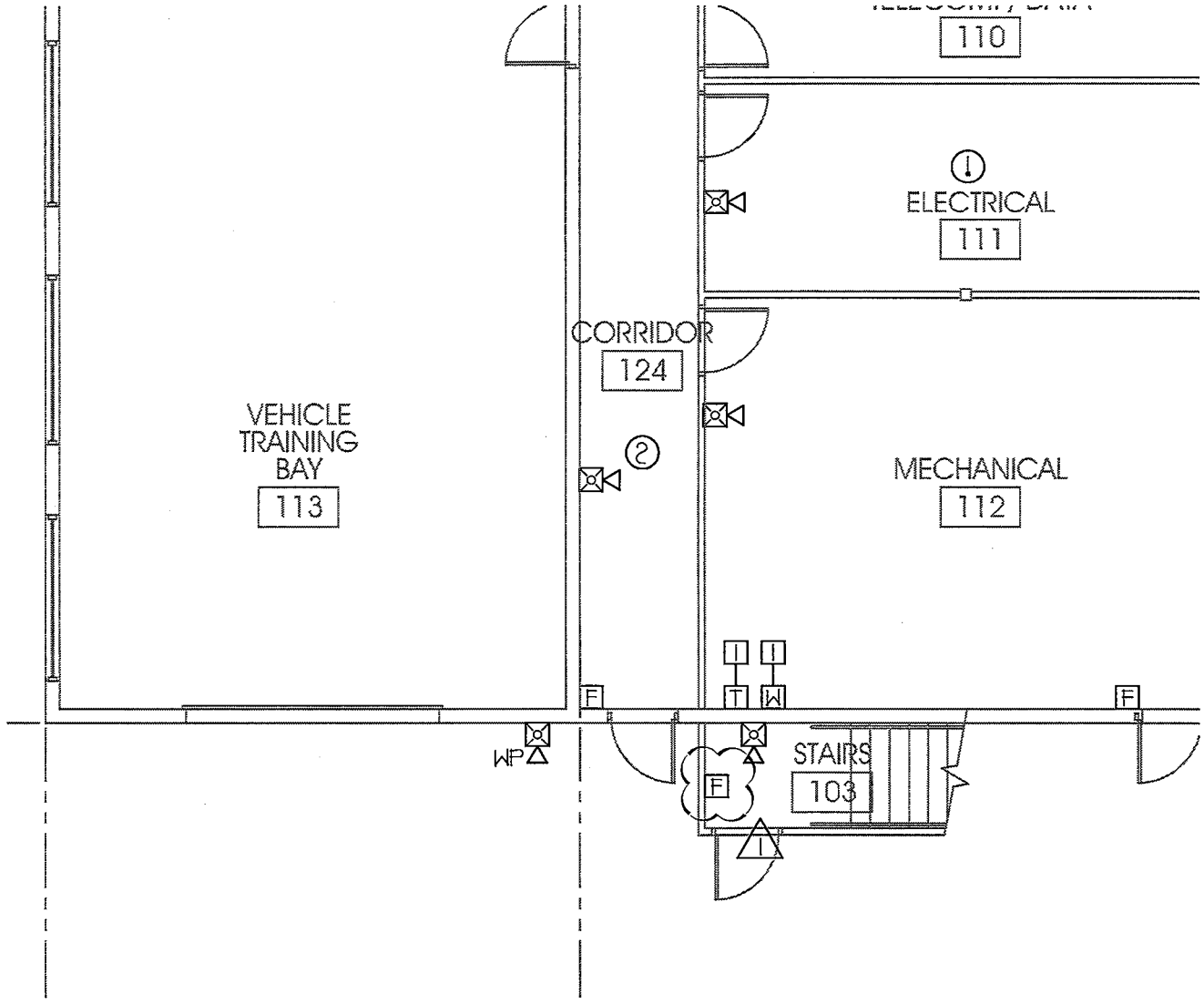
E302


WP
UNIT
STORAGE
115
VAULT
115A
FC
1
FC
6
P-25
P-29
CORRIDOR
126
STORAGE
OFFICE
115B
CHAIR/
TABLE

E401


WP
WP
UNIT STORAGE 115
ERI-17
IDS PANEL
AREA NOTIFICATION PANEL
FITNESS 116
CORRIDOR 120
VAULT 115A
STORAGE OFFICE 115B
CORRIDOR 122
CHAIR/ TABLE STORAGE 114B
WP
ASSEMBLY HALL 114

