

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT			1. CONTRACT ID CODE	PAGE OF PAGES
			J	1   10
2. AMENDMENT/MODIFICATION NO. 0001	3. EFFECTIVE DATE 20-May-2004	4. REQUISITION/PURCHASE REQ. NO. W22W9K-4084-7247	5. PROJECT NO.(If applicable)	
6. ISSUED BY U. S. ARMY ENGINEER DISTRICT, LOUISVILLE 600 DR. MARTIN LUTHER KING, JR. PLACE ROOM 821 LOUISVILLE KY 40202-2230	CODE W912QR	7. ADMINISTERED BY (If other than item 6) MILITARY/RESERVE TEAM 600 DR. M. L. KING, JR. PL., RM 821 ATTN: SHARON K. EVANS LOUISVILLE KY 40202-2230		CODE DACA27
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)			<input checked="" type="checkbox"/> 9A. AMENDMENT OF SOLICITATION NO. W912QR-04-B-0003	
			<input checked="" type="checkbox"/> 9B. DATED (SEE ITEM 11) 03-May-2004	
			10A. MOD. OF CONTRACT/ORDER NO.	
			10B. DATED (SEE ITEM 13)	
CODE	FACILITY CODE			
11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS				
<input checked="" type="checkbox"/> The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer <input type="checkbox"/> is extended, <input checked="" type="checkbox"/> is not extended. Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning <u>1</u> copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.				
12. ACCOUNTING AND APPROPRIATION DATA (If required)				
13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.				
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.				
B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).				
C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:				
D. OTHER (Specify type of modification and authority)				
E. IMPORTANT: Contractor <input type="checkbox"/> is not, <input type="checkbox"/> is required to sign this document and return _____ copies to the issuing office.				
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) Solicitation W912QR-04-B-0003, PTR Additions for Pierce, Kingsolver and Mudge Schools, Ft. Knox, Kentucky is hereby amended as follows: a. Replace sections 01110N, 01451L, 01500A, 01525, 02300A, 02510A, 2531, 02556A, 05210A, 6410, 9510, 10800, 13080, 15070A, 15400A, 16375A, 16415A with the attached revised sections. b. Add the attached sections 01000 and 16710N. c. Replace drawings MPE1101, MPE2101, MPE3101, A-102, M-502, P501, E101, E102, E103, E104 with the revised attached drawings. d. Wage decision KY030007 is hereby replaced with the revised attached KY030007 14 May 2004. e. Due date remains unchanged. f. All amendments shall be acknowledged as indicated in item 11.				
Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.				
15A. NAME AND TITLE OF SIGNER (Type or print)			16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
			TEL: _____ EMAIL: _____	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA		16C. DATE SIGNED
_____ (Signature of person authorized to sign)		BY _____ (Signature of Contracting Officer)		20-May-2004

Amendment 0001  
PTR Addition to 3 schools – Kingsolver, Mudge & Pierce Elementary  
Fort Knox, Kentucky

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General Decision Number: KY030007 03/19/2004 KY7

Superseded General Decision Number: KY020007

State: Kentucky

Construction Types: Building

Counties: Hardin, Jefferson and Meade Counties in Kentucky.

BUILDING CONSTRUCTION PROJECTS (Does not include single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	06/13/2003
1	10/31/2003
2	12/12/2003
3	03/05/2004
4	03/19/2004

ASBE0051-001 10/01/2003

	Rates	Fringes
Asbestos/Insulator Worker (Includes application of all insulating materials, protective coverings, coatings and finishings to all types of mechanical systems).....	\$ 21.68	8.24

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ASBE0207-014 06/01/2002

	Rates	Fringes
Hazardous Material Handler (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging & disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems).....	\$ 14.80	5.70

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\* BOIL0040-001 01/01/2004

	Rates	Fringes
Boilermaker.....	\$ 29.40	14.42

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BRKY0001-001 06/01/2001

	Rates	Fringes
Bricklayer BRICKLAYERS; CAULKERS; CLEANERS; POINTERS & STONE MASONS.....	\$ 20.00	5.43
LAYOUT MAN; & SAW MAN.....	\$ 20.25	5.43

REFRACTORY; & ACID BRICK. . . . \$ 20. 50 5. 43

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BRKY0001- 003 06/01/2001

	Rates	Fringes
Marble Setter, Terrazzo Worker & Tile Setter.....	\$ 19. 59	3. 65
Marble, terrazzo and tile finisher.....	\$ 13. 34	3. 05

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CARP0064- 002 06/01/2003

	Rates	Fringes
Carpenters:.....	\$ 19. 70	7. 42
Piledriverman.....	\$ 19. 95	7. 42

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CARP1031- 003 06/01/2003

	Rates	Fringes
Millwright.....	\$ 22. 90	10. 65

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ELEC0369- 001 05/28/2003

	Rates	Fringes
Electricians:.....	\$ 25. 25	8. 68

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ELEC0369- 002 05/28/2003

	Rates	Fringes
Line Construction		
Cable Splicer.....	\$ 25. 75	15. 5%+2. 75
Equipment Operator A: John Henry Rock Drill, D6 (or equivalent) and above, Trackhoe Digger, Cranes (greater than 25 tons and less than 45 tons).....	\$ 22. 73	15. 5%+2. 75
Equipment Operator B: Cranes (6-25 tons), Backhoes, Road Tractor, Dozer up to D5, Pressure Digger- Wheel ed or Tracked, all Tension Wire Stringing Equipment....	\$ 20. 20	15. 5%+2. 75
Equipment Operator C: Trencher, Vibratory Compactor, Ground Rod Driver, Boom Truck (6 ton or below), Skid Steer Loaders.....	\$ 16. 41	15. 5%+2. 75
Groundman.....	\$ 18. 94	15. 5%+2. 75

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Lineman & Technician . . . . . \$ 25.25 15.5%+2.75

Cranes 45 tons or larger to be paid 100% of journeyman  
lineman's rate.

ELEV0020-001 10/01/2001

JEFFERSON COUNTY:

	Rates	Fringes
Elevator Mechanic . . . . .	\$ 25.755	7.455+a+b

FOOTNOTES:

a. Seven Paid Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Day after Thanksgiving; & Christmas Day

b. Employer contributes 8% of regular hourly rate to vacation pay credit for employee who has worked in business more than 5 years; 6% for less than 5 years.

ENGI0181-020 06/01/2003

	Rates	Fringes
Power Equipment Operator		
GROUP 1 . . . . .	\$ 20.60	9.15
GROUP 2 . . . . .	\$ 17.76	9.15
GROUP 3 . . . . .	\$ 16.74	9.15

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1 - Auto Patrol; Batch Plant; Bituminous Paver; Cableway; Central Compressor Plant; Clamshell; Concrete Mixer (1 cu. ft. or over); Concrete Pump; Crane; Crusher Plant; Derrick; Derrick Boat; Ditching & Trenching Machine; Dragline; Dredge Operator; Dredge Engineer; Elevating Grader & Loader; Hoe Type Machine; Hoist (1 Drum when used for stack or chimney construction or repair); Hoisting Engine (2 or more Drums); Locomotive; Motor Scrapper; Carry-All Scoop; Bulldozer; Mechanic; Orangepeel Bucket; Piledriver; Power Blade; Motor Grader; Roller (Bituminous); Scarifier; Shovel; Tractor Shovel; Truck Crane; Winch Truck; Push Dozer; Highlift; Boom Cat; Core Drill; Hopto; Tow or Push Boat; A-Frame Winch Truck; Concrete Paver; Gradeall; Hoist; Hyster; Pumpcrete; Ross Carrier; Boom; Tail Boom; Rotary Drill; Hydro Hammer; Mucking Machine; Rock Spreader (Attached to Equipment); Scoopmobile; Kecal Loader; Tower Crane (French, German & Other Types); Hydrocrane; Backfiller; Gurry; Subgrader; Tunnel Mining Machine, including Moles; Shield or similar types of Tunnel Mining Equipment; & Forklift (Regardless of Lift Height)

GROUP 2 - Air Compressor (Over 900 CFM); Bituminous Mixer; Joint Sealing Machine; Concrete Mixer (Under 21 cu. ft.); Form Grader; Roller (Rock); Tractor (50 H.P. & Over); Bull Float; Finish Machine; Outboard Motor Boat; Flexplane; Fire person; Boom Type Tamping Machine; Greaser on Grease Facilities Servicing Heavy Equipment; Switchman or Brakeman; Whirley Oiler; Self-Propelled Compactor; Tractair & Road Widening Trencher & Farm Tractor with attachments (Except Backhoe, Highlift & End Loader); Elevator; Hoisting Engineer (1 Drum or Buck Hoist, Firebrick Masonry Excluded); Well

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Point; Grout Pump; Throttle Valve Person; Tugger; & Electric Vibrator Compactor

GROUP 3 - Bituminous Distributor; Cement Gun; Conveyor; Mud Jack; Paving Joint Machine; Roller (Earth); Tamping Machine; Tractor (Under 50 H.P.); Vibrator; Oiler; Concrete Saw; Burlap & Curing Machine; Truck Crane Oiler; Hydro Seeder; Power Form Handling Equipment; Deckhand Steersman; & Hydraulic Post Driver

CRANE WITH BOOM 150 FEET & OVER, INCLUDING JIB SHALL RECEIVE \$.50 ABOVE GROUP 1

IRON0070-001 10/01/2003

	Rates	Fringes
Ironworkers:		
Structural; Ornamental; Reinforcing; & Precast Concrete Erectors.....	\$ 23.39	11.75

LAB00576-001 07/01/2003

	Rates	Fringes
Laborers:		
GROUP 1.....	\$ 14.67	6.43
GROUP 2.....	\$ 14.87	6.43
GROUP 3.....	\$ 15.07	6.43
GROUP 4.....	\$ 15.67	6.43
GROUP 5.....	\$ 16.17	6.43

GROUP 1 - General; Carpenter Tender; Cement Finisher Tender; Placing of Concrete; Wrecking of Buildings; Hand Digging & Hand Backfilling of Ditches; Clearing of Rights-of-Way & Building Sites; Curing of Concrete; Application Hardener; Handling of Chemically Treated Lumber; Installing of Wood Sheeting & Shoring; Signal Laborer; Concrete Bucket & Masonry Work; Cleaning & Moving of General Purpose Materials; General Cleanup of Scrap & Debris

GROUP 2 - Mason Tender; Side Rail Setter (Metal); Stackman; Fork Lift Operator (Masonry & Plastering Contractors only); Power Driven Georgia Buggy; Chain Saw; Vibrator Operator; Mesh Handler; Power Tools (Air, Diesel, Electric, Gasoline); Wagon Drill; Pipe Layer; Wall Man; Treatment of Exposed Concrete (Chip, Bush Hammer & Rub); Concrete Saw; Gasoline Tamping Machine; Walk Behind Trenching Machine; Burner Man; Joint Maker; Asphalt Raker; & Mobile Sweeper

GROUP 3 - Air Track Driller; Introflax Burning Rod; Gunnite Nozzle Man Operator; Sewer, Tunnel Laborer (Free Air); & Sand Hog or Mucker (Free Air)

GROUP 4 - Holeman Drilled Piers; Augered Caissons; Sand Miner (Tunnel Free Air); Caisson Worker; & Powderman

GROUP 5 - Tunnel Person & Tunnel Miner (Pressure & Free Air); Environmental Worker; Toxic & Hazardous Waste; & Asbestos Removal Free Hanging Scaffold Above 30' receives \$.25 Premium

PAIN0118-001 05/01/2003

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	Rates	Fringes
<b>Painters:</b>		
Abrasive Blaster; Fireproofing; Lead Abatement; Spray; & Waterblasting 4000 PSI and Above.....	\$ 17.87	6.47
Brush; Drywall Finisher-Vinyl Hanger.....	\$ 17.37	6.47

PAIN0639-002 05/01/2003

	Rates	Fringes
Sign Painter & Erector.....	\$ 17.57	4.55+a+b+c

FOOTNOTES: a. 7 Paid Holidays: New Year's Day; Memorial Day;  
July 4th; Labor Day; Thanksgiving Day; Christmas Day & 1  
Floating Day

b. Vacation Pay: After 1 year's service - 5 days' paid  
vacation; After 2, but less than 10 years' service - 10 days'  
paid vacation; After 10, but less than 20 years' service - 15  
days' paid vacation; After 20 years' service - 20 days' paid  
vacation

c. Funeral leave up to 3 days maximum paid leave for death of  
mother, father, brother, sister, spouse, child,  
mother-in-law, father-in-law, grandparent & inlaw provided  
employee attends funeral

PAIN1165-004 04/01/2003

	Rates	Fringes
Glazier.....	\$ 21.61	6.74

PLAS0692-028 06/01/2003

	Rates	Fringes
Cement Mason.....	\$ 18.15	7.50

\* PLUM0107-001 02/01/2004

	Rates	Fringes
Plumber/Pipefitter.....	\$ 27.60	8.52

PLUM0522-001 08/01/2003

	Rates	Fringes
Pipefitter/steamfitter.....	\$ 27.60	8.52

R00F0147-001 07/01/2003

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Rates                      Fringes

Roofers:..... \$ 18. 40                      6. 07

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SFKY0669- 001 01/01/2004

Rates                      Fringes

Sprinkler Fitter..... \$ 25. 05                      9. 70

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SHEE0110- 003 12/01/2003

HARDIN & JEFFERSON COUNTIES:

Rates                      Fringes

Sheet metal worker..... \$ 25. 55                      10. 42

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SHEE0110- 004 12/01/2003

MEADE COUNTY:

Rates                      Fringes

Sheet metal worker..... \$ 27. 30                      10. 42

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TEAM0089- 001 06/01/2003

Rates                      Fringes

Truck drivers:

GROUP 1.....	\$ 17. 52	a&b
GROUP 2.....	\$ 17. 63	a&b
GROUP 3.....	\$ 17. 70	a&b
GROUP 4.....	\$ 17. 80	a&b

WORK ON HAZARDOUS OR TOXIC WASTE SITES - \$4. 00 PREMIUM

FOOTNOTES:

a. Employer contribution of \$321. 70 per employee per week whose name appears on the payroll and has been employed a minimum of 20 work days within any 90 consecutive day period.

b. Paid vacation of 40 hours to any employee who has been regularly employed on a project for 1 year and who has worked a minimum of 1,200 hours during the year, and 2 weeks' paid vacation to any employee who has completed 3 years' employment on a project and who has worked 1,200 hours since their 2nd anniversary date.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1 - 3 Tons & Under; Greaser; Tire Changer; & Mechanic Tender

GROUP 2 - Over 3 Tons; Semi-Trailer or Pole Trailer; Dump Tandem Axles; Farm Tractor (When used to pull building material & equipment)

GROUP 3 - Concrete Mixer (Hauling on jobsites); & Truck

Mechanics

GROUP 4 - Euclids & Other Heavy Moving Equipment; Lowboy; Winch, A-Frame & Monorail Truck (To transport building materials)

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.  
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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

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In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.  
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WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
 Wage and Hour Division  
 U. S. Department of Labor  
 200 Constitution Avenue, N. W.  
 Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator

U. S. Department of Labor

200 Constitution Avenue, N. W.

Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board

U. S. Department of Labor

200 Constitution Avenue, N. W.

Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION PTR Addition to 3 Schools - Kingsolver, Mudge & Pierce Elementary						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEWER	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		15070A	SD-02 Shop Drawings														
			Contractor Designed Bracing	1.2.4	G AO												
			SD-03 Product Data														
			Contractor Designed Bracing	1.2.4	G AO												
		16710n	SD-02 Shop Drawings														
			Telecommunications drawings	1.7.1	G												
			AO														
			Distribution frames	1.7.2	G												
			SD-03 Product Data														
			Telecommunications cabling	2.3	G												
			AO														
			Patch panels	2.4.3	G												
			Telecommunications	2.6	G												
			outlet/connector assemblies														
			Equipment support frame	2.4.1	G												
			Building protector assemblies		G												
			Connector blocks	2.4.2	G												
			Protector modules		G												
			SD-06 Test Reports														
			Telecommunications cabling	3.3.1	G												
			testing														
			AO														
			Factory reel tests	3.3.1.2	G												
			SD-07 Certificates														
			Contractor Qualifications	1.7.3.1	G												
			AO														



## SECTION 01000

CONSTRUCTION SCHEDULE  
01/2000

## PART 1 GENERAL

## 1.1 SCHEDULE

Commence, prosecute, and complete the work under this contract in accordance with the following schedule and Section 00800L SPECIAL CLAUSES.

Item of Work	Commencement of Work (calendar days)	Completion of Work (calendar days)	Liquidated Damages per calendar day
(1) Earthwork at Mudge Elementary School, Fort Knox, KY (per Section 02300A EARTHWORK FOR BUILDINGS AND UTILITIES	Ref. Section 00800L	60-120	Ref. paragraph 1.4.a Section 00800L SPECIAL CLAUSES
(2) Construct classroom addition at Kingsolver Elementary School, Fort Knox, KY. All work indicated on the drawings and specifications.	Ref. Section 00800L	Ref. Section 00800L	Ref. paragraph 1.4.a Section 00800L SPECIAL CLAUSES
(3) Construct classroom addition at Pierce Elementary School, Fort Knox, KY. All work indicated on the drawings and specifications.	Ref. Section 00800L	Ref. Section 00800L	Ref. paragraph 1.4.a Section 00800L SPECIAL CLAUSES
(4) Construct classroom addition at Mudge Elementary School, Fort Knox, KY. Remainder of work indicated on the drawings and specifications.	When consolidation of foundation soil is acceptable per requirements of Section 02300A	Ref. Section 00800L	Ref. paragraph 1.4.a Section 00800L SPECIAL CLAUSES

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The first 60 days (maximum) shall be limited to site survey, the material procurement (including submittal and approval) process and the submittal and approval of the required contractual plans. No physical work shall be accomplished on or in the existing buildings or to its utilities to render it without any of its utilities during this time frame.

1.2 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER (OCT 1989)

Reference 00800L SPECIAL CLAUSES

1.3 CONTRACTOR ACCESS AND USE OF PREMISES

1.3.1 Regulations

Ensure that Contractor personnel employed on the project become familiar with and obey Fort Knox regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. To minimize traffic congestion, delivery of materials shall be outside of peak traffic hours (6:30 to 8:00 a.m. and 3:30 to 5:00 p.m.) unless otherwise approved by the Contracting Officer. Wear hard hats in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. The Contractor's equipment shall be conspicuously marked for identification. For additional conduct and dress requirements, reference Section 00800L SPECIAL CLAUSES.

1.3.2 Occupied and Existing Building

It is the intent of these provisions to provide for maximum coordination between construction activities pursuant to this contract and concurrent ongoing routine activities of school personnel. Interference with and inconvenience to the occupants or routine of the facility shall be held to an absolute minimum.

- a. The Contractor will be working in and around an existing building which is occupied as indicated on the calendar in paragraph 1.3.5. Do not enter the building without prior approval of the Contracting Officer.
- b. The Contractor shall maintain all required exits per Fire Marshal and Contracting Officer. In addition, security and fire alarm service shall be maintained throughout construction.
- c. The existing building and its contents shall be kept secure at all times. Provide temporary closures as required to maintain security as directed by the Contracting Officer.
- d. Provide dust covers or protective enclosures to protect existing work that remains and Government material located in the building during the construction period.
- e. Relocate movable furniture as required to perform the work, protect the furniture, and replace the furniture in its original locations upon completion of the work. Leave attached equipment in place, and protect it against damage, or temporarily disconnect, relocate, protect, and reinstall it at the completion of the work.

### 1.3.3 Project Restrictions

- a. Restrict employees/representatives to the work site and control travel directly to and from the work site.
- b. Ensure that yellow plastic material is not used for warning signs, covering materials, etc.
- c. Restore all traffic/parking/security signs and markings, including space numbers, designations, and lines, to their original form if such signs/markings are defaced or deleted during construction/repair.
- d. Be responsible for control and security of Contractor-owned equipment and materials at the work site. Report immediately, missing/lost/stolen property to the Ft. Knox Police Department (phone) as each case occurs.
- e. Ensure that no material or vehicle is stacked within 10 feet of the construction fence. Remove from the work site, or secure ladders or other such equipment which could be used to climb the perimeter fence.
- f. Provide written notification to the Contracting Officer 2 weeks prior to actual start of work to allow for notification of the appropriate departments, offices, and shops of the impact resulting from the contract work. Such notifications will include specific details such as work schedules and impact.
- g. Ensure that no opening in the roof/walls/windows/fence of the building exists at the end of the work day and does not exist where penetration is possible during non-working hours. If the building cannot be secured at the end of the work day, coordinate action with the Contracting Office to notify the cognizant code to arrange for a security watch by their personnel.
- h. Utility cutovers and interruptions are specified in Section 01500A TEMPORARY CONSTRUCTION FACILITIES AND ADMINISTRATIVE REQUIREMENTS.
- i. Permission to interrupt any activity roads and/or utility service shall be requested in writing a minimum of 7 calendar days prior to the desired date of interruption.
- j. The work under this contract requires special attention to the scheduling and conduct of the work in connection with existing operations. Identify on the construction schedule each factor which constitutes a potential interruption to operations.

### 1.3.4 Work Hours

- a. Work in the existing building shall be performed from 3:30 p.m. to 7:00 a.m. Monday through Friday, weekends or holidays (refer to school calendar at the end of Section 00800L SPECIAL CLAUSES). When operational needs require scheduling of work to the existing building from 7:00 a.m. to 3:30 p.m. (Monday through Friday), or on weekends and holidays, provide written notification at least 7 days in advance to the Contracting Officer, who will obtain approval from the user. Such notifications will include specific dates, hours of work, location of work, type of work to be performed, contract number and project title. The Contracting Officer will provide a copy of the notification to the Security Officer along with written notification to the Security Officer that work, as scheduled, has been approved by the respective department, office, or shop concerned.

b. Exclusionary Period:

No work shall be performed during national holidays as indicated on the calendar without prior written approval of the Contracting Officer. This period has not been considered in computing the time allowed for the performance of this contract.

1.4 PHASING AND SEQUENCE

1.4.1 General

In addition to the submittals required by clause SCHEDULES FOR CONSTRUCTION CONTRACTS (see Section 00700, FAR 52.236-15) the Contractor shall submit for approval a summary work schedule setting forth schedule dates for initiation and completion of construction in each work area. No work shall be performed prior to approval of this schedule and all work shall be performed in strict adherence thereto. If departures from this schedule appear to be required or desired, the Contracting Officer shall be promptly notified and his approval will be required prior to implementation of said departure(s).

1.4.1.1 Interference with School Activities

Work shall not interfere with school activities.

1.4.2 Phasing and Sequence

Phase I: Structural fill and surcharge fill shall be installed at Mudge Elementary School and consolidation, as defined in Section 02300A EARTHWORK FOR BUILDINGS AND UTILITIES, shall be reached prior to start of construction.

Phase II: At the contractor's option, with the government's approval, construction can be started either at Kingsolver or Pierce Elementary School individually or simultaneously. This work can start upon the government issuance of the Notice to Proceed as defined in Section 00800L, and can run concurrently with Phase I work.

Phase III: Work can commence on Mudge Elementary School when consolidation requirements, as defined in Section 02300A, have been obtained.

1.4.2.1 Completion Date

All work under this contract shall be complete by July 27, 2005.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

**Amdt #0001**

SECTION 01110N

SUMMARY OF WORK  
02/03

PART 1 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1 Project Description

The work includes construction of a four (4) classroom addition at Kingsolver, Mudge and Pierce Elementary Schools to lower the Pupil-To-Teacher Ratio (PTR) and incidental related work.

1.1.2 Location

The work shall be located at Fort Knox, Kentucky as indicated. The exact location is as shown on the drawings.

1.2 EXISTING WORK

In addition to "FAR 52.236-9, Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements":

- a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.
- b. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work shall be in a condition equal to or better than that which existed before new work started.

1.3 LOCATION OF UNDERGROUND FACILITIES

Scan the construction site with electromagnetic or sonic equipment, and mark the surface of the ground where existing underground utilities are discovered. Verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated to be specified or removed but indicated or discovered during scanning in locations to be traversed by piping, ducts, and other work to be conducted or installed. Verify elevations before installing new work closer than nearest manhole or other structure at which an adjustment in grade can be made.

1.3.1 Notification Prior to Excavation

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- a. **Contact the following companies at least 2 days in advance of the excavation/trenching dates.**
- b. **Mark the boundaries of the excavation/trenching area with white marking paint, if practical, or if there are several locations to be marked for one work site.**
- c. **BEFORE YOU DIG (BUD)**  
**Call 1-800-752-6007. Our contact number is 1051. The name of the account is Fort Knox DBOS. You will receive a confirmation**

number. LG&E, Bell South Telephone, and Racliff Cable will be contacted by BUD.

d. GAS, WATER & SEWER MAINS

Call the plumbing shop at 502-624-5954.

e. WATER & SEWER SERVICES

Notify your inspector and they will in turn call in work order.

f. TELECOMMUNICATIONS

Call Telemon at 502-624-4300. Telemon will locate Post telephone and Sprint Communications utilities.

g. ELECTRIC

High voltage (Primary or over 600 volts): Call Nolin RECC at 270-765-6153.

Low voltage (Secondary or under 600 volts): Notify your inspector and he in turn will call in a work order to have utilities located.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

**Amdt #0001**

SECTION 01451L

CONTRACTOR QUALITY CONTROL

**8/03**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(2001) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(2000b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable lump-sum prices contained in the Bidding Schedule.

1.2.1 SUBMITTALS

SD-01 Preconstruction Submittals

Quality Control Plan; G, AO

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

**\*1**

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The site project superintendent is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The project **manager** in this context shall be the highest level manager responsible for the overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction

and construction related activities at the site. Contractor shall use the Corp of Engineers Quality Control System when turning in submittals. Reference <http://24.221.12.75/QCS/04QCSupdates.htm>; <http://winrms.usace.army.mil/contractors.htm>. RMS Support Center telephone: (760) 247-0217.

### 3.2 QUALITY CONTROL PLAN

The Contractor shall furnish for review by the Government, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

#### 3.2.1 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01330 SUBMITTAL PROCEDURES.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)
- f. Procedures for tracking preparatory, initial, and follow-up

control phases and control, verification, and acceptance tests including documentation.

- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.
- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

### 3.2.2 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

### 3.2.3 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

## 3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 30 calendar days prior to the Coordination Meeting.

During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

### 3.3.1 Subcontractor CQC Orientation

Before a Subcontractor begins work on the jobsite, the CQC Manager will train the Subcontractor by showing the video tape entitled "CQC - A Bridge (or Pathway) to Success" and answering any questions pertaining to quality

control operations. This requirement is waived only if a Subcontractor attended the initial coordination meeting described above. A copy of this video can be borrowed from the Contracting Officer. A record of the orientation shall be documented in the QC Report.

### 3.4 QUALITY CONTROL ORGANIZATION

#### 3.4.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure safety and contract compliance. A Site Safety Health Officer (SSHO) will be required for this contract. The Site Safety Health Officer (SSHO) and CQC System Manager can be the same person/individual. The SSHO can either be a member of the CQC staff, or shall receive delegated authority directly from an authorized official of the firm; the SSHO shall have the authority to stop work which is not in compliance with the USACE EM 385-1-1. See Section 01525 for additional requirements and experience qualification for the SSHO. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. The Contractor shall provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Complete records of all letters, material submittals, show drawing submittals, schedules and all other project documentation shall be promptly furnished to the CQC organization by the Contractor. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

#### 3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a construction person with a minimum of 10 years in related work. This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned as CQC System Manager but may have duties as the SSHO in addition to quality control duties. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

#### 3.4.3 CQC Personnel

**\*1**

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: SSHO. **The SSHO** may be employees of the prime Contractor on this project; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals may perform other duties but must be allowed sufficient time to perform their assigned quality control duties

as described in the Quality Control Plan.

The word "graduate" below indicates an individual possessing a four-year college degree accredited in the respective field listed.

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#### Experience Matrix

Area	Qualifications
a. SSHO	See Section 01525
b. Testing, Adjusting and Balancing (TAB) Personnel	Specialist must be a member of AABC or an experienced technician of the firm certified by the NEBB.

#### 3.4.4 Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager shall have completed and passed the course entitled "Construction Quality Management For Contractors" within the last 5 years. This course is periodically offered by the Associated Builders and Constructors, Inc., or Associated General Contractor, Inc., and the U.S. Army Corps of Engineers, 696 Virginia Road, Concord, MA 01742-2751.

#### 3.4.5 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

#### 3.5 SUBMITTALS AND DELIVERABLES

Submittals shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. The submittals required by Sections 15950A HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS; 15951A DIRECT DIGITAL CONTROL FOR HVAC; 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS; and 15995A COMMISSIONING OF HVAC SYSTEMS shall be coordinated with Section 01330 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required.

#### 3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

##### 3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

- a. A review of each paragraph of applicable specifications, reference codes, and standards. A copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field shall be made available by the Contractor at the preparatory inspection. These copies shall be maintained in the field and available for use by Government personnel until final acceptance of the work.
- b. A review of the contract drawings.
- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
- f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- g. A review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. Resolve all differences.
- k. Discussion of the initial control phase.
- l. The Government shall be notified at least 24 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

### 3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance.

Verify required control inspection and testing.

- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
- g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

### 3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

### 3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

## 3.7 TESTS

### 3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers validated testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and

comply with testing standards.

- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

### 3.7.2 Testing Laboratories

#### 3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

#### 3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of \$1,375.00 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

### 3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

### 3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

For delivery by mail:

Commander and Director  
U.S. Army Engineer Waterways Experiment Station  
ATTN: CEWES-GS  
3909 Halls Ferry Road

Vicksburg, MS 39180-6199

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the Special Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications, the CQC Manager shall conduct an inspection of the work. A punch list of items which do not conform to the approved drawings and specifications shall be prepared and included in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Fort Knox Community Schools/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed.

These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase shall be identified (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.
- g. Offsite surveillance activities, including actions taken.
- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- i. Instructions given/received and conflicts in drawings and/or specifications.
- j. Contractor's verification statement.
- k. These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.
- l. Deficiency Tracking System. The Contractor shall maintain a cumulative list of deficiencies identified for the duration of the project. Deficiencies to be listed include those failures, Government oral observations and Notifications of Noncompliance. The list shall be maintained at the project site. Copies of updated listings shall be submitted to the Government at least

every 30 days.

3.10 SAMPLE FORMS AND RESIDENT MANAGEMENT SYSTEM FORMS

Forms are generated by the RMS software.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

-- End of Section --

**Amdt #0001**

SECTION 01500A

TEMPORARY CONSTRUCTION FACILITIES  
AND ADMINISTRATIVE REQUIREMENTS  
02/97

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Site Plan

The site plan indicates the proposed location and dimensions of an area to be fenced and used by the Contractor, avenues of ingress/egress to the fenced area and areas which have to be graveled to prevent the tracking of mud are also identified. The Contractor shall indicate on this site plan, the number and location of trailers to be used and details of the fence installation. The Contractor shall also indicate if the use of a supplemental or other staging area is desired.

1.1.2 Identification of Employees

The Contractor shall be responsible for furnishing to each employee, and for requiring each employee engaged on the work to display, identification as approved and directed by the Contracting Officer. Prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of any employee. When required, the Contractor shall obtain and provide fingerprints of persons employed on the project. Contractor and subcontractor personnel shall wear identifying markings on hard hats clearly identifying the company for whom the employee works.

1.1.3 Employee Parking

Contractor employees shall park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking shall not interfere with school employees' vehicles, school bus, delivery and sanitation vehicles, students' ingress and egress, and established parking requirements of the school.

1.2 AVAILABILITY AND USE OF UTILITY SERVICES

1.2.1 Payment for Utility Services

The Government will make all reasonably required utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The Contractor will not be charged for utilities consumed, however the Contractor shall carefully conserve all utilities furnished without charge.

1.2.2 Temporary Connections

The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary connections and distribution lines to water and electrical for site trailers and temporary construction facilities. The Contractor shall

notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired. At the Contractor's option, the temporary construction power for the PTR additions can be fed from an existing breaker in an existing panel of the classroom pod closest to the new PTR addition or from the closest primary service. All wiring extended from the existing classroom pod panel shall be run above the ceiling to either a temporary weatherhead through the exterior wall for overhead service to the temporary construction power location or through the exterior wall and down for buried service to the temporary construction power location. All temporary wiring shall be protected with overcurrent devices in accordance with the NEC. All temporary wiring inside the existing building shall be run in EMT conduit. Overhead wiring to the temporary construction power location shall be triplex cable designed for overhead service. All holes cut in any existing masonry shall be accomplished using a core drill no larger than the required conduit size plus 1/4 inch maximum. All damage to existing ceilings resulting from installation of the temporary conduit and feeders shall be repaired to original condition. The hole through the exterior wall shall be filled with mortar in the exterior face brick and interior CMU upon removal of the temporary service. If the Contractor chooses to connect to existing primary service, such connection shall be accomplished by Nolin RECC and a meter shall be installed on this service and consumption paid for by Fort Knox Community Schools. The Contractor is responsible for all coordination and cost for installation of temporary electrical service, including cost associated with a separate meter. Contractor shall contact the Fire Department at 624-6016 and M.P. Company Alarms Desk at 624-2443 prior to and immediately following any planned power outages.

#### 1.2.3 Requirement for Backflow Prevention on Temporary/Permanent Potable Water Connections

The contractor shall install a backflow prevention device on all connections to the potable water system. The backflow prevention device shall be a reduced pressure or double check type, meeting all the State code requirements for backflow preventers on potable water. If the contractor requests the use of a fire hydrant and receives approval from the Contracting Officer's Representative a backflow prevention device and meter meeting the Contracting Officer's approval shall be installed prior to each use.

#### 1.2.4 Sanitation

The Contractor shall provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

#### 1.2.5 Telephone

The Contractor shall make arrangements and pay all costs for telephone facilities. As a minimum, Contractor shall provide an office phone or cellular phone for the contract superintendent. The phone number shall be provided to the Contracting Officer.

### 1.3 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

#### 1.3.1 Bulletin Board

Immediately upon beginning of work, the Contractor shall provide a

weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work the bulletin board shall be removed by and remain the property of the Contractor.

#### 1.3.2 Project Signs

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The Contractor shall furnish and install a project sign at each PTR addition site, **in accordance with Section 00800L SPECIAL CLAUSES.**

#### 1.4 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic and shall notify the Contracting Officer a minimum of 10 days in advance of any traffic changes or road closures. The Contractor shall maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

All commercial vehicles larger than a pickup to include panel vans with no side or rear windows are to enter Fort Knox, KY through one location (Brandenburg Road) where the vehicles will be "scanned."

##### 1.4.1 Haul Roads

The Contractor will be required to use the haul routes shown on the plans unless otherwise permitted in writing by the Contracting Officer. The Contractor shall maintain the haul routes and shall keep the dust problem under control by wetting the surface as needed. Sweeping and cleaning of pavements will be done as necessary to remove spillage resulting from the hauling operations. After all hauling has been completed, the Contractor shall restore the earth areas used for the haul routes to original condition by final grading, shaping, compacting, and grassing, and shall clean and sweep all paved areas as required. Any pavement damaged as a result of hauling operations under this contract for both the earth and other materials shall be promptly repaired by the Contractor, as approved by the Contracting Officer. The cost of maintenance and repair of the haul routes, as mentioned above, shall be considered as a subsidiary obligation of the Contractor. The axle load of earth hauling equipment operating on paved streets shall not exceed 18,000 pounds.

##### 1.4.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

#### 1.5 CONTRACTOR'S TEMPORARY FACILITIES

##### 1.5.1 Administrative Field Offices

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel. The Contractor may, at its option, furnish and maintain a trailer-type mobile office acceptable to the Contracting Officer and providing as a minimum the facilities specified above. The trailer shall be securely anchored to the ground at all four corners to guard against movement during high winds.

##### 1.5.2 Storage Area

The Contractor shall construct a temporary 8 foot high chain link fence around trailers and materials as indicated on the drawings. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. Mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area at the end of each work day.

##### 1.5.3 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the military boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

##### 1.5.4 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on the military property.

##### 1.5.5 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment.

Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

#### 1.5.6 New Building

In the event a new building is constructed for the temporary project field office, it shall be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. It shall be equipped with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. It shall be provided with a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building shall be waterproof, shall be supplied with a heater, shall have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Approved sanitary facilities shall be furnished. The windows and doors shall be screened and the doors provided with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins shall be non-removable. The windows shall be arranged to open and to be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the building through these panels. In warm weather, air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 20 degrees F below the outside temperature when the outside temperature is 95 degrees F, shall be furnished. Any new building erected for a temporary field office shall be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work shall become the property of the Contractor and shall be removed from the site. All charges for telephone service for the temporary field office shall be borne by the Contractor, including long distance charges.

#### 1.5.7 Security Provisions

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

#### 1.6 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor shall install a satisfactory means of communication, such as telephone or other suitable devices. The devices shall be made available for use by Government personnel.

#### 1.7 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and

erect temporary project safety fencing at the work site. The safety fencing shall be 8-foot brown chain link fence, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site.

#### 1.8 PARTNERING

Following contract award, the Government intends to propose a voluntary partnering relationship with the Contractor. This partnering relationship will attempt to draw on strengths of each organization to facilitate communications and minimize delays to achieve a quality product, within budget, and on schedule. Participation in such partnering activities may include attendance at coordination meetings and cooperation in other efforts to promote the partnering relationship. The Government and the Contractor will each bear their own costs for participation in the partnering relationship, with no change in the contract price. Participation will not result in any change in the terms or price of the contract.

#### 1.9 INSTALLATION REGULATIONS

The employees of the Contractor will be required to abide by all installation regulations as published by the Commanding Officer. A copy of these regulations can be obtained from the Area/Resident Engineer at the installation. All costs in connection therewith shall be included in the contract price for the work.

#### 1.10 TESTING LABORATORIES

Testing is required to be performed by the Contractor as part of his Quality Control Program to verify contract compliance. This Quality Control Testing is to be conducted by a project or commercial laboratory which has been found adequate and qualified by a Corps of Engineers Division Laboratory Inspection Team.