E501A


110
ELECTRICAL
111
CORRIDOR
124
VEHICLE
TRAINING
BAY
113
MECHANICAL
112
WP
STAIRS
103

E501B

A

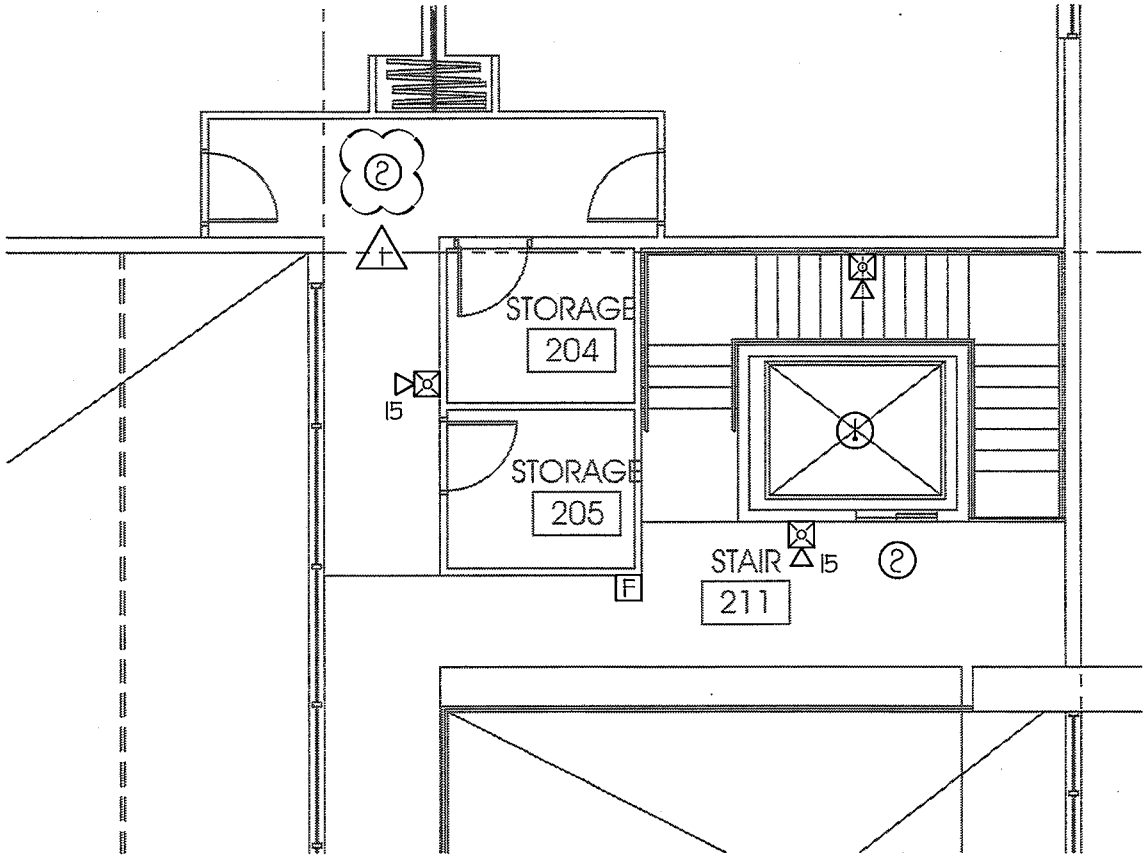
KEYED NOTE LEGEND:

*FOR SHEET E501 ONLY.