##### 1.10.1 Approved Testing Laboratories

**\*1**

A composite listing of approved testing laboratories within the Louisville District is available at <http://www.wes.army.mil/SL/MTC/ValStatesTbl.htm> and select "Kentucky". The Contractor should engage the services of a laboratory contained in the composite list.

##### 1.10.2 Other Laboratory Services

The Contractor may engage the services of a laboratory other than those approved by Corps of Engineers District Laboratory Inspection Team if they comply with the following:

a. The Contractor identifies and proposes the unapproved laboratory a minimum of 90 days prior to the start of testing. This time is necessary to allow for scheduling an inspection by a Corps of Engineers District Laboratory team. The time for Government inspection will not be the basis for an increase in the contract performance period.

b. All costs of Government inspection shall be the responsibility

of the Contractor.

c. The Contractor may request Government inspection and approval prior to award by forwarding a written request to:

US Army Engineer District, Louisville  
Environmental and Materials Unit

1.11 ENVIRONMENTAL EVALUATION FOR SITE CONTAMINATION - CATEGORY I

1.11.1 Site Evaluation

The job site has been evaluated for potential site contamination. The site is located in a traditionally nonhazardous location. The installation has no reason to suspect contamination.

1.11.2 Contractual Responsibilities of All Parties in the Event of Encounter with Contamination

If the Contractor encounters materials or conditions which indicate that there may be contamination on the site, the Contractor shall stop all work on the job site and report the discovery of the contaminants to the Contracting Officer's Representative (COR). The Contracting Officer, will issue a written order to the Contractor to resume work or to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government as provided in FAR 52.242-14 - SUSPENSION OF WORK. The Government will be responsible for making an assessment of the contaminated site if this course of action is determined to be appropriate. After the assessment has been completed, the Government reserves the right to the following courses of action:

- a. Direct the Contractor to resume work.
- b. Clean up the contaminated site prior to directing the Contractor to resume work. The COR will determine whether the cleanup is to be accomplished by others or the Contractor.
- c. Relocate the project site.
- d. Terminate the contract for the convenience of the Government as provided in FAR 52.249-1 - TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (SHORT FORM) or FAR 52.249-2 - TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) - ALTERNATE I as applicable.

\*1  
1.12 NOT USED

\*1  
1.13 NOT USED

\*1  
1.14 NOT USED

\*1  
1.14.1 NOT USED

\*1  
1.14.2 NOT USED

\*1

1.15 NOT USED

\*1

1.15.1 NOT USED

\*1

1.15.2 NOT USED

1.16 CONTRACTOR VEHICLE/EQUIPMENT ACCESS TO FORT KNOX

The Contractor shall be responsible for furnishing an identification badge/card through the Fort Knox Resident Office to each employee prior to the employees working on-site, and for requiring each employee engaged on the work to display identification as may be approved and directed by the Contracting Officer. All prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of the employee or completion of the contract. When required by the Contracting Officer, the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project.

If a foreign national is to work on Fort Knox, the following procedure must be used to obtain identification:

**Before arriving on Post:**

A designated escort/sponsor for visitors with valid military I.D. must be assigned. Color copies or originals of passports, VISAs, etc. of visitors must be supplied. Go to the Antiterrorism Operations and Intelligence Cell Office, Building 1002 in the basement and pick up the required forms. The forms must show the visitor AND escort/sponsor information. The forms should then be taken to the Provost Marshall's Office for approval, Building 204. Once approved, the names will be added on an immediate entry list.

**Upon arrival on Post:**

Visitors and escort/sponsor will be stopped at the gates and procedure will start from the beginning of the procedure above. Once forms are completed, they will be sent for approval, which takes approximately one hour.

1.17 OUTAGES

Contractor's work requiring outages of utility systems or building systems will require 2 weeks' advance notice and will be subject to the approval of the Contracting Officer. Contractor will be held responsible for unauthorized utility disruptions that cause damage or loss to the Government's real property, equipment, or operations. The Contractor will be held responsible for utility disruptions that extend beyond this period.

Limits of Duration:

Water ----- 4 hours  
Sewer ----- 4 hours  
Electricity ----- 4 hours  
Natural Gas: Seasons to be determined by Fort Knxo DBOS  
    During heating season -- 3 hours  
    During cooling season -- 6 hours  
Chilled Water: Seasons to be determined by Fort Knox DBOS  
    During heating season -- 3 hours

During cooling season -- 6 hours

The Contractor shall provide temporary utilities systems for any utility outage longer than the limits of duration shown above.

#### 1.18 CONTINUITY

All tools, labor and materials required to complete any item of work within a given work area or requiring an outage of any building utility or system, shall be available at the site prior to commencement thereof. Once work has commenced on an item of work, said work shall be continuously and diligently performed to completion and acceptance. Breaks in work to be negotiated with the Contracting Officers Representative if other than Holidays.

#### 1.19 PERMITS

##### 1.19.1 Disposal Permits

A permit is required to use the installation land clearing and inert debris and demolition landfills. Landfill permits shall be processed with the Environmental Branch of the DBOS Environmental and Natural Resources Division through the Contracting Officer. Permits are issued for the life of the specific contract only. Only materials produced on the project for which the permits are issued may be disposed of in the land clearing and inert debris and demolition landfills. The Contractor shall keep a copy of the completed permit with the vehicle throughout the contract disposal operation. Copies of the disposal permit forms will be provided at the Preconstruction Conference. The land clearing and inert debris and demolition debris disposal site locations are shown on the drawings.

#### 1.20 ROAD CLOSURES

Road closures will require 2 weeks' advance written notice and be subject to the Contracting Officer's approval. Notice shall state reason for closure, date and time closure will commence and estimated duration of closure. A sketch shall be provided showing location of excavated area and placement of barricades and signs. Closures shall be limited to a maximum of 5 calendar days.

#### 1.21 LANDFILLS

##### 1.21.1 Land Clearing and Inert Debris (LCID) Landfill

The land clearing and inert debris (LCID) landfill is permitted for disposal of yard waste (pine needles, limbs, trees, untreated wood, unpainted wood), inert debris (bricks, concrete, rubble, glass, concertina wire), and uncontaminated soil.

##### 1.21.2 Demolition Landfill

The demolition landfill is permitted for disposal of construction and renovation debris: buildings, asphalt, painted and treated wood, incidental scrap metals, shingles, and debris incidental to construction such as cement or joint compound bags, plastic pails or metal cans or drums, insulation, and wallboard.

##### 1.21.3 Transfer Station

White goods (appliances), tires, aluminum cans, and municipal solid waste (such as paper, plastic, cardboard, or household garbage) must be disposed of at the transfer station. Special arrangements must be made with the Environmental Branch of the DBOS Environmental and Natural Resources Division through the Contracting Officer to dispose of liquids, hazardous waste, and tires.

#### 1.21.4 Municipal Solid Waste (MSW)

Municipal solid waste (MSW) shall be disposed of in dumpsters designated for MSW. Operating hours for the transfer station are 7:30 a.m. to 3:00 p.m. MSW shall be defined as any wastes other than those described above, to include garbage, vegetable waste and containers thereof resulting from the handling, preparation, cooking and consumption of foods, and excess quantities of paper, plastic, and cardboard (construction material packaging is acceptable).

#### 1.21.5 Trash Containers

All trash containers on the job site must be covered at all times to ensure that trash does not blow around. In addition, all light/loose material will be secured such that it will not blow around during windy weather.

#### 1.21.6 Construction Debris Leaving Site

All construction debris/trash that leaves the project site will be covered from the time that it leaves the construction site. Any mud or soil which leaves the project site will be cleaned up by the Contractor immediately upon discovery or notification of such an occurrence.

#### 1.22 LANDFORMS

Contractor will be required to maintain existing landforms, drainage patterns, and healthy, mature vegetation to the maximum extent possible and will replace damaged vegetation, sod, and ground cover.

#### 1.23 TOPSOIL

Any suitable topsoil stripped from the site during the course of work will be stockpiled onsite for reuse. Any excess topsoil remaining upon completion of project will be disposed of off-site.

#### 1.24 UNFORESEEN SITE CONDITIONS

##### \*1

Any unforeseen site conditions, unmapped utility systems, or historical/archeological items encountered during site surveys, soil borings, or construction excavation will be reported to the Contracting Officer **within 48 hours of being encountered.**

#### 1.25 REPLACEMENT

The Contractor shall be held responsible for the replacement of any utility systems, facilities, or Government equipment damaged during the course of the contract.

#### 1.26 MOWING

The Contractor will mow the grass on the construction site weekly or when the following conditions warrant: centipede grass will be maintained to a

maximum height of 2 inches and a minimum height of 1 inch; all other grasses will be mowed to keep the height of the grass to a maximum of 4 inches and a minimum of 2 inches.

#### 1.27 COMMUNICATIONS SYSTEMS

The Director of Information Management will be notified through the Contracting Officer's Representative of the preparatory meeting for the communications system.

#### 1.28 COLOR BOARDS

Five sets of color boards shall be submitted, in addition to samples required elsewhere. Such submittals shall be made not later than 60 days prior to approval date required to achieve compliance with approved project schedule. Each set of boards shall include samples of colors and finishes of all exterior and interior building surfaces such as walls, floors and ceilings. The samples will be presented on 8-inch by 10-1/2-inch boards (modules) with a maximum spread of 24 inches by 31-1/2 inches for foldouts.

The modules shall be designed to fit in a standard looseleaf, three-ring binder. If more space is needed, more than one board per set may be submitted. The Contractor shall certify that he has reviewed the color samples in detail and that they are in strict accordance with the contract drawings and specifications, except as may be otherwise explicitly stated. If multiple material and finish (color) schemes are required, samples shall be identified by scheme and coordinated to room names and numbers shown on the architectural floor plans and room finish and color schedule. Submittal of the color boards shall not relieve the Contractor of the responsibility to submit the samples required by technical specifications.

#### 1.29 PHOTOGRAPHS

##### 1.29.1 Pre-Construction Photographs

Prior to starting any construction activity, the contractor shall make a photographic record (still or video) of the existing conditions in any area (new or existing) where the contractor is required to do any work. The intent of this photographic record is to eliminate or minimize all disputes arising from questions regarding conditions prior to construction versus conditions after construction.

##### 1.29.2 Construction Progress Photographs

\*1

The Contractor shall, during the progress of the project, furnish the Contracting Officer progress photographs and color slides to depict progress of construction. Digital photographs may be submitted on electronic media in lieu of slides. The photographs and slides shall be taken between the 1st and 5th day of each month and be delivered to the Contracting Officer not later than the 20th day of the same month taken. The photographs and slides shall be taken from not less than six positions for each month as selected by the Contracting Officer. They shall show, inasmuch as practicable, work accomplished during the previous month. The photographs shall be 8-inch by 10-inch color glossy prints and the slides 35 millimeter color slides. Each photograph shall be **neatly** identified showing date made, contract title and number and a brief description of work depicted and shall be sequentially numbered. The identifying data shall be placed on the back of the prints. Slides shall have a number placed on the frame corresponding to the appropriate identified print, the name of the project, the date and a brief description of work depicted. No

identifying data shall appear on the face of prints or in the viewing area of slides. One copy of each photograph and the corresponding negative and slide **or digital media** shall be furnished to the Contracting Officer by the time stipulated above. No separate payment will be made for these services and all costs in connection therewith shall be considered incidental to costs of the overall project.

1.30 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

1.31 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

**Amdt #0001**

SECTION 01525

SAFETY AND OCCUPATIONAL HEALTH REQUIREMENTS

**8/03**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z359.1 (1999) Safety Requirements for Personal  
Fall Arrest Systems, Subsystems and  
Components

ASME INTERNATIONAL (ASME)

ASME B30.22 (2000) Articulating Boom Cranes

ASME B30.5 (2000) Mobile and Locomotive Cranes

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926.65 Hazardous Waste Operations and Emergency  
Response

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10 (1998) Portable Fire Extinguishers

NFPA 241 (1996) Safeguarding Construction,  
Alteration and Demolition Operations

NFPA 70 (1990) National Electric Code

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

29 CFR 1910 Safety and Health Regulation in General  
Industry

29 CFR 1910.120 Hazardous Waste Operations and Emergency  
Response

29 CFR 1910.146 Permit-required Confined Spaces

29 CFR 1910.94 Ventilation

29 CFR 1915 Confined and Enclosed Spaces and Other  
Dangerous Atmospheres in Shipyard  
Employment

29 CFR 1926 Safety and Health Regulations for  
Construction

29 CFR 1926.500

Fall Protection

U. S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1

(1996) Safety and Health Requirements  
Manual

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-01 Preconstruction Submittals

Site Safety & Health Officer Qualifications (SSHO); G, AO

Accident Prevention Plan (APP); G, AO

Activity Hazard Analysis (AHA); G, AO

### SD-06 Test Reports

#### Reports

Submit reports as their incidence occurs, in accordance with the requirements of the paragraph entitled, "Reports."

Accident Reports

Monthly Exposure Reports

Regulatory Citations and Violations

Crane Reports

### SD-07 Certificates

Confined Space Entry Permit

Submit one copy of each permit attached to each Daily Quality Control Report.

## 1.3 DEFINITIONS

a. High Visibility Accident. Any mishap which may generate publicity and/or high visibility.

b. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

c. Multi-Employer Work Site (MEWS). A multi-employer work site, as defined by OSHA, is one in which many employers occupy the same site. The Government considers the Prime Contractor to be the "controlling

authority" for all work site safety and health of the subcontractors.

d. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:

- (1) Death, regardless of the time between the injury and death, or the length of the illness;
- (2) Days away from work;
- (3) Restricted work;
- (4) Transfer to another job;
- (5) Medical treatment beyond first aid;
- (6) Loss of consciousness; or
- (7) A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

e. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.

f. Operating Envelope. The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).

g. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the six elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; two-blocking; overload; and collision, including unplanned contact between the load, crane, and/or other objects. A dropped load, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.).

h. Site Safety and Health Officer (SSHO). The qualified or competent person who is responsible for the on-site safety and health required for the project. The Contractor quality control (QC) person can be the SSHO on this project.

i. Low-slope roof. A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

#### 1.4 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, work performed shall comply with USACE EM 385-1-1, and all federal, state, and local laws, ordinances, and the following criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria,

ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

#### 1.5 DRUG PREVENTION PROGRAM

Conduct a proactive drug and alcohol use prevention program for all workers, prime and subcontractor, on the site. Ensure that no employee uses illegal drugs or consumes alcohol during work hours. Ensure there are no employees under the influence of drugs or alcohol during work hours. After accidents, collect blood, urine, or saliva specimens and test the injured and involved employees for the influence of drugs and alcohol. A copy of the test shall be made available to the Contracting Officer upon request.

#### 1.6 SITE QUALIFICATIONS, DUTIES AND MEETINGS

##### 1.6.1 Personnel Qualifications

##### 1.6.1.1 Site Safety and Health Officer (SSHO)

Site Safety and Health Officer (SSHO) shall be provided at the work site at all times to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. SSHO shall be employed by the prime. SSHO qualifications in resume form with education certifications shall be submitted per paragraph 1.2. The SSHO can be as follows: the Contractor's quality control system manager or an individual other than the CQC system manager who is answerable to the CQC System Manager, and is a member of the quality control team, not the project superintendent or an individual other than the CQC System Manager who is not a member of the CQC staff, and is not answerable to the CQC System Manager, but is appointed by an official of the Contractor, not the project superintendent.

**\*1**

**An alternate SSHO shall be provided and** shall be equally qualified as the SSHO and shall be capable of performing the full duties of the SSHO during any very brief period of work when the SSHO is absent. To insure that safety and health conditions are maintained/enforced at all items, and a SSHO is present at all items, the Contractor shall designate an alternate to perform the safety and health requirements stated herein to cover any extended period when the SSHO can not be present, such as during absences for vacations/extended sickness, or when there are multiple shifts that requires additional coverage. The alternate shall have the same qualifications/training as the SSHO.

The SSHO, and alternate, shall meet the following requirements:

Level 1:

- Worked on similar projects.
- 10-hour OSHA construction safety class or equivalent within last 3 years.
- Competent person training as needed.

##### 1.6.1.2 Competent Person for Confined Space Entry

Provide a competent person meeting the requirements of EM 385-1-1 who is assigned in writing by the Designated Authority to assess confined spaces and who possesses demonstrated knowledge, skill and ability to:

- a. Identify the structure, location, and designation of confined and

permit-required confined spaces where work is done;

- b. Calibrate and use testing equipment including but not limited to, oxygen indicators, combustible gas indicators, carbon monoxide indicators, and carbon dioxide indicators, and to interpret accurately the test results of that equipment;
- c. Perform all required tests and inspections specified in 29 CFR 1910.146 and 29 CFR 1915 Subpart B;
- d. Assess hazardous conditions including atmospheric hazards in confined space and adjacent spaces and specify the necessary protection and precautions to be taken;
- e. Determine ventilation requirements for confined space entries and operations;
- f. Assess hazards associated with hot work in confined and adjacent space and determine fire watch requirements; and,
- g. Maintain records required.

#### 1.6.1.3 Competent Person for the Health Hazard Control and Respiratory Protection Program

Provide a competent person meeting the requirements of EM 385-1-1 who is:

- a. Capable by education, specialized training and/or experience of anticipating, recognizing, and evaluating employee exposure to hazardous chemical, physical and biological agents in accordance with USACE EM 385-1-1, Section 6.
- b. Capable of specifying necessary controls and protective actions to ensure worker health.

#### 1.6.1.4 Crane Operators

Crane operators shall meet the requirements in USACE EM 385-1-1, Appendix G.

#### 1.6.2 Personnel Duties

##### 1.6.2.1 Site Safety and Health Officer (SSHO)/Superintendent

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Safety inspection logs shall be attached to the Contractors' daily quality control report.
- b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.
- c. Maintain applicable safety reference material on the job site.
- d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.
- e. Implement and enforce accepted APPS and AHAs.

f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. A list of unresolved safety and health deficiencies shall be posted on the safety bulletin board.

g. Ensure sub-contractor compliance with safety and health requirements.

h. Other duties as identified per Specification Section 01451L.

Failure to perform the above duties will result in dismissal of the superintendent and/or SSO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

### 1.6.3 Meetings

#### 1.6.3.1 Preconstruction Conference

a. The Contractor will be informed, in writing, of the date of the preconstruction conference. The purpose of the preconstruction conference is for the Contractor and the Contracting Officer's representatives to become acquainted and explain the functions and operating procedures of their respective organizations and to reach mutual understanding relative to the administration of the overall project's APP before the initiation of work.

b. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the AHAs and special plans, program and procedures associated with it).

c. The Contractor shall discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated activity hazard analyses (AHAs) that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.

d. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Work shall not begin until there is an accepted APP.

#### 1.6.3.2 Weekly Safety Meetings

Conduct weekly safety meetings at the project site for all employees. The Contracting Officer will be informed of the meeting in advance and be allowed attendance. Minutes showing contract title, signatures of attendees and a list of topics discussed shall be attached to the Contractors' daily quality control report.

#### 1.6.3.3 Work Phase Meetings

The appropriate AHA shall be reviewed and attendance documented by the Contractor at the preparatory, initial, and follow-up phases of quality control inspection. The analysis should be used during daily inspections to ensure the implementation and effectiveness of safety and health controls.

## 1.7 TRAINING

### 1.7.1 New Employee Indoctrination

New employees (prime and sub-contractor) will be informed of specific site hazards before they begin work. Documentation of this orientation shall be kept on file at the project site.

### 1.7.2 Periodic Training

Provide Safety and Health Training in accordance with USACE EM 385-1-1 and the accepted APP. Ensure all required training has been accomplished for all onsite employees.

### 1.7.3 Training on Activity Hazard Analysis (AHA)

Prior to beginning a new phase, training will be provided to all affected employees to include a review of the AHA to be implemented.

## 1.8 ACCIDENT PREVENTION PLAN (APP)

The Contractor shall use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in USACE EM 385-1-1, Appendix A, "Minimum Basic Outline for Preparation of Accident Prevention Plan". Where a paragraph or subparagraph element is not applicable to the work to be performed indicate "Not Applicable" next to the heading. Specific requirements for some of the APP elements are described in paragraph 1.8.1.

The APP shall be job-specific and shall address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Any portions of the Contractor's overall safety and health program referenced in the APP shall be included in the applicable APP element and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer and any designated CSP and/or CIH.

Submit the APP to the Contracting Officer a minimum of 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP. The Contracting Officer reviews and comments on the Contractor's submitted APP and accepts it when it meets the requirements of the contract provisions.

Once accepted by the Contracting Officer, the APP and attachments will be

enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

Once work begins, changes to the accepted APP shall be made only with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and quality control manager. Should any unforeseen hazard become evident during the performance of work, the project Site Safety and Health Officer (SSHO) shall inform the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, all necessary action shall be taken by the Contractor to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment.

Copies of the accepted plan will be maintained at the Contracting Officer's office and at the job site.

The APP shall be continuously reviewed and amended, as necessary, throughout the life of the contract. Unusual or high-hazard activities not identified in the original APP shall be incorporated in the plan as they are discovered.

#### 1.8.1 EM 385-1-1 Contents

In addition to the requirements outlines in Appendix A of USACE EM 385-1-1, the following is required:

a. Names and qualifications (resumes including education, training, experience and certifications) of all site safety and health personnel designated to perform work on this project to include the designated site safety and health officer and other competent and qualified personnel to be used such as CSPs, CIHs, STSs, CHSTs. The duties of each position shall be specified.

b. Qualifications of competent and of qualified persons. As a minimum, competent persons shall be designated and qualifications submitted for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; personal protective equipment and clothing to include selection, use and maintenance.

c. Confined Space Entry Plan. Develop a confined space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)

d. Health Hazard Control Program. The Contractor shall designate a competent and qualified person to establish and oversee a Health Hazard Control Program in accordance with USACE EM 385-1-1, Section 6. The program shall ensure that employees, on-site Government representatives, and others, are not adversely exposed to chemical, physical and biological agents and that necessary controls and

protective actions are instituted to ensure health.

e. Crane Critical Lift Plan. Prepare and sign weight handling critical lift plans for lifts over 75 percent of crane hoist's maximum load limit; lifts involving more than one crane or hoist; lifts of personnel; and technically difficult lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks in accordance with USACE EM 385-1-1, paragraph 16.c.18. and submit 15 calendar days prior to on-site work.

f. Alcohol and Drug Abuse Plan

(1) Describe plan for random checks and testing with pre-employment screening in accordance with the DFAR Clause subpart 252.223-7004, "Drug Free Work Force."

(2) Description of the on-site prevention program

g. Fall Protection and Prevention (FP&P) Plan. The plan shall be site specific and address all fall hazards in the work place and during different phases of construction. It shall address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 6 feet. A qualified person shall prepare and sign the plan. The plan shall include fall protection and prevention systems, equipment and methods employed for every phase of work, responsibilities, rescue and escape equipment and operations, training requirements, and monitoring methods. The accepted Fall Protection and Prevention Plan shall be kept and maintained at the job site for the duration of the project.

h. Site Demolition Plan. The safety and health aspects prepared in accordance with Section 02220, DEMOLITION LRL version.

i. Excavation Plan. The safety and health aspects prepared in accordance with Section 02300, EARTHWORK FOR BUILDINGS AND UTILITIES.

j. Training Records and Requirements. List of mandatory training and certifications which are applicable to this project (e.g. explosive actuated tools, fall protection, vehicle operator, forklift operators, personal protective equipment); list of requirements for periodic retraining/certification; outline requirements for supervisory and employee safety meetings.

#### 1.9 ACTIVITY HAZARD ANALYSIS (AHA)

The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1. Submit the AHA for review at least 15 calendar days prior to the start of each phase. Format subsequent AHA as amendments to the APP. An AHA will be developed by the Contractor for every operation involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or subcontractor is to perform work. The analysis must identify and evaluate hazards and outline the proposed methods and techniques for the safe completion of each phase of work. At a minimum, define activity being performed, sequence of work, specific safety and health hazards anticipated, control measures (to include personal protective equipment) to eliminate or reduce each hazard to acceptable levels, equipment to be used, inspection requirements, training requirements for all involved, and the competent person in charge of that phase of work. For work with fall hazards, including fall hazards

associated with scaffold erection and removal, identify the appropriate fall arrest systems. For work with materials handling equipment, address safeguarding measures related to materials handling equipment. For work requiring excavations, include requirements for safeguarding excavations. An activity requiring an AHA shall not proceed until the AHA has been accepted by the Contracting Officer's representative and a meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activity, including on-site Government representatives. The Contractor shall document meeting attendance at the preparatory, initial, and follow-up phases of quality control inspection. The AHA shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

Activity hazard analyses shall be updated as necessary to provide an effective response to changing work conditions and activities. The on-site superintendent, site safety and health officer and competent persons used to develop the AHAs, including updates, shall sign and date the AHAs before they are implemented.

#### 1.10 DISPLAY OF SAFETY INFORMATION

Upon start of construction, erect a safety bulletin board at the job site. The following information shall be displayed on the safety bulletin board in clear view of the on-site construction personnel, maintained current, and protected against the elements and unauthorized removal. No separate payment for the furnishing/erecting of the bulletin board as specified and cost thereof shall be considered a subsidiary obligation of the Contractor:

- a. Map denoting the route to the nearest emergency care facility.
- b. Emergency phone numbers.
- c. Copy of the most up-to-date APP.
- d. AHA(s).
- e. OSHA 300A Form.
- f. Confined space entry permit.
- g. OSHA Safety and Health Protection-On-The-Job Poster.

#### 1.11 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in the article "References." Maintain applicable equipment manufacturer's manuals.

#### 1.12 EMERGENCY MEDICAL TREATMENT

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

### 1.13 REPORTS

#### 1.13.1 Accident Reports

a. For recordable injuries and illnesses, and property damage accidents resulting in at least \$2,000 in damages, the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the USACE Accident Report Form 3394 and provide the report to the Contracting Officer within 1 calendar day of the accident. The Contracting Officer will provide copies of any required or special forms.

#### 1.13.2 Accident Notification

Notify the Contracting Officer as soon as practical, but not later than four hours, after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$2,000, or any weight handling equipment accident involving a overturned crane, collapsed boom, or any other major damage to the crane or adjacent property. Information shall include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on site and Government investigation is conducted.

#### 1.13.3 Monthly Exposure Reports

Monthly exposure reporting to the Contracting Officer is required to be attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. The Contracting Officer will provide copies of any special forms.

#### 1.13.4 Regulatory Citations and Violations

Contact the Contracting Officer immediately of any OSHA or other regulatory agency inspection or visit, and provide the Contracting Officer with a copy of each citation, report, and contractor response. Correct violations and citations promptly and provide written corrective actions to the Contracting Officer.

#### 1.13.5 Crane Reports

Submit crane inspection reports required in accordance with USACE EM 385-1-1, Appendix H and as specified herein with Daily Reports of Inspections.

#### 1.13.6 Certificate of Compliance

The Contractor shall provide a Certificate of Compliance for each crane entering an activity under this contract (see Contracting Officer for a blank certificate). Certificate shall state that the crane and rigging gear meet applicable OSHA regulations (with the Contractor citing which OSHA regulations are applicable, e.g., cranes used in construction, shall comply with 29 CFR 1926 and USACE EM 385-1-1 section 16 and Appendix H. Certify on the Certificate of Compliance that the crane operator(s) is qualified and trained in the operation of the crane to be used. The

Contractor shall also certify that all of its crane operators working on the DOD activity have been trained in the proper use of all safety devices (e.g., anti-two block devices). These certifications shall be posted on the crane.

#### 1.14 HOT WORK

Prior to performing "Hot Work" (welding, etc.) or operating other flame-producing devices, a written permit shall be requested from the Installation Fire Department. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity.

a. Oil painting materials (paint, brushes, empty paint cans, etc.), and all flammable liquids shall be removed from the facility at quitting time. All painting materials and flammable liquids shall be stored outside in a suitable metal locker or box and will require re-submittal with non-hazardous materials.

b. Accumulation of trays, paper, shavings, sawdust, boxes and other packing materials shall be removed from the facility at the close of each workday and such material disposed of in the proper containers located away from the facility.

c. The storage of combustible supplies shall be a safe distance from structures.

d. Area outside the facility undergoing work shall be cleaned of trash, paper, or other discarded combustibles at the close of each workday.

e. All portable electric devices (saws, sanders, compressors, extension chord, lights, etc.) shall be disconnected at the close of each workday. When possible, the main electric switch in the facility shall be deactivated.

f. When starting work in the facility, Contractors shall require their personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the Installation Fire Department phone number. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED TO THE INSTALLATION FIRE DEPARTMENT IMMEDIATELY.

#### PART 2 PRODUCTS (NOT APPLICABLE)

#### PART 3 EXECUTION

##### 3.1 CONSTRUCTION AND/OR OTHER WORK

The Contractor shall comply with USACE EM 385-1-1, NFPA 241, the APP, the AHA, and other related submittals and activity fire and safety regulations.

##### 3.1.1 Hazardous Material Use

Each hazardous material must receive approval prior to being brought onto the job site or prior to any other use in connection with this contract. Allow a minimum of 10 working days for processing of the request for use of

a hazardous material. Any work or storage involving hazardous chemicals or materials must be done in a manner that will not expose Government or Contractor employees to any unsafe or unhealthful conditions. Adequate protective measures must be taken to prevent Government or Contractor employees from being exposed to any hazardous condition that could result from the work or storage. The Prime Contractor shall keep a complete inventory of hazardous materials brought onto the work-site. Approval by the Contracting Officer of protective measures and storage area is required prior to the start of the work.

### 3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials.

### 3.1.3 Unforeseen Hazardous Material

If material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

### 3.2 PRE-OUTAGE COORDINATION MEETING

Contractors are required to apply for utility outages at least 15 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Contracting Officer and the Ft. Knox Community Schools Director of Logistics to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

### 3.3 FALL HAZARD PROTECTION AND PREVENTION

The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and escape procedures.

#### 3.3.1 Training

The Contractor shall institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, the Contractor shall provide training for each employee who might be exposed to fall hazards. Training requirements shall be in accordance with USACE EM 385-1-1, section 21.A.16.

### 3.3.2 Fall Protection Equipment

The Contractor shall enforce use of the fall protection equipment designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is on a surface 1.8 m(6 feet) or more above lower levels. Fall protection systems such as guardrails, personnel fall arrest system, safety nets, etc., are required when working within 1.8m (6 feet) of any leading edge. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems may be required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. Fall protection must comply with 29 CFR 1926.500, Subpart M and USACE EM 385-1-1.

#### 3.3.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ANSI Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 6 feet. The total fall distance shall always be taken into consideration when attaching a person to a fall arrest system.

#### 3.3.3 Fall Protection for Roofing Work

Fall protection controls shall be implemented based on the type of roof being constructed and work being performed. The roof area to be accessed shall be evaluated for its structural integrity including weight-bearing capabilities for the projected loading.

##### a. Low Sloped Roofs:

(1) For work within 6 feet of an edge, on low-slope roofs, personnel shall be protected from falling by use of personal fall arrest systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized.

(2) For work greater than 6 feet from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

#### 3.3.4 Safety Nets

If safety nets are used as the selected fall protection system on the project, they shall be provided at unguarded workplaces, machinery, dangerous operations and leading edge work. Safety nets shall be tested

immediately after installation with a drop test of 400 pounds and every six months thereafter.

### 3.3.5 Horizontal Lifelines

Horizontal lifelines shall be designed, installed, certified and used under the supervision of a qualified person as part of a complete fall arrest system (29 CFR 1926.500).

## 3.4 SCAFFOLDING

Employees shall be provided with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Access to scaffold platforms greater than 6 feet in height shall be accessed by use of a stair tower. Vertical ladders commonly provided by scaffold system manufacturers shall not be used for accessing scaffold platforms greater than 6 feet in height. The use of an adequate gate is required. Contractor shall ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. Special care shall be given to ensure scaffold systems are not overloaded. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material is prohibited. The first tie-in shall be at the height equal to 4 times the width of the smallest dimension of the scaffold base. Work platforms shall be placed on mud sills. Scaffold or work platform erectors shall have fall protection during the erection and dismantling of scaffolding or work platforms that are more than six feet. Delineate fall protection requirements when working above six feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work. For additional requirements, see Section 00800, paragraph 1.43.

## 3.5 EQUIPMENT

### 3.5.1 Material Handling Equipment

- a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.
- b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.
- c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

### 3.5.2 Weight Handling Equipment

- a. The Contractor shall notify the Contracting Officer 15 days in advance of any cranes entering the activity so that necessary quality assurance spot checks can be coordinated. Contractor's operator shall remain with the crane during the spot check.
- b. The Contractor shall comply with the crane manufacturer's

specifications and limitations for erection and operation of cranes and hoists used in support of the work. Erection shall be performed under the supervision of a designated person (as defined in ASME B30.5). All testing shall be performed in accordance with the manufacturer's recommended procedures.

c. The Contractor shall comply with ASME B30.5 for mobile and ASME B30.22 for articulating boom cranes.

d. The presence of Government personnel does not relieve the Contractor of an obligation to comply with all applicable safety regulations. The Government will investigate all complaints of unsafe or unhealthful working conditions received in writing from contractor employees, federal civilian employees, or military personnel.

e. Each load shall be rigged/attached independently to the hook/master-link in such a fashion that the load cannot slide or otherwise become detached. Christmas-tree lifting (multiple rigged materials) is not allowed.

f. Under no circumstance shall a Contractor make a lift at or above 90% of the cranes rated capacity in any configuration.

g. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and shall follow the requirements of USACE EM 385-1-1 section 11 and ASME B30.5 or ASME B30.22 as applicable.

h. Crane suspended personnel work platforms (baskets) shall not be used unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Personnel shall not be lifted with a line hoist or friction crane.

i. A fire extinguisher having a minimum rating of 10BC and a minimum nominal capacity of 5lb of extinguishing agent shall be available at all operator stations or crane cabs. Portable fire extinguishers shall be inspected, maintained, and recharged as specified in NFPA 10, Standard for Portable Fire Extinguishers.

j. All employees shall be kept clear of loads about to be lifted and of suspended loads.

k. A weight handling equipment operator shall not leave his position at the controls while a load is suspended.

l. Only Contractor crane operators who have met the requirements of 29 CFR 1910.94, 29 CFR 1910.120, 29 CFR 1926.65, 29 CFR 1926.500, USACE EM 385-1-1, ASME B30.5, and ASME B30.22 and other local and state requirements shall be authorized to operate the crane.

m. The Contractor shall use cribbing when performing lifts on outriggers.

n. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

o. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.

p. A substantial and durable rating chart containing legible letters and figures shall be provided with each crane and securely mounted onto the crane cab in a location allowing easy reading by the operator while seated in the control station.

q. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.

r. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.

s. The Contractor shall certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

### 3.5.3 Equipment and Mechanized Equipment

a. Equipment shall be operated by designated qualified operators. Proof of qualifications shall be kept on the project site for review.

b. Manufacture specifications or owner's manual for the equipment shall be on site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Such additional safety precautions or requirements shall be incorporated into the AHAs.

c. Equipment and mechanized equipment shall be inspected in accordance with manufacturer's recommendations for safe operation by a competent person prior to being placed into use.

d. Daily checks or tests shall be conducted and documented on equipment and mechanized equipment by designated competent persons.

### 3.6 EXCAVATIONS

The competent person for excavations performed as a result of contract work shall be on-site when excavation work is being performed, and shall inspect, and document the excavations daily prior to entry by workers. The competent person must evaluate all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly.

#### 3.6.1 Utility Locations

Prior to digging, the appropriate digging permit must be obtained. All underground utilities in the work area must be positively identified by a private utility locating service in addition to any station locating service and coordinated with the station utility department. Any markings made during the utility investigation must be maintained throughout the contract.

#### 3.6.2 Utility Location Verification

The Contractor must physically verify underground utility locations by hand digging using wood or fiberglass handled tools when any adjacent

construction work is expected to come within three feet of the underground system. Digging within 2 feet of a known utility must not be performed by means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility the utility shall be exposed by hand digging every 100 feet if parallel within 5 feet of the excavation.

### 3.6.3 Utilities with Concrete Slabs

Utilities located within concrete slabs and the like are extremely difficult to identify. The location must be coordinated with station utility departments in addition to a private locating service. Outages on system utilities shall be used in circumstances where concrete chipping, saw cutting, or core drilling is required and utilities are unable to be completely identified.

### 3.6.4 Shoring Systems

Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on site for review. Job-made shoring or shielding shall have the registered professional engineer stamp, specifications, and tabulated data.

Extreme care must be used when excavating near direct burial electric underground cables.

### 3.6.5 Trenching Machinery

Trenching machines with digging chain drives shall be operated only when the spotters/laborers are in plain view of the operator. Operator and spotters/laborers shall be provided training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Documentation of the training shall be kept on file at the project site.

## 3.7 ELECTRICAL

### 3.7.1 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Positive cable identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. Insulating blankets, hearing protection, and switching suits may be required, depending on the specific

job and as delineated in the Contractor's AHA.

### 3.7.2 Portable Extension Cords

Portable extension cords shall be sized in accordance with manufacturer ratings for the tool to be powered and protected from damage. All damaged extension cords shall be immediately removed from service. Portable extension cords shall comply with EM 385-1-1 and shall be inspected in accordance with the requirements of NFPA 70.

### 3.8 WORK IN CONFINED SPACES

The Contractor shall comply with the requirements in Section 06.I of USACE EM 385-1-1 and OSHA 29 CFR 1910.146. Any potential for a hazard in the confined space requires a permit system to be used.

- a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 06.I.05 of USACE EM 385-1-1 for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.
- b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.
- c. Ensure the use of rescue and retrieval devices in confined spaces greater than 5 feet in depth. Conform to Sections 06.I.09, 06.I.10 and 06.I.11 of USACE EM 385-1-1.
- d. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.
- e. Include training information for employees who will be involved as entrants and attendants for the work. Conform to Section 06.I.06 of USACE EM 385-1-1.
- f. Daily Entry Permit. Post the permit in a conspicuous place close to the confined space entrance.