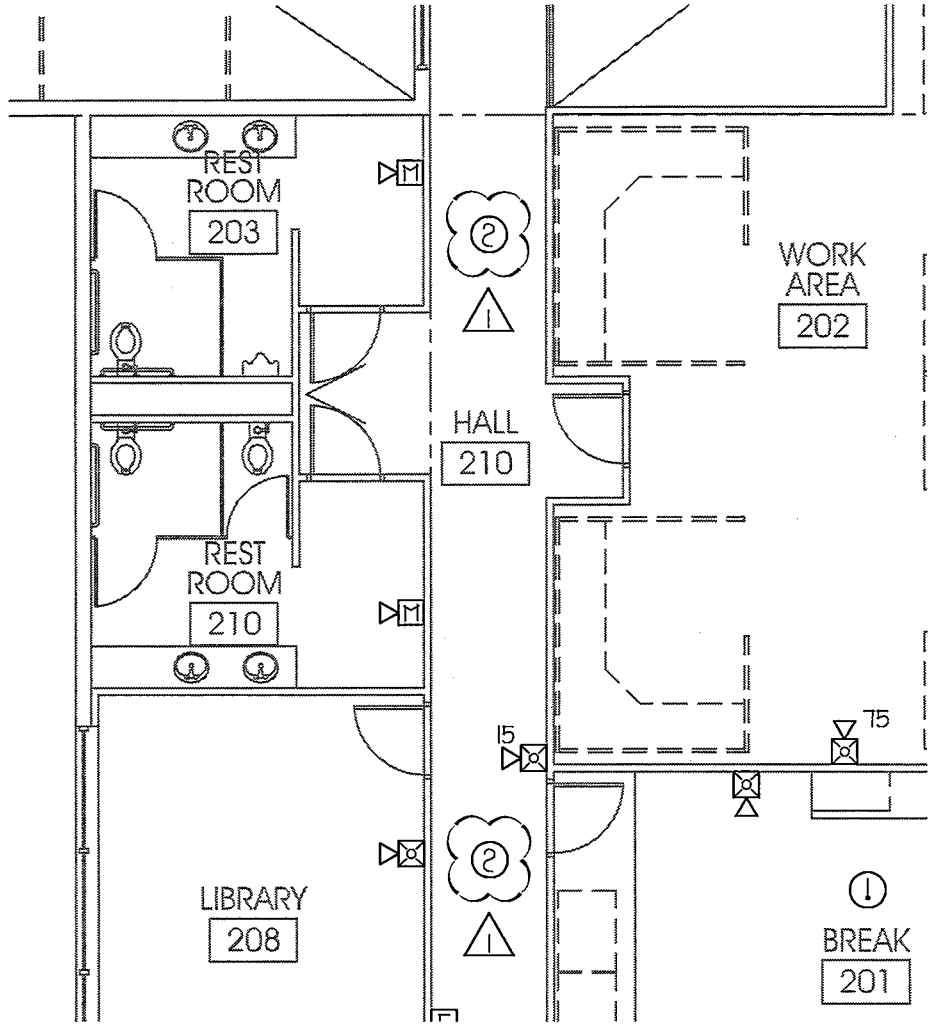
1. REFER TO THE INTRUSION DETECTION SYSTEM RISER ON SHEET E702 FOR IDS SYSTEM REQUIREMENTS.
2. CONFIRM EXACT LOCATION OF DEVICE WITH THE OWNER.
3. ROUTE CONDUIT FOR THIS CIRCUIT ABOVE EAST DOUBLE DOORS TO STORAGE UNIT 115.
4. EXTEND 3/4" C. WITH PULL STRING TO TELECOM/DATA 110. CONFIRM EXACT STUB UP LOCATIONS ON BOTH ENDS WITH THE OWNER.