### 3.9 CRYSTALLINE SILICA

Grinding, abrasive blasting, and foundry operations of construction materials containing crystalline silica, shall comply with OSHA regulations, such as 29 CFR 1910.94, and USACE EM 385-1-1, Appendix C. The Contractor shall develop and implement effective exposure control and elimination procedures to include dust control systems, engineering controls, and establishment of work area boundaries, as well as medical surveillance, training, air monitoring, and personal protective equipment.

### 3.10 HOUSEKEEPING

#### 3.10.1 Clean-Up

All debris in work areas shall be cleaned up daily or more frequently if

necessary. Construction debris may be temporarily located in an approved location. Garbage accumulation must be removed each day from work areas and placed in refuse containers.

### 3.10.2 Dust control

In addition to the dust control measures required elsewhere in the contract documents, dry cutting of brick or masonry shall be prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to this prohibition on a case-by-case basis. Wet cutting must address control of water run off.

-- End of Section --

**Amdt #0001**

SECTION 02300A

EARTHWORK FOR BUILDINGS AND UTILITIES

**12/97**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 1140	(1997) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(1990; R 1996e1) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 MEASUREMENT

1.2.1 Excavation

The unit of measurement for excavation and borrow will be included in the lump sum price.

1.3 DEFINITIONS

1.3.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, or MH. Satisfactory materials for grading shall be comprised of stones less than 8 inches, except for entrance/exit pad which shall be comprised of stones less than 3 inches in any dimension.

### 1.3.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. The Contracting Officer shall be notified of any contaminated materials.

### 1.3.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

### 1.3.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density.

### 1.3.5 Topsoil

Material suitable for topsoils obtained from offsite areas and areas indicated on the drawings.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

Earthwork; G, AO.

Procedure and location for disposal of unused satisfactory material.  
Proposed source of borrow material.

Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas.

#### SD-06 Test Reports

Testing;

Within 24 hours of conclusion of physical tests, copies of test results, including calibration curves and results of calibration tests.

#### SD-07 Certificates

Testing;

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

#### 1.5 SUBSURFACE DATA

Subsurface soil boring logs and a subsoil investigation report are available. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

#### 1.6 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

**\*1**

##### 1.6.1 Excavation Requirements

**Before excavating, reference Section 01110N SUMMARY OF WORK for excavation procedures and requirements.**

#### 1.7 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed. Newly designated waste areas on Government-controlled land shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

#### PART 2 PRODUCTS (Not Applicable)

#### PART 3 EXECUTION

##### 3.1 STRIPPING OF TOPSOIL

Where indicated or directed, topsoil shall be stripped to a depth of 8 inches. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 1 inch in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be stockpiled in locations approved by the contracting officer.

##### 3.2 GENERAL EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and

elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in areas approved for surplus material storage or designated waste areas. Unsatisfactory excavated material shall be disposed of in designated waste or spoil areas.

During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

### 3.3 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas shown on drawings or from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

### 3.4 GRADING AREAS

Where indicated, work will be divided into grading areas within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. The Contractor shall not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing.

### 3.5 BACKFILL FOR BUILDING PAD

#### 3.5.1 Kingsolver and Pierce Elementary Schools

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

#### 3.5.2 Mudge Elementary School

### 3.5.2.1 General

Due to the soft soils present at the lower site elevations, and the amount of fill that is required to level the site, a potential exists for differential settlement of the new building foundation. To reduce this potential for settlement, the building area shall be pre-loaded with the scheduled thickness of fill plus an additional two feet of surcharge fill, and allowed to consolidate prior to beginning construction of the building.

A maximum 3-inch consolidation of the foundation soil is expected to occur in a time frame of about 2 to 4 months. A drainage layer shall be incorporated between the on-site soils and the new fill material in order to achieve the desired consolidation in the estimated time. Settlement platforms shall be installed to monitor and evaluate the actual rate and amount of settlement induced by the embankment loads. During and after placement of the pre-load embankment, data collected from settlement platforms shall be evaluated by an approved commercial testing laboratory and/or geotechnical engineer, to determine how much settlement has occurred and when the majority of the estimated consolidation has been achieved. The Contracting Officer will review the results and will determine when the pre-load portion of the fill can be removed and when construction of the building can begin.

### 3.5.2.2 Surcharging Building Site

- a. Prepare existing ground surface as described in Section 3.7.1. After ground surface has been stripped of unsatisfactory materials, place a 1 to 2-foot thick layer of No. 3 stone at the lower site elevations to help stabilize any existing soft surface soils and provide a drainage layer between the on-site soils and the new fill material.
- b. Review stripped surfaces at higher site elevations for soft surface materials by proof-rolling and observation. Undercut and replace any soft soils with properly compacted fill or bridge with a layer of No. 3 stone.
- c. Install two settlement platforms at locations indicated on the drawing in accordance with Section 216 of the current Kentucky Department of Highways Standard Specifications for Road and Bridge Construction and KYDOY Standard Drawing RGX-015.
- d. After placing and leveling the top plates of each of the two settlement platforms, the embankment soil can be placed. Care must be taken when placing the fill soils so that the settlement platforms are not damaged or disturbed.
- e. Soil embankments supporting floor slabs and foundations shall be compacted in maximum 8-inch lifts (loose thickness) to 100 percent of the Standard Proctor density at a moisture content within 2 percent of optimum. The pre-load embankment area which will remain after consolidation of the soils shall be compacted as indicated above. At the lowest elevation this is approximately 6 feet of soil. The additional two feet of pre-load embankment, which will be removed following consolidation, can be compacted to 90 percent of the standard Proctor density. Reference Section 1.4.1 for definition of satisfactory materials that may be used for fill.
- f. The testing laboratory and/or geotechnical engineer shall measure

and record settlement, to the nearest 0.01 foot, and elevation of the embankment at weekly intervals or more frequently in order that no more than 10 percent of the expected settlement occurs between readings. Data shall be submitted to the Contracting Officer weekly.

g. Stop work at any location where settlement platforms are disturbed or damaged, and make necessary repairs or replacement. As the embankment is constructed, add sections of 2 ½-inch and 4-inch pipe to the assembly, tightening each new section of 2 ½-inch pipe before taking a reading to ensure that the next added section does not affect future readings. As work progresses, keep the top of the outer pipe closed with a 4-inch standard cap. When work is complete, secure the cap to the final outer pipe section.

h. Site grading and temporary drainage ditches and/or pipes shall be maintained so that positive drainage is provided during construction.

### 3.6 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS

#### 3.6.1 General Requirements

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; to a depth of 8 inches; scarify and recompact the next 8 inches of subgrade; and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface.

#### 3.6.2 Frozen Material

Embankment shall not be placed on a foundation which contains frozen material, or which has been subjected to freeze-thaw action. This prohibition encompasses all foundation types, including the natural ground, all prepared subgrades (whether in an excavation or on an embankment) and all layers of previously placed and compacted earth fill which become the foundations for successive layers of earth fill. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a depth that is acceptable to the Contracting Officer and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompact to the specified criteria before additional material is placed. The Contracting Officer will determine when placement of fill shall cease due to cold weather. The Contracting Officer may elect to use average daily air temperatures, and/or physical observation of the soils for his determination. Embankment material shall not contain frozen clumps of soil, snow, or ice.

### 3.7 EMBANKMENTS

#### 3.7.1 Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3

inches. The material shall be placed in successive horizontal layers of loose material not more than 8 inches in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

### 3.8 SUBGRADE PREPARATION

#### 3.8.1 Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 6 inches below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. The elevation of the finish subgrade shall not vary more than 0.05 foot from the established grade and cross section.

#### 3.8.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Each layer of the embankment shall be compacted to at least 95 percent of laboratory maximum density.

### 3.9 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turving materials.

### 3.10 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 4 inch depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a thickness of 6 inches and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from offsite areas or areas indicated by the contracting officer.

### 3.11 TESTING

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. Field in-place density shall be determined in accordance with ASTM D 1556. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompact to meet specification requirements. Tests on recompact areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

#### 3.11.1 Fill and Backfill Material Gradation

One test per 15 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C 136.

#### 3.11.2 In-Place Densities

- a. One test per 1,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.
- b. One test per 1,000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

#### 3.11.3 Moisture Contents

In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

#### 3.11.4 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 10 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

#### 3.11.5 Tolerance Tests for Subgrades

Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

### 3.12 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain

effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, ballast, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

-- End of Section --

**Amdt #0001**

SECTION 02510A

WATER DISTRIBUTION SYSTEM  
05/02

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 88	(1996) Seamless Copper Water Tube
ASTM D 1599	(1999) Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(1996b) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1997) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D 2774	(1994) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2996	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

- ASTM D 2997 (1995) Centrifugally Cast "Fiberglass"  
(Glass-Fiber-Reinforced  
Thermosetting-Resin) Pipe
- ASTM D 3139 (1998) Joints for Plastic Pressure Pipes  
Using Flexible Elastomeric Seals
- ASTM D 3839 (1994a) Underground Installation of  
"Fiberglass" (Glass-Fiber-Reinforced  
Thermosetting Resin) Pipe
- ASTM F 477 (1999) Elastomeric Seals (Gaskets) for  
Joining Plastic Pipe
- ASTM F 1483 (1998) Oriented Poly(Vinyl Chloride),  
PVC0, Pressure Pipe

ASME INTERNATIONAL (ASME)

- ASME B1.20.1 (1983; R 1992) Pipe Threads, General  
Purpose (Inch)
- ASME B16.26 (1988) Cast Copper Alloy Fittings for  
Flared Copper Tubes

AMERICAN WATER WORKS ASSOCIATION (AWWA)

- AWWA B300 (1992) Hypochlorites
- AWWA B301 (1992) Liquid Chlorine
- AWWA C104 (1995) Cement-Mortar Lining for  
Ductile-Iron Pipe and Fittings for Water
- AWWA C110 (1993) Ductile-Iron and Gray-Iron  
Fittings, 3 In. Through 48 In. (75 mm  
through 1200 mm), for Water and Other  
Liquids
- AWWA C111 (1995) Rubber-Gasket Joints for  
Ductile-Iron Pressure Pipe and Fittings
- AWWA C153 (1994; Errata Nov 1996) Ductile-Iron  
Compact Fittings, 3 In. Through 24 In. (76  
mm through 610 mm) and 54 In. through 64  
In. (1,400 mm through 1,600 mm) for Water  
Service
- AWWA C203 (1997) Coal-Tar Protective Coatings and  
Linings for Steel Water Pipelines - Enamel  
and Tape - Hot-Applied
- AWWA C701 (1988) Cold-Water Meters - Turbine Type,  
for Customer Service
- AWWA C706 (1996) Direct-Reading, Remote-Registration  
Systems for Cold-Water Meters

AWWA C800	(1989) Underground Service Line Valves and Fittings
AWWA C900	(1997; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution
AWWA C901	(1996) Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service
AWWA C905	(1997) Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. Through 36 In.
AWWA C909	(1998) Molecularly Oriented Polyvinyl Chloride (PVC) Pressure Pipe, 4 IN through 12 IN (100 mm through 300 mm), for Water Distribution
AWWA C950	(1995) Fiberglass Pressure Pipe
AWWA M23	(1980) Manual: PVC Pipe - Design and Installation

ASBESTOS CEMENT PIPE PRODUCERS ASSOCIATION (ACPPA)

ACPPA 1344	(1988) Recommended Work Practices for A/C Pipe
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DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA TRD	(1997) Thrust Restraint Design for Ductile Iron Pipe
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 49	(1994) Hazardous Chemicals Data
NFPA 325-1	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 704	(1996) Identification of the Fire Hazards of Materials for Emergency Response

## 1.2 PIPING

This section covers water service lines, and connections to building service at a point approximately 5 feet outside buildings and structures to which service is required. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

### 1.2.1 Service Lines

Piping for water service lines less than 3 inches in diameter shall be galvanized steel, polyvinyl chloride (PVC) plastic, Oriented PVC plastic polyethylene, or copper tubing, unless otherwise shown or specified.

Piping for water service lines 3 inches and larger shall be ductile iron, polyvinyl chloride (PVC) plastic, filament-wound or centrifugally cast reinforced thermosetting resin, reinforced plastic mortar pressure pipe or steel, unless otherwise shown or specified.

#### 1.2.2 Excavation, Trenching, and Backfilling

\*1

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02300A **EARTHWORK FOR BUILDINGS AND UTILITIES**, except as modified herein.

##### 1.2.2.1 Excavation Requirements

**Before excavating reference Section 01110N SUMMARY OF WORK for excavation procedures and requirements.**

#### 1.3 MANUFACTURER'S REPRESENTATIVE

The Contractor shall have a manufacturer's field representative present at the jobsite during the installation and testing of PE, RTRP, and/or RPMP pipe to provide technical assistance and to verify that the materials are being installed in accordance with the manufacturer's prescribed procedures. When the representative feels that the Contractor is installing and testing the PE, RTRP, and/or RPMP pipe in a satisfactory manner, certification shall be written to note which individuals employed by the Contractor are capable of properly installing the pipe. The field representative shall advise the Contractor of unsatisfactory conditions immediately when they occur. Such conditions include improper diameter of pipe ends, damaged interior liner, poorly prepared joints, improper curing of joints, moving pipe before joints are cured, bending pipe to follow abrupt changes in trench contours, leaving pipe ends open in trench overnight, not properly drying joints after rain storms, exceeding effective adhesive life, sharp objects in trench bed, backfill that could damage pipe, improper procedure for concrete encasement of pipe, omission of thrust blocks at changes in direction or any other condition which could have an adverse effect on the satisfactory completion and operation of the piping system.

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

##### SD-03 Product Data

Installation; G, AO.

The manufacturer's recommendations for each material or procedure to be utilized.

Waste Water Disposal Method; G, AO.

The method proposed for disposal of waste water from hydrostatic tests and disinfection, prior to performing hydrostatic tests.

Satisfactory Installation; G, AO.

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications, and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

SD-06 Test Reports

Bacteriological Disinfection; G, AO.

Test results from commercial laboratory verifying disinfection.

SD-07 Certificates

Manufacturer's Representative; G, AO.

The name and qualifications of the manufacturer's representative and written certification from the manufacturer that the representative is technically qualified in all phases of PE, RTRP, and/or RPMP pipe laying and jointing and experienced to supervise the work and train the Contractor's field installers, prior to commencing installation.

Installation; G, AO.

A statement signed by the manufacturer's field representative certifying that the Contractor's personnel are capable of properly installing the pipe on the project.

Meters; G, AO.

Manufacturer's certificate stating that each meter furnished has been tested for accuracy of registration and compliance with the accuracy and capacity requirements of the appropriate AWWA standard.

1.5 HANDLING

Pipe and accessories shall be handled to ensure delivery to the trench in sound, undamaged condition, including no injury to the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor in a satisfactory manner, at no additional cost to the Government. No other pipe or material shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

1.5.1 Coated and Wrapped Steel Pipe

Coated and wrapped steel pipe shall be handled in conformance with AWWA C203.

1.5.2 Polyethylene (PE) Pipe Fittings and Accessories

PE pipe, fittings, and accessories shall be handled in conformance with AWWA C901.

1.5.3 Miscellaneous Plastic Pipe and Fittings

Polyvinyl Chloride (PVC), Reinforced Thermosetting Resin Pipe (RTRP), and Reinforced Plastic Mortar Pressure (RPMP) pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1.

PART 2 PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PE Plastic Pipe

Pipe, tubing, and heat-fusion fittings shall conform to AWWA C901.

2.1.1.2 PVC Plastic Pipe

Pipe, couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B.

a. Pipe Less Than 4 inch Diameter:

(1) Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 80, with joints meeting requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified. Pipe couplings when used, shall be tested as required by ASTM D 2464.

(2) Elastomeric-Gasket Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 40, with joints meeting the requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified, or it may be pipe conforming to requirements of ASTM D 2241, elastomeric joint, with the following applications:

SDR	Maximum Working Pressure psi	Minimum Hydrostatic Pressure psi
26	100	133
21	120	160
17	150	200
13.5	200	266

(3) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the

requirements of 150 psi working pressure and 200 psi hydrostatic test pressure.

- b. Pipe 4 through 12 inch Diameter: Pipe, couplings and fittings shall conform to AWWA C900, Class 150, CIOD pipe dimensions, elastomeric-gasket joint, unless otherwise shown or specified.
- c. Pipe 14 through 36 inch Diameter: Pipe shall conform to AWWA C905 unless otherwise shown or specified.

#### 2.1.1.3 Oriented Polyvinyl Chloride (PVC) Plastic Pipe

Pipe, couplings, and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454-B. Pipe shall conform to AWWA C909, Class 150, and to ASTM F 1483 and shall have an outside diameter equal to cast iron outside diameter.

#### 2.1.2 Reinforced Thermosetting Resin Pipe (RTRP)

Pipe shall have a quick-burst strength greater than or equal to four times the normal working pressure of the pipe. The quick-burst strength test shall conform to the requirements of ASTM D 1599.

##### 2.1.2.1 RTRP-I

RTRP-I shall conform to ASTM D 2996, except pipe shall have an outside diameter equal to cast iron outside diameter or standard weight steel pipe.

The pipe shall be suitable for a normal working pressure of 150 psi at 73 degrees F. The inner surface of the pipe shall have a smooth uniform continuous resin-rich surface liner conforming to ASTM D 2996.

##### 2.1.2.2 RTRP-II

RTRP-II shall conform to ASTM D 2997. Pipe shall have an outside diameter equal to standard weight steel pipe.

#### 2.1.3 Copper Tubing

Copper tubing shall conform to ASTM B 88, Type K, annealed.

### 2.2 FITTINGS AND SPECIALS

#### 2.2.1 PVC Pipe System

- a. For pipe less than 4 inch diameter, fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings; fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467; and fittings for elastomeric-gasket joint pipe shall be iron conforming to AWWA C110 or AWWA C111. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104.
- b. For pipe 4 inch diameter and larger, fittings and specials shall be iron, bell end in accordance with AWWA C110, 150 psi pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or fittings and specials may be of the same material as the pipe with elastomeric gaskets, all in conformance with AWWA

C900. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Fittings shall be bell and spigot or plain end pipe, or as applicable. Ductile iron compact fittings shall be in accordance with AWWA C153.

#### 2.2.2 RTRP Pipe

Fittings and specials shall be compatible with the pipe supplied. Filament wound or molded fittings up to 6 inches shall conform to AWWA C950. Fittings shall be suitable for working and testing pressures specified for the pipe.

#### 2.2.3 Copper Tubing System

Fittings and specials shall be flared and conform to ASME B16.26.

### 2.3 JOINTS

#### 2.3.1 Plastic Pipe Jointing

##### 2.3.1.1 PE Pipe

Joints for pipe fittings and couplings shall be strong tight joints as specified for PE in Paragraph INSTALLATION. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendation, and as approved by the Contracting Officer.

##### 2.3.1.2 PVC Pipe

Joints, fittings, and couplings shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer.

##### 2.3.1.3 PVC0 Pipe

Joints shall conform to ASTM D 3139. Elastomeric gaskets shall conform to ASTM F 477.

#### 2.3.2 RTRP Pipe

##### 2.3.2.1 RTRP-I, Grade 1 and 2

Joints shall be bell and spigot with elastomeric gasket, mechanical coupling with elastomeric gasket, threaded and bonded coupling, or tapered bell and spigot with compatible adhesive. All RTRP-I materials shall be products of a single manufacturer.

##### 2.3.2.2 RTRP-II, Grade 1 and 2

Joints shall be the bell and spigot type with elastomeric gasket, bell and spigot with adhesive, butt-jointed with adhesive bonded reinforced overlay, mechanical, flanged, threaded or commercially available proprietary joints, provided they are capable of conveying water at the pressure and temperature of the pipe.

#### 2.3.3 Isolation Joints

Isolation joints shall be installed between nonthreaded ferrous and nonferrous metallic pipe, fittings and valves. Isolation joints shall

consist of a sandwich-type flange isolation gasket of the dielectric type, isolation washers, and isolation sleeves for flange bolts. Isolation gaskets shall be full faced with outside diameter equal to the flange outside diameter. Bolt isolation sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

- a. Sleeve-type couplings shall be used for joining plain end pipe sections. The two couplings shall consist of one steel middle ring, two steel followers, two gaskets, and the necessary steel bolts and nuts to compress the gaskets.
- b. Split-sleeve type couplings may be used in aboveground installations when approved in special situations and shall consist of gaskets and a housing in two or more sections with the necessary bolts and nuts.

#### 2.3.4 Copper Tubing Jointing

Joints shall be compression-pattern flared and shall be made with the specified fittings.

### 2.4 VALVES

#### 2.4.1 Ball Valves

Valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve (fullport), and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening. Ball valves shall conform to MSS SP-110.

#### 2.4.2 Vacuum and Air Relief Valves

Vacuum and air relief valves shall be of the size shown and shall be of a type that will release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the line when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float.

### 2.5 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "WATER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

### 2.6 VALVE PITS

Valve pits shall be constructed at locations indicated or as required above and in accordance with the details shown. Concrete shall have compressive strength of 3000 psi in accordance with Section 03300CAST-IN-PLACE

STRUCTURAL CONCRETE.

2.7 MISCELLANEOUS ITEMS

2.7.1 Service Clamps

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

2.7.2 Corporation Stops

Corporation stops shall have standard corporation stop thread conforming to AWWA C800 on the inlet end, with flanged joints, compression pattern flared tube couplings, or wiped joints for connections to goosenecks.

2.7.3 Goosenecks

Copper tubing for gooseneck connections shall conform to the applicable requirements of ASTM B 88, Type K, annealed. Length of cable requirement connections shall be in accordance with standard practice.

2.7.4 Service Stops

Service stops shall be water-works inverted-ground-key type, oval or round flow way, tee handle, without drain. Pipe connections shall be suitable for the type of service pipe used. All parts shall be of bronze with female iron-pipe-size connections or compression-pattern flared tube couplings, and shall be designed for a hydrostatic test pressure not less than 200 psi.

2.7.5 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 150 psi. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 50 foot-pound.

2.7.6 Service Boxes

Service boxes shall be cast iron or concrete and shall be extension service boxes of the length required for the depth of the line, with either screw or slide-type adjustment. The boxes shall have housings of sufficient size to completely cover the service stop or valve and shall be complete with identifying covers.

2.7.7 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

#### 2.7.8 Meters

Meters shall be the type and size shown on the drawings or specified. Meters of each of the various types furnished and installed shall be supplied by one manufacturer.

##### 2.7.8.1 Turbine Type

Turbine type meters shall conform to AWWA C701 Class I. The main casing shall be bronze with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706. Meters shall comply with the accuracy and capacity requirements of AWWA C701.

##### 2.7.9 Meter Boxes

Meter boxes shall be of cast iron or concrete. The boxes shall be of sufficient size to completely enclose the meter and shutoff valve or service stop. Meter boxes set in paved areas subject to vehicular traffic shall be cast iron, or concrete with cast iron lid and cast iron meter reader lid. Boxes set in sidewalks, not subject to vehicular traffic, shall be concrete with cast iron lid and cast iron meter reader lid. Plastic boxes and lids shall not be used. Box height shall extend from invert of the meter to final grade at the meter location. The lid shall have the word "WATER" cast in it.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed. Squeeze type mechanical cutters shall not be used for ductile iron.

##### 3.1.2 Adjacent Facilities

###### 3.1.2.1 Sewer Lines

Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe, for a distance of at least 10 feet each side of the crossing, shall be fully encased in concrete or shall be made of pressure pipe with no joint located

within 3 feet horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.

#### 3.1.2.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

#### 3.1.2.3 Copper Tubing Lines

Copper tubing shall not be installed in the same trench with ferrous piping materials.

#### 3.1.2.4 Nonferrous Metallic Pipe

Where nonferrous metallic pipe, e.g. copper tubing, crosses any ferrous piping material, a minimum vertical separation of 12 inches shall be maintained between pipes.

#### 3.1.3 Joint Deflection

##### 3.1.3.1 Offset for Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but shall not exceed 5 degrees.

#### 3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Water-line materials shall not be dropped or dumped into the trench. Abrasion of the pipe coating shall be avoided. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by and at the Contractor's expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

##### 3.1.4.1 Plastic Pipe Installation

RTRP shall be installed in accordance with ASTM D 3839. RPMP shall be installed in accordance with the manufacturer's recommendations. PE Pipe shall be installed in accordance with ASTM D 2774. PVC pipe shall be installed in accordance with AWWA M23.

##### 3.1.4.2 Piping Connections

Where connections are made between new work and existing mains, the

connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with ACPPA 1344.

#### 3.1.4.3 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

#### 3.1.4.4 Flanged Pipe

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

#### 3.1.5 Jointing

##### 3.1.5.1 PE Pipe Requirements

Jointing shall comply with ASTM D 2657, Technique I-Socket Fusion or Technique II-Butt Fusion.

##### 3.1.5.2 PVC Plastic Pipe Requirements

- a. Pipe less than 4 inch diameter: Threaded joints shall be made by wrapping the male threads with approved thread tape or applying an approved lubricant, then threading the joining members together. The joint shall be tightened using strap wrenches to prevent damage to the pipe and/or fitting. To avoid excessive torque, joints shall be tightened no more than one thread past hand-tight. Preformed rubber-ring gaskets for elastomeric-gasket joints shall be made in accordance with ASTM F 477 and as specified. Pipe ends for push-on joints shall be beveled to facilitate assembly and marked to indicate when the pipe is fully seated. The gasket shall be prelubricated to prevent displacement. The gasket and ring groove in the bell or coupling shall match. The manufacturer of the pipe or fitting shall supply the elastomeric gasket. Couplings shall be provided with stops or centering rings to assure that the coupling is centered on the joint. Solvent cement joints shall use sockets conforming to ASTM D 2467. The solvent cement used shall meet the requirements of ASTM D 2564; the joint assembly shall be made in accordance with ASTM D 2855 and the manufacturer's specific recommendations.
- b. Pipe 4 through 12 inch diameter: Joints shall be elastomeric gasket as specified in AWWA C900. Jointing procedure shall be as specified for pipe less than 4 inch diameter with configuration using elastomeric ring gasket.
- c. Pipe 14 through 36 inch diameter: Joints shall be elastomeric gasket push-on joints made in accordance with AWWA M23.

##### 3.1.5.3 RTRP I, RTRP II Pipe

- a. RTRP I: Assembly of the pipe shall be done in conformance with the manufacturer's written instruction and installation procedures. Field joints shall be prepared as specified by the

pipe manufacturer. Several pipe joints having interference-fit type couplings may be field bonded and cured simultaneously. However, the pipe shall not be moved and additional joints shall not be made until the previously laid joints are completely cured.

Joints not having interference-fit type coupling shall be fitted with a clamp which shall hold the joint rigidly in place until the joint cement has completely cured. The clamps shall have a protective material on the inner surface to prevent damage to the plastic pipe when the clamp is tightened in place. The pipe manufacturer shall provide a device or method to determine when the joint is pulled against the pipe stop. Additionally, the pipe manufacturer shall furnish a gauge to measure the diameter of the spigot ends to ensure the diameter conforms to the tolerances specified by the manufacturer. All pipe ends shall be gauged. Factory certified tests shall have been satisfactorily performed to verify that short-term rupture strength is 1,500 psior greater when carried out in accordance with ASTM D 1599. At any ambient temperature, field bonded epoxy-cemented joints shall be cured with a self-regulating, thermostatically temperature controlled, electrical heating blanket for the time and temperature recommended by the manufacturer for the applicable size and type of joint, or by an alternate heating method recommended by the manufacturer and approved by the Contracting Officer. The joint sections shall not be moved during heating, or until the joint has cooled to ambient temperature.

- b. RTRP II: A reinforced overlay joint shall be used to join sections together through a placement of layers of reinforcement fiberglass roving, mat, tape or fabric thoroughly saturated with compatible catalyzed resin.
- c. Fittings and Specials for RTRP Pipe: Metal to RTRP pipe connections shall be made by bolting steel flanges to RTRP pipe flanges. Cast-iron fitting with gasket bell or mechanical joint may be used with RTRP if pipe has cast iron outside diameter. Steel flanges shall be flat-faced type. Where raised-face steel flanges are used, spacer rings shall be used to provide a flat-face seat for RTRP pipe flanges. A full-face Buna "N" gasket 1/8 inch thick with a shore hardness of 50-60 shall be used between all flanged connections. The RTRP pipe flange shall have raised sealing rings. Flat washers shall be used under all nuts and bolts on RTRP and RPMP pipe flanges. Bolts and nuts shall be of noncorrosive steel and torqued to not more than 100 foot pounds. Flanges shall not be buried. A concrete pit shall be provided for all flanged connections.

#### 3.1.5.4 Copper Tubing Requirements

Joints shall be made with flared fittings. The flared end tube shall be pulled tightly against the tapered part of the fitting by a nut which is part of the fitting, so there is metal-to-metal contact.

#### 3.1.5.5 Bonded Joints Requirements

Bonded joints shall be installed in accordance with details specified for joints in paragraph JOINTS.

#### 3.1.5.6 Isolation Joints and Dielectric Fittings

Isolation joints and dielectric fittings shall be installed in accordance with details specified in paragraph JOINTS. Dielectric unions shall be encapsulated in a field-poured coal-tar covering, with at least 1/8 inch thickness of coal tar over all fitting surfaces.

### 3.1.5.7 Transition Fittings

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

### 3.1.6 Installation of Service Lines

Service lines shall include the pipeline connecting building piping to water distribution lines to the connections with the building service at a point approximately 5 feet outside the building where such building service exists. Where building services are not installed, the Contractor shall terminate the service lines approximately 5 feet from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps. All service stops and valves shall be provided with service boxes. Service lines shall be constructed in accordance with the following requirements:

#### 3.1.6.1 Service Lines 50 mm (2 Inches) and Smaller

Service lines 2 inches and smaller shall be connected to the main by a directly-tapped corporation stop or by a service clamp. A corporation stop and a copper gooseneck shall be provided with either type of connection. Maximum sizes for directly-tapped corporation stops and for outlets with service clamps shall be as in TABLE I. Where 2 or more gooseneck connections to the main are required for an individual service, such connections shall be made with standard branch connections. The total clear area of the branches shall be at least equal to the clear area of the service which they are to supply.

TABLE I. SIZE OF CORPORATION STOPS AND OUTLET

Pipe Size Inches	Corporation Stops, Inches For Ductile-Iron Pipe	Outlets w/Service Clamps, Inches Single & Double Strap
3	--	1
4	1	1
6	1-1/4	1-1/2
8	1-1/2	2
10	1-1/2	2
12 & larger	2	2

NOTE:

- a. Service lines 1-1/2 inches and smaller shall have a service stop.
- b. Service lines 2 inches in size shall have a gate valve.

### 3.1.6.2 Service Lines Larger than 50 mm (2 Inches)

Service lines larger than 2 inches shall be connected to the main by a tapped saddle, tapping sleeve and valve, service clamp or reducing tee, depending on the main diameter and the service line diameter, and shall have a gate valve. Lines 3 inches and larger may use rubber-seated butterfly valves as specified above, or gate valves.

### 3.1.7 Setting of Meters, Valves and Valve Boxes

#### 3.1.7.1 Location of Meters

Meters and meter boxes shall be installed at the locations shown on the drawings. The meters shall be centered in the boxes to allow for reading and ease of removal or maintenance.

#### 3.1.7.2 Location of Valves

After delivery, valves, including those in hydrants, shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and hydrants and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Check, pressure reducing, vacuum, and air relief valves shall be installed in valve pits. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be tamped around each valve box or pit to a distance of 4 feet on all sides of the box, or the undisturbed trench face if less than 4 feet.

#### 3.1.7.3 Location of Service Boxes

Where water lines are located below paved streets having curbs, the boxes shall be installed directly back of the curbs. Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of street surfacing, walks and driveways.

### 3.1.8 Tapped Tees and Crosses

Tapped tees and crosses for future connections shall be installed where shown.

### 3.1.9 Thrust Restraint

Plugs, caps, tees and bends deflecting 11.25 degrees or more, either vertically or horizontally, on waterlines 4 inches in diameter or larger, and fire hydrants shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

#### 3.1.9.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2,000 psi after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be

poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

### 3.1.9.2 Restrained Joints

For ductile-iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA TRD.

## 3.2 HYDROSTATIC TESTS

Where any section of a water line is provided with concrete thrust blocking for fittings or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved.

### 3.2.1 Pressure Test

After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 200 psi. Water supply lines designated on the drawings shall be subjected for 1 hour to a hydrostatic pressure test of 200 psi. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

- a. Wet or unstable soil conditions in the trench.
- b. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.
- c. Maintaining the trench in an open condition would delay completion of the project.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 3.2.2 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 200 psi pressure. Water supply lines designated on the drawings

shall be subjected to a pressure equal to 200 psi. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section, necessary to maintain pressure within 5 psi of the specified leakage test pressure after the pipe has been filled with water and the air expelled. Piping installation will not be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

$$L = 0.0001351ND(P \text{ raised to } 0.5 \text{ power})$$

L = Allowable leakage in gallons per hour

N = Number of joints in the length of pipeline tested

D = Nominal diameter of the pipe in inches

P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

### 3.2.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

### 3.2.4 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be as specified. Replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

- a. Pressure test and leakage test may be conducted concurrently.
- b. Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

## 3.3 BACTERIAL DISINFECTION

### 3.3.1 Bacteriological Disinfection

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as specified. After pressure tests have been made, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall be either liquid chlorine, calcium hypochlorite, or sodium hypochlorite, conforming to paragraph MISCELLANEOUS ITEMS. The chlorinating material shall provide a dosage of not less than 50 ppm and shall be introduced into the water

lines in an approved manner. Polyvinyl Chloride (PVC) pipe lines shall be chlorinated using only the above specified chlorinating material in solution. The agent shall not be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the end of the retention period. Valves on the lines being disinfected shall be opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period, each fire hydrant on the line shall be opened and closed several times. From several points in the unit, personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with state approved methods. The commercial laboratory shall be certified by the state's approving authority for examination of potable water. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

#### 3.4 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

**Amdt #0001**

SECTION 02531

SANITARY SEWERS  
07/03

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM A 74	(1998) Cast Iron Soil Pipe and Fittings
ASTM A 746	(1999) Ductile Iron Gravity Sewer Pipe
ASTM C 150	(2002a) Portland Cement
ASTM C 270	(2002) Mortar for Unit Masonry
ASTM C 443	(2002) Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 564	(1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 828	(2001) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 924	(2002) Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 94/C 94M	(2000e2) Ready-Mixed Concrete
ASTM C 969	(2002) Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM D 1784	(1999ae1) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2235	(2001) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings

ASTM D 2241	(2000) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2321	(2000) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2002) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2002) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2680	(2001) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 2996	(2001) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 2997	(2001) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3034	(2000) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3262	(2001) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
ASTM D 3350	(2002a) Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3840	(2001) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications
ASTM D 4161	(2001) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM F 402	(1993; R 1999) Safe Handling of Solvent Cements, Primers, and Cleaners Used for

Joining Thermoplastic Pipe and Fittings

ASTM F 477	(2002e1) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 714	(2001) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F 894	(1998a) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F 949	(2001a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C104	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C153	(2000) Ductile-Iron Compact Fittings for Water Service
AWWA C600	(1999) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C900	(1997) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
AWWA M23	(2002) Manual: PVC Pipe - Design and Installation

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose, Inch
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CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2000) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(1997) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	(1992) Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 Inch)
UBPPA UNI-B-6	(1998) Recommended Practice for the Low-Pressure Air Testing of Installed Sewer Pipe

1.2 SYSTEM DESCRIPTION

1.2.1 Sanitary Sewer Gravity Pipeline

Provide building connections 4 inch lines of cast iron soil pipe acrylonitrile-butadiene-styrene (ABS) solid-wall plastic pipe or polyvinyl chloride (PVC) plastic pipe at the Contractor's option.

Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 5 feet outside of building walls.

1.3 GENERAL REQUIREMENTS

**\*1**

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02300 EARTHWORK **FOR BUILDINGS AND UTILITIES**. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

**\*1**

**1.3.1 Excavation Requirements**

**Before excavating, reference Section 01110N SUMMARY OF WORK for excavation procedures and requirements.**

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings; G, AO

Precast concrete manhole

Metal items

Frames, covers, and gratings

SD-03 Product Data; G, AO

Pipeline materials

Submit manufacturer's standard drawings or catalog cuts.

SD-07 Certificates; G, AO

Portland Cement

Certificates of compliance stating the type of cement used in  
manufacture of concrete pipe, fittings and precast manholes.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of  
handling. Store materials on site in enclosures or under protective  
coverings. Store plastic piping and jointing materials and rubber gaskets  
under cover out of direct sunlight. Do not store materials directly on the  
ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and  
sizes. Store off the ground in a manner affording easy accessibility and  
not causing excessive rusting or coating with grease or other objectionable  
materials.

1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03300N, "Cast-In-Place Concrete."

1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure  
delivery to the trench in sound undamaged condition. Carry, do not drag,  
pipe to trench.

PART 2 PRODUCTS

2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements  
specified below.

2.1.1 Cast-Iron Soil Piping

2.1.1.1 Cast-Iron Hub and Spigot Soil Pipe and Fittings

ASTM A 74, service, with ASTM C 564 compression-type rubber gaskets.

2.1.1.2 Cast-Iron Hubless Soil Pipe and Fittings

CISPI 301 with CISPI 310 coupling joints.

2.1.2 Ductile Iron Gravity Sewer Pipe and Associated Fittings

2.1.2.1 Ductile Iron Gravity Pipe and Fittings

Ductile iron pipe shall conform to ASTM A 746. Fittings shall conform to AWWA C110 or AWWA C153. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends. Fittings shall have strength at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the joints specified hereinafter. Pipe and fittings shall have cement-mortar lining conforming to AWWA C104, standard thickness.

2.1.2.2 Ductile Iron Gravity Joints and Jointing Materials

Pipe and fittings shall have push-on joints, except as otherwise specified in this paragraph. Push-on joint pipe ends and fitting ends, gaskets, and lubricant for joint assembly shall conform to AWWA C111.