1

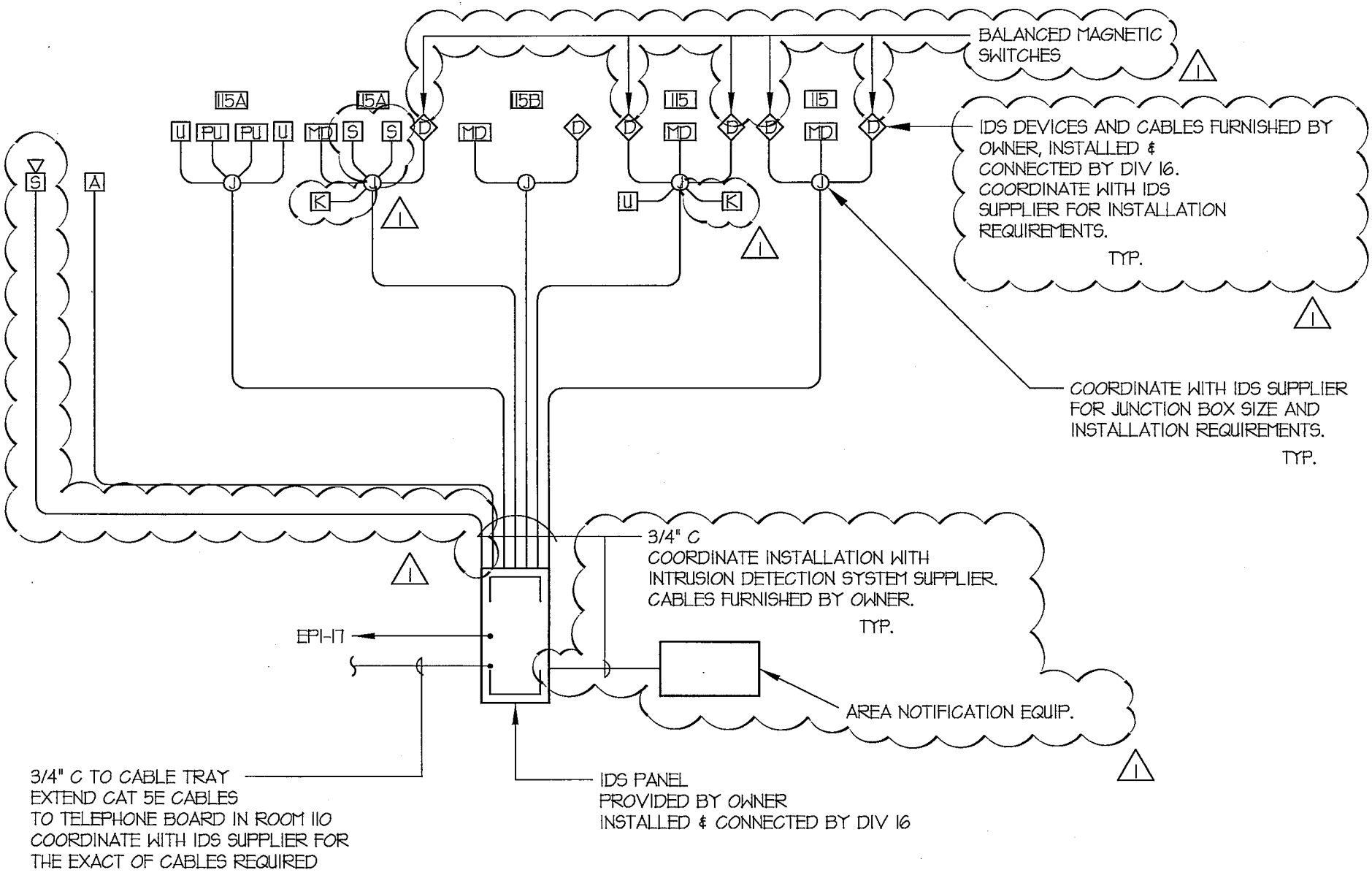
E501C



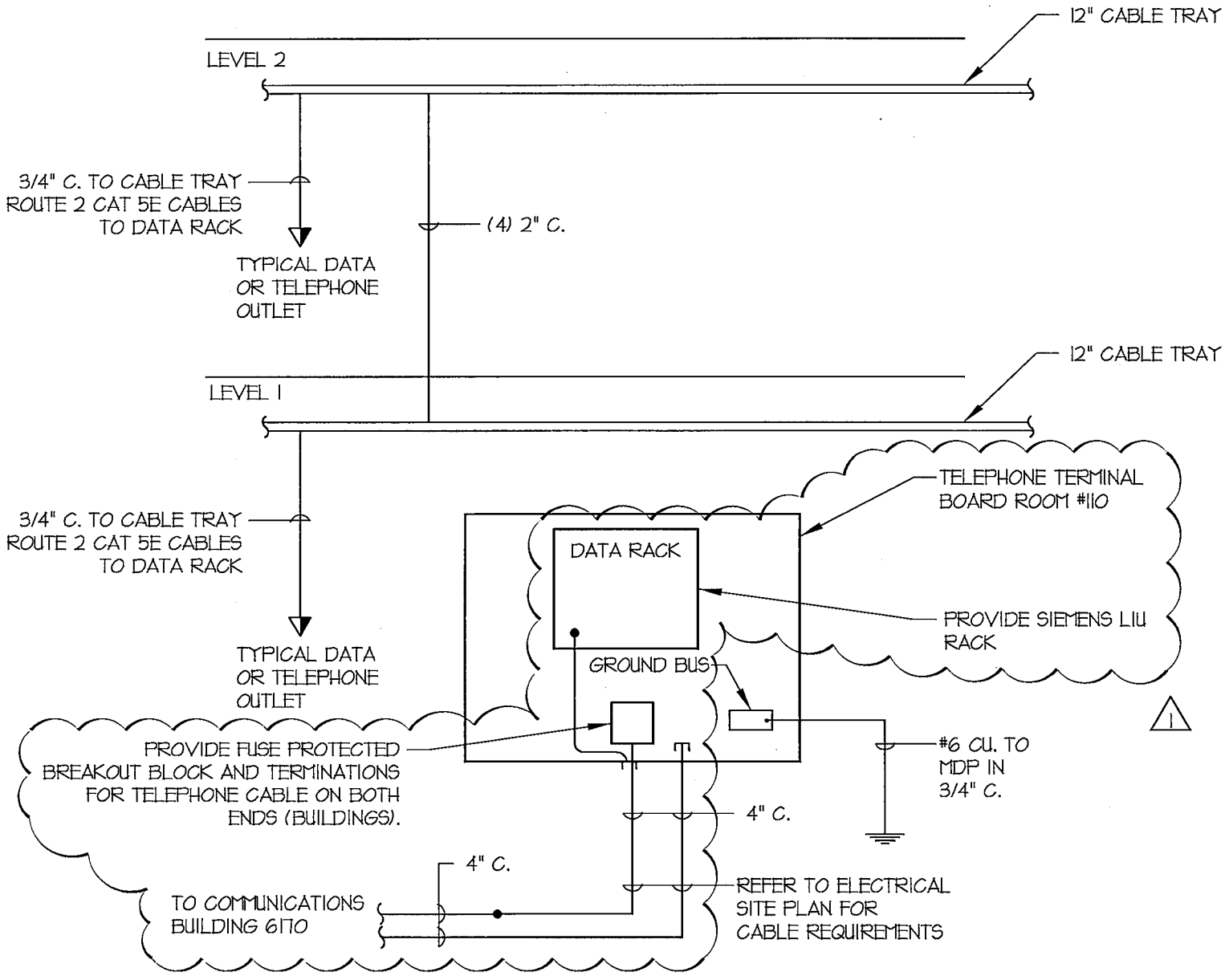
E502A


REST ROOM 203
WORK AREA 202
HALL 210
REST ROOM 210
LIBRARY 208
BREAK 201
15
75

E502B


BALANCED MAGNETIC SWITCHES
115A
115A
115B
115
115
U
PU
PU
U
MD
S
S
D
MD
D
D
MD
D
D
MD
S
A
K
K
U
J
IDS DEVICES AND CABLES FURNISHED BY OWNER, INSTALLED & CONNECTED BY DIV 16. COORDINATE WITH IDS SUPPLIER FOR INSTALLATION REQUIREMENTS.
TYP.
COORDINATE WITH IDS SUPPLIER FOR JUNCTION BOX SIZE AND INSTALLATION REQUIREMENTS.
TYP.
3/4" C
COORDINATE INSTALLATION WITH INTRUSION DETECTION SYSTEM SUPPLIER. CABLES FURNISHED BY OWNER.
TYP.
EPI-17
AREA NOTIFICATION EQUIP.
3/4" C TO CABLE TRAY
EXTEND CAT 5E CABLES TO TELEPHONE BOARD IN ROOM 110
COORDINATE WITH IDS SUPPLIER FOR THE EXACT OF CABLES REQUIRED
IDS PANEL
PROVIDED BY OWNER
INSTALLED & CONNECTED BY DIV 16

E702A



COMMUNICATIONS RISER

A4

E702

SCALE: NONE

E702B