2.1.3 ABS Composite Plastic Piping

2.1.3.1 ABS Composite Plastic Pipe and Fittings

ASTM D 2680.

2.1.3.2 Jointing Materials for ABS Composite Plastic Piping

Solvent cement and primer shall conform to ASTM D 2680.

2.1.4 ABS Solid-Wall Plastic Piping

2.1.4.1 ABS Solid-Wall Plastic Pipe and Fittings

ASTM D 2751, SDR 35, with ends suitable for either solvent cement joints or elastomer joints.

2.1.4.2 ABS Solid-Wall Plastic Joints and Jointing Materials

Solvent cement for solvent cement joints shall conform to ASTM D 2235. Elastomeric joints shall conform to ASTM D 3212. Gaskets for elastomeric joints shall conform to ASTM F 477.

2.1.5 PVC Plastic Gravity Sewer Piping

2.1.5.1 PVC Plastic Gravity Pipe and Fittings

ASTM D 3034, SDR 35, or ASTM F 949 with ends suitable for elastomeric gasket joints.

2.1.5.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D 3212. Gaskets shall conform to ASTM F 477.

## 2.1.6 PVC Plastic Pressure Pipe and Associated Fittings

### 2.1.6.1 PVC Plastic Pressure Pipe and Fittings

- a. Pipe and Fittings Less Than 4 inch Diameter: Pipe, couplings and fittings shall be manufactured of materials conforming to ASTM D 1784, Class 12454B.

(1) Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785, Schedule 80, with joints meeting requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified. Fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings. Pipe couplings when used, shall be tested as required by ASTM D 2464.

(2) Push-On Joint: ASTM D 3139, with ASTM F 477 gaskets. Fittings for push-on joints shall be iron conforming to AWWA C110 or AWWA C111. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104.

(3) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure. Fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467.

- b. Pipe and Fittings 4 inch Diameter to 12 inch: Pipe shall conform to AWWA C900 and shall be plain end or gasket bell end, Pressure Class 150 (DR 18), with cast-iron-pipe-equivalent OD. Fittings shall be gray-iron or ductile-iron conforming to AWWA C110 or AWWA C153 and shall have cement-mortar lining conforming to AWWA C104, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified, as approved, for push-on joint suitable for use with the PVC plastic pressure pipe specified in this paragraph.

### 2.1.6.2 PVC Plastic Pressure Joints and Jointing Material

Joints for pipe, 4 inch to 12 inch diameter, shall be push-on joints as specified in ASTM D 3139. Joints between pipe and fittings shall be push-on joints as specified in ASTM D 3139 or shall be compression-type joints/mechanical-joints as respectively specified in ASTM D 3139 and AWWA C111. Each joint connection shall be provided with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe shall conform to ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical-joints for joint connections between pipe and fittings shall be as specified in AWWA C111, respectively, for push-on joints and mechanical-joints.

### 2.1.7 High Density Polyethylene Pipe

ASTM F 894, Class 63, size 18 inch through 120 inch. ASTM F 714, size 4 inch through 48 inch. The polyethylene shall be certified by the resin producer as meeting the requirements of ASTM D 3350, cell Class 334433C.

The pipe stiffness shall be greater than or equal to  $1170/D$  for cohesionless material pipe trench backfills. Fittings for High Density Polyethylene Pipe: ASTM F 894. Joints for high density polyethylene pipe: Rubber gasket joints shall conform to ASTM C 443.

#### 2.1.8 Reinforced Plastic Mortar Pipe (RPMP)

Reinforced plastic mortar pipe shall be produced by centrifugal casting and shall have an outside diameter equal to ductile iron pipe dimensions from 18 inch to 48 inch. The inner surface of the pipe shall have a smooth uniform continuous resin-rich surface liner. The minimum pipe stiffness shall be 36 psi. RPMP shall be in accordance with ASTM D 3262. Fittings for RPMP: ASTM D 3840. Joints for RPMP: Bell and spigot gasket coupling utilizing an elastomeric gasket in accordance with ASTM D 4161 and ASTM F 477.

#### 2.1.9 Reinforced Thermosetting Resin Pipe (RTRP)

RTRP pipe: ASTM D 3262. Fittings for RTRP: ASTM D 3262. Joints for RTRP: Bell and spigot type utilizing an elastomeric gasket in accordance with ASTM F 477.

##### 2.1.9.1 Filament Wound RTRP-I

RTRP-I shall conform to ASTM D 2996, except pipe shall have an outside diameter equal to cast iron outside diameter or standard weight steel pipe. The pipe shall be suitable for a normal working pressure of 150 psi at 73 degrees F. The inner surface of the pipe shall have a smooth uniform continuous resin-rich surface liner conforming to ASTM D 2996.

##### 2.1.9.2 Centrifugally Cast RTRP-II

RTRP-II shall conform to ASTM D 2997. Pipe shall have an outside diameter equal to standard weight steel pipe.

### 2.2 CONCRETE MATERIALS

#### 2.2.1 Cement Mortar

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

#### 2.2.2 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking.

#### 2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94/C 94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

### PART 3 EXECUTION

#### 3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

### 3.1.1 General Requirements for Installation of Pipelines

Apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

#### 3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building, unless otherwise indicated. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

#### 3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 02300, Earthwork.

#### 3.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

#### 3.1.1.4 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

### 3.1.2 Special Requirements

#### 3.1.2.1 Installation of Cast Iron Soil Piping

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the recommendations of the pipe manufacturer. Make joints with the rubber gaskets specified for cast iron soil pipe joints and assemble in accordance with the recommendations of the pipe manufacturer.

#### 3.1.2.2 Installation of Ductile Iron Gravity Sewer Pipe

Unless otherwise specified, install pipe and associated fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of AWWA C600 for

pipe installation and joint assembly.

- a. Make push-on joints with the gaskets and lubricant specified for this type joint and assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.

#### 3.1.2.3 Installation of ABS Composite Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the recommendations of the plastic pipe manufacturer. Make joints with the primer and solvent cement specified for this joint and assemble in accordance with the recommendations of the pipe manufacturer. Handle solvent cement in accordance with ASTM F 402.

#### 3.1.2.4 Installation of ABS Solid-Wall Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the recommendations of the plastic pipe manufacturer. Make solvent cement joints with the solvent cement previously specified for this type joint. Make elastomeric joints with the gaskets specified for this type joint and assemble in accordance with the recommendations of the pipe manufacturer. Handle solvent cement in accordance with ASTM F 402.

#### 3.1.2.5 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D 2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D 2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

#### 3.1.2.6 Installation of PVC Plastic Pressure Pipe and Fittings

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section; with the requirements of UBPPA UNI-B-3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

- a. Pipe Less Than 4 Inch Diameter:

- (1) Threaded joints shall be made by wrapping the male threads with joint tape or by applying an approved thread lubricant, then threading the joining members together. The joints shall be tightened with strap wrenches which will not damage the pipe and fittings. The joint shall be tightened no more than 2 threads past hand-tight.

- (2) Push-On Joints: The ends of pipe for push-on joints shall be beveled to facilitate assembly. Pipe shall be marked to indicate when the pipe is fully seated. The gasket shall be lubricated to prevent displacement. Care shall be exercised to ensure that the gasket remains in proper position in the bell or coupling while making the joint.

- (3) Solvent-weld joints shall comply with the manufacturer's instructions.
- b. Pipe 4 Inch Diameter Joints: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to fittings, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UBPPA UNI-B-3 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners specified for this type joint and assemble in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel.
- c. Pipe anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to ASTM C 94/C 94M having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

### 3.1.3 Concrete Work

Cast-in-place concrete is included in Section 03300, "Cast-In-Place Concrete."

The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

### 3.1.4 Manhole Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements

specified under paragraph entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

### 3.1.5 Miscellaneous Construction and Installation

#### 3.1.5.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

#### 3.1.5.2 Metal Work

- a. Workmanship and finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

#### 3.1.6 Sewage Absorption Trench Construction

Grade pipe lines uniformly downward to the outlet. Lay perforated pipe with the perforations downward. Lay drain tile with 1/4 inch open joints. Cover open joints of drain tile with the cover material specified so that it extends not less than 100 degrees on each side of the vertical center line of the tile. Wire covering in place.

#### 3.1.7 Installations of Wye Branches

Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

### 3.2 FIELD QUALITY CONTROL

#### 3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

#### 3.2.2 Tests for Nonpressure Lines

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line. When pressure piping is used in a nonpressure line for nonpressure use, test this piping as specified for nonpressure pipe.

##### 3.2.2.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

- a. Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in accordance with ASTM C 969. Make calculations in accordance with the Appendix to ASTM C 969.
- b. Low-pressure air tests: Perform tests as follows:
  - (1) Clay pipelines: Test in accordance with ASTM C 828. Allowable pressure drop shall be as given in ASTM C 828. Make calculations in accordance with the Appendix to ASTM C 828.
  - (2) Concrete pipelines: Test in accordance with ASTM C 924. Allowable pressure drop shall be as given in ASTM C 924. Make calculations in accordance with the Appendix to ASTM C 924.
  - (3) Ductile-iron pipelines: Test in accordance with the applicable requirements of ASTM C 924. Allowable pressure drop shall be as given in ASTM C 924. Make calculations in accordance with the Appendix to ASTM C 924.
  - (4) ABS composite plastic pipelines: Test in accordance with the applicable requirements of UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.
  - (5) PVC plastic pipelines: Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

-- End of Section --

**Amdt #0001**

SECTION 02556A

GAS DISTRIBUTION SYSTEM  
07/03

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN GAS ASSOCIATION (AGA)

AGA XR0104 (2001) AGA Plastic Pipe Manual for Gas Service

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B109.2 (2000) Diaphragm-Type Gas Displacement Meters (500 cubic ft./hour Capacity and Over)

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 5L (2000) Line Pipe

API Spec 6D (2002) Specification for Pipeline Valves

ASTM INTERNATIONAL (ASTM)

ASTM A 53/A 53M (2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 181/A 181M (2001) Carbon Steel Forgings, for General-Purpose Piping

ASTM D 2513 (2001ae1) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

ASTM D 2517 (2000e1) Reinforced Epoxy Resin Gas Pressure Pipe and Fittings

ASTM D 2683 (1998) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

ASTM D 3261 (1997) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM D 3308 (2001) PTFE Resin-Skived Tape

ASTM D 3350 (2002a) Polyethylene Plastics Pipe and Fittings Materials

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose, Inch
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(2002) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.34	(1996) Valves Flanged, Threaded, and Welding End
ASME B16.40	(2002) Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems
ASME B31.8	(2000) Gas Transmission and Distribution Piping Systems
ASME BPVC SEC VIII D1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
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MASTER PAINTERS INSTITUTE (MPI)

MPI 9	(Jan 2003) Exterior Alkyd Enamel
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NACE INTERNATIONAL (NACE)

NACE RP0185	(1996) Extruded, Polyolefin Resin Coating Systems with Soft Adhesives for Underground or Submerged Pipe
NACE RP0274	(1998) High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 58	(2001) Liquefied Petroleum Gas Code
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THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 25	(1997; R 2000) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II
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SSPC SP 1 (1982; R 2000) Solvent Cleaning  
SSPC SP 3 (1982; R 2000) Power Tool Cleaning  
SSPC SP 6 (2000) Commercial Blast Cleaning  
SSPC SP 7 (2000) Brush-Off Blast Cleaning

UNDERWRITERS LABORATORIES (UL)

UL Gas&Oil Dir (2000) Gas and Oil Equipment Directory

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

49 CFR 192 Transportation of Natural and Other Gas by  
Pipeline: Minimum Federal Safety Standards

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise indicated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Pipe, Fittings, and Associated Materials; G, AO

Drawings shall contain complete schematic and piping diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of the system and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-03 Product Data

Materials and Equipment; G, AO

A complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions, including, but not limited to the following:

- a. Dielectric Waterways and Flange Kits.
- b. Meters.
- c. Pressure Reducing Valves.
- d. Regulators.
- e. Emergency Gas Supply Connection.

Spare Parts; G, AO

Spare parts lists for each different item of material and equipment specified.

Connections to Existing Lines; G, AO

Notification of the Contractor's schedule for making connections to existing gas lines, at least 10 days in advance.

Welding Steel Piping; G, AO

A copy of qualified welding procedures along with a list of names and identification symbols of performance qualified welders and welding operators.

Jointing Polyethylene and Fiberglass Piping; G, AO

A copy of qualified jointing procedures, training procedures, qualifications of trainer, and training test results for joiners and inspectors.

Connection and Abandonment Plan; G, AO

A copy of procedures for gas line tie in, hot taps, abandonment/removal or demolition, purging, and plugging as applicable in accordance with ASME B31.8.

#### SD-06 Test Reports

Pressure and Leak Tests; G, AO

Data from all pressure tests of the distribution system.

#### SD-07 Certificates

Utility Work; G, AO

Certification from the Operating Agency/Utility Company that work for which the Utility is responsible has been completed.

Training; G, AO

A copy of each inspector's and jointer's training certificate with respective test results.

#### SD-10 Operation and Maintenance Data

Gas Distribution System; G, AO

Six copies, in booklet form and indexed, of site specific natural gas operation and maintenance manual for each gas distribution system including system operation, system maintenance, equipment operation, and equipment maintenance manuals described below. If operation and maintenance manuals are provided in a common volume, they shall be clearly differentiated and separately indexed.

The System Operation Manual shall include but not be limited to the following:

- a. Maps showing piping layout and locations of all system valves and gas line markers.
- b. Step-by-step procedures required for system startup, operation, and shutdown. System components and equipment shall be indexed to the gas maps.
- c. Isolation procedures and valve operations to shut down or isolate each section of the system. Valves and other system components shall be indexed to the gas maps.
- d. Descriptions of Site Specific Standard Operation Procedures including permanent and temporary pipe repair procedures, system restart and test procedures for placing repaired lines back in service, and procedures for abandoning gas piping and system components.
- e. Descriptions of Emergency Procedures including: isolation procedures including required valve operations with valve locations indexed to gas map, recommended emergency equipment, checklist for major emergencies and procedures for connecting emergency gas supply.

The Equipment Operation Manual shall include, but not be limited to, detail drawings, equipment data, and manufacturer supplied operation manuals for all equipment, valves and system components.

The System Maintenance Manuals shall include, but not be limited to:

- a. Maintenance check list for entire gas distribution system.
- b. Descriptions of site specific standard maintenance procedures.
- c. Maintenance procedures for installed cathodic protection systems.
- d. Piping layout, equipment layout, and control diagrams of the systems as installed.
- e. Identification of pipe materials and manufacturer by location, pipe repair procedures, and jointing procedures at transitions to other piping materials or piping from different manufacturer.

The Equipment Maintenance Manuals shall include but not be limited to the following:

- a. Identification of valves and other equipment by materials, manufacturer, vendor identification and location.
- b. Maintenance procedures and recommended maintenance tool kits for all valves and equipment.
- c. Recommended repair methods, either field repair, factory repair, or whole-item replacement for each valve component or piece of equipment or component item.

d. Routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide.

### 1.3 GENERAL REQUIREMENTS

#### 1.3.1 Welding Steel Piping

Welding and nondestructive testing procedures for pressure piping are specified in Section 05093A WELDING PRESSURE PIPING. Structural members shall be welded in accordance with Section 05090A WELDING, STRUCTURAL.

#### 1.3.2 Jointing Polyethylene and Fiberglass Piping

Piping shall be joined by performance qualified joiners using qualified procedures in accordance with AGA XR0104. Manufacturer's prequalified joining procedures shall be used. Joints shall be inspected by an inspector qualified in the joining procedures being used and in accordance with AGA XR0104. Joiners and inspectors shall be qualified at the jobsite by a person who has been trained and certified by the manufacturer of the pipe, to train and qualify joiners and inspectors in each joining procedure to be used on the job. Training shall include use of equipment, explanation of the procedure, and successfully making joints which pass tests specified in AGA XR0104. The Contracting Officer shall be notified at least 24 hours in advance of the date to qualify joiners and inspectors.

#### 1.3.3 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Valves, flanges, and fittings shall be marked in accordance with MSS SP-25.

#### 1.3.4 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

#### 1.3.5 Handling

Pipe and components shall be handled carefully to ensure a sound, undamaged condition. Particular care shall be taken not to damage pipe coating. No pipe or material of any kind shall be placed inside another pipe or fitting after the coating has been applied, except as specified in paragraph INSTALLATION. Plastic pipe shall be handled in conformance with AGA XR0104.

#### 1.3.6 Spare Parts

The Contractor shall submit spare parts data for each different item of equipment and material specified, after approval of the detail drawings and not later than two months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

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### 1.3.7 Excavation Requirements

**Before excavating, reference Section 01110N SUMMARY OF WORK for excavation procedures and requirements.**

## PART 2 PRODUCTS

### 2.1 PIPE, FITTINGS, AND ASSOCIATED MATERIALS

#### 2.1.1 Steel Pipe

Steel pipe shall conform to ASTM A 53/A 53M, Grade A or B, Type E or S, Schedule 40; or API Spec 5L seamless or electric resistance welded, Schedule 40, black steel pipe as specified in ASME B31.8. Furnace butt welded pipe may be used in sizes 1-1/2 inches and smaller.

#### 2.1.2 Small Fittings

Fittings 1-1/2 inches and smaller shall conform to ASME B16.11.

#### 2.1.3 Fittings, 2 Inches and Larger

Pipe flanges and flanged fittings including bolts, nuts, and bolt patterns shall be in accordance with ASME B16.5. Butt weld fittings shall be in accordance with ASME B16.9. Weld neck flanges shall be used.

#### 2.1.4 Steel Forged Branch Connections

Connections shall conform to ASTM A 181/A 181M, Class 60, carbon steel.

#### 2.1.5 Flange Gaskets

Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1/16 inch minimum thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with nitrile butadiene rubber (NBR), or glass fibers bonded with polytetrafluoroethylene, suitable for maximum 600 degrees F service and meeting applicable requirements of ASME B31.8.

#### 2.1.6 Pipe Threads

Pipe threads shall conform to ASME B1.20.1.

#### 2.1.7 Polyethylene Pipe, Tubing, Fittings and Joints

Polyethylene pipe, tubing, fittings and joints shall conform to ASTM D 3350 and ASTM D 2513, pipe designations PE 2406 and PE 3408, rated SDR 11 or less, as specified in ASME B31.8. Pipe sections shall be marked as required by ASTM D 2513. Butt fittings shall conform to ASTM D 3261 and socket fittings shall conform to ASTM D 2683. Fittings shall match the service rating of the pipe. Minimum wall thickness shall be per ASME B31.8, Table 842.32(c). Polyethylene pipe, tubing, and fittings shall be recommended by the manufacturer for use with LPG.

#### 2.1.8 Fiberglass Pipe, Fittings and Adhesive

Fiberglass pipe, fittings and adhesive shall conform to ASTM D 2517. Pipe sections shall be marked as required by ASTM D 2517. Minimum wall thickness shall be selected based on ASME B31.8, Table 842.33(c).

## 2.1.9 Sealants for Steel Pipe Threaded Joints

### 2.1.9.1 Sealing Compound

Joint sealing compound shall be as listed in UL Gas&Oil Dir, Class 20 or less.

### 2.1.9.2 Tape

Polytetrafluoroethylene tape shall conform to ASTM D 3308.

### 2.1.10 Identification

Pipe flow markings and metal tags for each valve, meter, and regulator shall be provided as required by the Contracting Officer.

### 2.1.11 Insulating Joint Materials

Insulating joint materials shall be provided between flanged or threaded metallic pipe systems where shown to isolate galvanic or electrolytic action.

#### 2.1.11.1 Threaded Joints

Joints for threaded pipe shall be steel body nut type, dielectric waterways with insulating gaskets.

#### 2.1.11.2 Flanged Joints

Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts and insulating washers for flange nuts.

#### 2.1.11.3 Dielectric Waterways and Flanges

Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways.

### 2.1.12 Gas Transition Fittings

Gas transition fittings shall be manufactured steel fittings approved for jointing steel and polyethylene or fiberglass pipe. Approved transition fittings are those that conform to AGA XR0104 requirements for transition fittings.

## 2.2 VALVES

Valves shall be suitable for shutoff or isolation service and shall conform to the following:

### 2.2.1 Steel Valves

Steel valves 1-1/2 inches and smaller installed underground shall conform

to ASME B16.34, carbon steel, socket weld ends, with square wrench operator adaptor. Steel valves 1-1/2 inches and smaller installed aboveground shall conform to ASME B16.34, carbon steel, socket weld or threaded ends with handwheel or wrench operator. Steel valves 2 inches and larger installed underground shall conform to API Spec 6D, carbon steel, butt weld ends, Class 150 with square wrench operator adaptor. Steel valves 2 inches and larger installed aboveground shall conform to API Spec 6D, carbon steel, butt weld or flanged ends, Class 150 with handwheel or wrench operator.

#### 2.2.2 Steel Valve Operators

Valves 8 inches and larger shall be provided with worm or spur gear operators, totally enclosed, grease packed, and sealed. The operators shall have Open and Closed stops and position indicators. Locking feature shall be provided where indicated. Wherever the lubricant connections are not conveniently accessible, suitable extensions for the application of lubricant shall be provided. Valves shall be provided with lubricant compatible with gas service.

#### 2.2.3 Polyethylene Valves

Polyethylene valves shall conform to ASME B16.40. Polyethylene valves, in sizes 1/2 inch to 6 inches, may be used with polyethylene distribution and service lines, in lieu of steel valves, for underground installation only.

### 2.3 PRESSURE REGULATORS

Regulators shall have ferrous bodies, shall provide backflow protection, and shall be designed to meet the pressure, load and other service conditions.

#### 2.3.1 Gas Main Regulators

Pressure regulators for main distribution lines, supplied from a source of gas which is at a higher pressure than the maximum allowable operating pressure for the system, and shall be equipped with pressure regulating devices of adequate capacity. In addition to the pressure regulating devices, a suitable method shall be provided to prevent overpressuring of the system in accordance with ASME B31.8. Suitable protective devices are as follows:

- a. Spring-loaded relief valve meeting the provisions of ASME BPVC SEC VIII D1.
- b. Pilot-loaded back pressure regulator used as relief valve, so designed that failure of the pilot system will cause the regulator to open.
- c. Weight-loaded relief valves.
- d. Monitoring regulator installed in series with the primary pressure regulator.
- e. Series regulator installed upstream from the primary regulator, set to limit the pressure on the inlet of the primary regulator continuously to the maximum allowable operating pressure of the system, or less.
- f. Automatic shutoff device installed in series with the primary regulator, set to shut off when the pressure on the distribution system

reaches the maximum allowable operating pressure of the system, or less. This device shall remain closed until manually reset.

g. Spring-loaded, diaphragm type relief valves.

#### 2.3.2 Service Line Regulators

Pressure regulators for individual service lines shall have ferrous bodies. Regulator shall be capable of reducing distribution line pressure to pressures required for users. Regulators shall be provided where gas will be distributed at pressures in excess of 10 inches of water column. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulators for liquified petroleum gas shall be adjusted to 10 to 12 inches of water column. Pressure relief for liquified petroleum gas shall be set at 16 inches of water column. Regulator shall have single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Regulator valve vent shall be of resilient materials designed to withstand flow conditions when pressed against the valve port. Regulator shall be capable of regulating downstream pressure within limits of accuracy and shall be capable of limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Regulator shall have a self contained service regulator. Regulator pipe connections shall not exceed 2 inch size.

#### 2.4 METERS

Meters shall conform to ANSI B109.2. Meters shall be pipe mounted. Meters shall be provided with over-pressure protection as specified in ASME B31.8 and frost protection. Meters shall be suitable for accurately measuring and handling gas at pressures, temperatures, and flow rates indicated. Meters shall have a pulse switch initiator capable of operating up to speeds of 500 pulses per minute with no false pulses and shall require no field adjustments. Initiators shall provide the maximum number of pulses up to 500 per minute that is obtainable from the manufacturer. It shall provide not less than one pulse per 100 cubic feet of gas.

#### 2.5 PROTECTIVE COVERING MATERIALS

Continuously extruded polyethylene and adhesive coating system materials shall conform to NACE RP0185, Type A.

### PART 3 EXECUTION

#### 3.1 EXCAVATION AND BACKFILLING

Earthwork shall be as specified in Section 02300 EARTHWORK.

#### 3.2 GAS MAINS

Pipe for gas mains shall be steel, polyethylene or fiberglass. Steel pipe and fittings shall be coated with protective covering as specified. Polyethylene or fiberglass mains shall not be installed aboveground.

#### 3.3 SERVICE LINES AND EMERGENCY GAS SUPPLY CONNECTION

Service lines shall be constructed of materials specified for gas mains and shall extend from a gas main to and including the point of delivery within 5 feet of the building. The point of delivery is the meter set assembly.

The service lines shall be connected to the gas mains as indicated. Where indicated, service line shall be provided with an isolation valve of the same size as the service line. The service lines shall be as short and as straight as practicable between the point of delivery and the gas main and shall not be bent or curved laterally unless necessary to avoid obstructions or otherwise permitted. Service lines shall be laid with as few joints as practicable using standard lengths of pipe. Shorter lengths shall be used only for closures. Polyethylene or fiberglass service lines shall not be installed aboveground.

### 3.4 WORKMANSHIP AND DEFECTS

Pipe, tubing, and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and blown free of chips and scale. Defective pipe, tubing, or fittings shall be replaced and shall not be repaired.

### 3.5 PROTECTIVE COVERING

#### 3.5.1 Protective Covering for Underground Steel Pipe

Except as otherwise specified, protective coverings shall be applied mechanically in a factory or field plant especially equipped for the purpose. Valves and fittings that cannot be coated and wrapped mechanically shall have the protective covering applied by hand, preferably at the plant that applies the covering to the pipe. Joints shall be coated and wrapped by hand. Hand coating and wrapping shall be done in a manner and with materials that will produce a covering equal in thickness to that of the covering applied mechanically.

##### 3.5.1.1 Thermoplastic Resin Coating System

The coating system shall conform to NACE RP0185, Type A. The exterior of the pipe shall be cleaned to a commercial grade blast cleaning finish in accordance with SSPC SP 6. Adhesive compound shall be applied to the pipe.

Immediately after the adhesive is applied, a seamless tube of polyethylene shall be extruded over the adhesive to produce a bonded seamless coating. The nominal thickness of the pipe coating system shall be 10 mils (plus or minus 10 percent) of adhesive and 40 mils (plus or minus 10 percent) of polyethylene for pipes up to 16 inches in diameter. For pipes 18 inches and larger in diameter, the pipe coating system thickness shall be 10 mils (plus or minus 10 percent) adhesive and 60 mils (plus or minus 10 percent) polyethylene. Joint coating and field repair material shall be applied as recommended by the coating manufacturer and shall be one of the following:

- a. Heat shrinkable polyethylene sleeves.
- b. Polyvinyl chloride pressure-sensitive adhesive tape.
- c. High density polyethylene/bituminous rubber compound tape.

The coating system shall be inspected for holes, voids, cracks, and other damage during installation.

##### 3.5.1.2 Inspection of Pipe Coatings

Any damage to the protective covering during transit and handling shall be repaired before installation. After field coating and wrapping has been applied, the entire pipe shall be inspected by an electric holiday detector

with impressed current set at a value in accordance with NACE RP0274 using a full-ring, spring-type coil electrode. The holiday detector shall be equipped with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. All holidays in the protective covering shall be repaired immediately upon detection. The Contracting Officer reserves the right to inspect and determine the suitability of the detector. Labor, materials, and equipment necessary for conducting the inspection shall be furnished by the Contractor.

### 3.5.2 Protective Covering for Aboveground Piping Systems

Finish painting shall conform to the applicable paragraphs of Section 09900 PAINTING, GENERAL and as follows:

#### 3.5.2.1 Ferrous Surfaces

Shop primed surfaces shall be touched up with ferrous metal primer same type paint as the shop primer. Surfaces that have not been shop primed shall be solvent-cleaned in accordance with SSPC SP 1. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be mechanically cleaned by power wire brushing in accordance with SSPC SP 3 or brush-off blast cleaned in accordance with SSPC SP 7 and primed with ferrous metal primer in accordance with SSPC Paint 25. Primed surfaces shall be finished with two coats of exterior alkyd paint conforming to MPI 9.

#### 3.5.2.2 Nonferrous Surfaces

Nonferrous surfaces shall not be painted.

### 3.5.3 Protective Covering for Piping in Valve Boxes and Manholes

Piping in valve boxes or manholes shall receive protective coating as specified for underground steel pipe.

## 3.6 INSTALLATION

Gas distribution system and equipment shall be installed in conformance with the manufacturer's recommendations and applicable sections of ASME B31.8, AGA XR0104 and 49 CFR 192. Abandoning existing gas piping shall be done in accordance with ASME B31.8. Pipe shall be cut without damaging the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable. On steel pipe 6 inches and larger, an approved gas-cutting-and-beveling machine may be used. Cutting of plastic pipe shall be in accordance with AGA XR0104. Valve installation in plastic pipe shall be designed to protect the plastic pipe against excessive torsional or shearing loads when the valve is operated and from other stresses which may be exerted through the valve or valve box. Polyethylene mains and service lines for LPG shall only be installed below ground in accordance with NFPA 58.

### 3.6.1 Installing Pipe Underground

Gas mains and service lines shall be graded as indicated. Joints in steel pipe shall be welded except as otherwise permitted for installation of valves. Mains shall have 24 inch minimum cover; service lines shall have 18 inch minimum cover; and both mains and service lines shall be placed on firmly compacted select material for the full length. Where indicated, the main shall be encased, bridged, or designed to withstand any anticipated external loads as specified in ASME B31.8. The encasement material shall

be standard weight black steel pipe with a protective coating as specified.

The pipe shall be separated from the casing by insulating spacers and sealed at the ends with casing bushings. Trench shall be excavated below pipe grade, bedded with bank sand, and compacted to provide full-length bearing. Laying the pipe on blocks to produce uniform grade will not be permitted. The pipe shall be clean inside before it is lowered into the trench and shall be kept free of water, soil, and all other foreign matter that might damage or obstruct the operation of the valves, regulators, meters, or other equipment. When work is not in progress, open ends of pipe or fittings shall be securely closed by expandable plugs or other suitable means. Minor changes in line or gradient of pipe that can be accomplished through the natural flexibility of the pipe material without producing permanent deformation and without overstressing joints may be made when approved. Changes in line or gradient that exceed the limitations specified shall be made with fittings. When cathodic protection is furnished, electrically insulated joints or flanges shall be provided. When polyethylene or fiberglass piping is installed underground, foil backed magnetic tape shall be placed above the pipe to permit locating with a magnetic detector. After laying of pipe and testing, trench shall be backfilled in accordance with Section 02300 EARTHWORK

### 3.6.2 Installing Pipe Aboveground

Aboveground piping shall be protected against dirt and other foreign matter as specified for underground piping. Joints in steel pipe shall be welded; however, joints in pipe 1-1/2 inches in diameter and smaller may be threaded; joints may also be threaded to accommodate the installation of valves. Flanges shall be of the weld neck type to match wall thickness of pipe.

## 3.7 PIPE JOINTS

Pipe joints shall be designed and installed to effectively sustain the longitudinal pullout forces caused by the contraction of piping or superimposed loads.

### 3.7.1 Threaded Steel Joints

Threaded joints in steel pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service or polytetrafluoroethylene tape applied to the male threads only. Caulking of threaded joints to stop or prevent leaks will not be permitted.

### 3.7.2 Welded Steel Joints

Gas pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.8. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected adversely. Electrodes that have been wetted or have lost any of their coating shall not be used.

### 3.7.3 Polyethylene and Fiberglass Pipe Jointing Procedures

Jointing procedures shall conform to AGA XR0104. Indiscriminate heat fusion joining of plastic pipe or fittings made from different polyethylene resins by classification or by manufacturer shall be avoided if other alternative joining procedures are available. If heat fusion joining of dissimilar polyethylenes is required, special procedures are required. The method of heat fusion joining dissimilar polyethylene resins shall be tested in accordance with paragraph TESTS, subparagraph Destructive Tests of Plastic Pipe Joints.

### 3.7.4 Connections Between Metallic and Plastic Piping

Connections shall be made only outside, underground, and with approved transition fittings.

### 3.8 VALVE BOXES

Valve boxes of cast iron not less than 3/16 inch thick shall be installed at each underground valve except where concrete or other type of housing is indicated. Valve boxes shall be provided with locking covers that require a special wrench for removal. Wrench shall be furnished for each box. The word "gas" shall be cast in the box cover. When the valve is located in a roadway, the valve box shall be protected by a suitable concrete slab at least 3 square feet. When in a sidewalk, the top of the box shall be in a concrete slab 2 feet square and set flush with the sidewalk. Boxes shall be adjustable extension type with screw or slide-type adjustments. Valve boxes shall be separately supported, not resting on the pipe, so that no traffic loads can be transmitted to the pipe. Valves shall only be located in valve boxes or inside of buildings.

### 3.9 DRIPS

Drips shall be installed at locations where indicated. Drips shall conform to the details shown or may be commercial units of approved type and capacity. A blow off pipe 1-1/4 inches or larger shall be connected to each drip at its lowest point and shall extend to or near the ground surface at a convenient location away from traffic. Discharge for each drip terminal (outlet) shall be provided with a reducing fitting, a plug valve, and a 1/2 inch nipple turned down. The discharge terminal (outlet) shall be inside a length of 12 inches or larger vitrified clay pipe, concrete sewer pipe or concrete terminal box set vertically on a bed of coarse gravel 1 foot thick and 3 feet square, and closed at the ground surface with a suitable replacement cover.

### 3.10 PRESSURE REGULATOR INSTALLATION

#### 3.10.1 Main Distribution Line Regulators

Pressure regulators shall be installed where shown. A valve shall be installed on each side of the regulator for isolating the regulator for maintenance. A bypass line with bypass valves or 3 way valves and an overpressurization pressure regulating device shall be provided. Regulators and valves shall be installed in rectangular reinforced concrete boxes. Boxes shall be large enough so that all required equipment can be properly installed, operated, and maintained. Sidewalls shall extend above ground line. The boxes shall be provided with cast iron manhole covers with locking provisions and 4 inch diameter vents. One key or other unlocking device shall be furnished with each cover. Discharge stacks,

vents, or outlet ports of all pressure relief devices shall be located where gas can be discharged into the atmosphere without undue hazard. Stacks and vents shall be provided with fittings to preclude entry of water.

### 3.10.2 Service Line Regulators

A shutoff valve, meter set assembly, and service regulator shall be installed on the service line outside the building, 18 inches above the ground on the riser. An insulating joint shall be installed on the inlet side of the meter set assembly and service regulator and shall be constructed to prevent flow of electrical current. A 3/8 inch tapped fitting equipped with a plug shall be provided on both sides of the service regulator for installation of pressure gauges for adjusting the regulator. All service regulator vents and relief vents shall terminate in the outside air in rain and insect resistant fittings. The open end of the vent shall be located where gas can escape freely into the atmosphere, away from any openings into the building and above areas subject to flooding.

### 3.11 METER INSTALLATION

Meters shall be installed in accordance with ASME B31.8. Permanent gas meters shall be installed with provisions for isolation and removal for calibration and maintenance, and shall be suitable for operation in conjunction with an energy monitoring and control system.

### 3.12 CONNECTIONS TO EXISTING LINES

Connections between new work and existing gas lines, where required, shall be made in accordance with ASME B31.8, using proper fittings to suit the actual conditions. When connections are made by tapping into a gas main, the connecting fittings shall be the same size as the pipe being connected.

#### 3.12.1 Connection to Government Owned/Operated Gas Lines

The Contractor shall provide connections to the existing gas lines in accordance with approved procedures. Deactivation of any portion of the existing system shall only be done at the valve location shown on the drawings. Reactivation of any existing gas lines will only be done by the Government. The Contractor's Connection and Abandonment Plan shall be submitted and approved prior to making any connections to existing gas lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made.

a. If facilities are abandoned in place, they shall be physically disconnected from the piping system. The open ends of all abandoned facilities shall be purged, capped, plugged or otherwise effectively sealed. Abandonment shall not be completed until it has been determined that the volume of gas or liquid hydrocarbons contained within the abandoned section poses no potential hazard. Air or inert gas may be used for purging, or the facility may be filled with water or other inert material. If air is used for purging, the Contractor shall ensure that a combustible mixture is not present after purging.

b. When a main is abandoned, together with the service lines connected to it, only the customer's end of such service lines is required to be sealed as stipulated above.

c. Service lines abandoned from the active mains shall be disconnected as close to the main as practicable.

d. All valves left in the abandoned segment shall be closed.

e. All abovegrade valves, risers, and vault and valve box covers shall be removed. Vault and valve box voids shall be filled with suitable compacted backfill material.

### 3.13 CATHODIC PROTECTION

Cathodic protection shall be provided for all metallic gas piping installed underground and shall be installed as specified in Section 13110ACATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

### 3.14 TESTS

#### 3.14.1 Destructive Tests of Plastic Pipe Joints

Each day, prior to making polyethylene heat fusion joints or fiberglass adhesive joints, a joint of each size and type to be installed that day shall be made by each person performing joining of plastic pipe that day and destructively tested. At least 3 longitudinal straps shall be cut from each joint. Each strap shall be visually examined, shall not contain voids or discontinuities on the cut surfaces of the joint area, and shall be deformed by bending, torque, or impact, and if failure occurs, it must not initiate in the joint area. If a joint fails the visual or deformation test, the qualified joiner who made that joint shall not make further field joints in plastic pipe on this job until that person has been retrained and requalified. The results of the destructive tests shall be recorded to include the date and time of the tests, size and type of the joints, ambient conditions, fusion iron temperature and names of inspectors and joiners.

#### 3.14.2 Pressure and Leak Tests

The system of gas mains and service lines shall be tested after construction and before being placed in service using air as the test medium. The normal operating pressure for the system is less than 20 psi. The test pressure is 50 psi. Prior to testing the system, the interior shall be blown out, cleaned and cleared of all foreign materials. All meters, regulators, and controls shall be removed before blowing out and cleaning and reinstalled after clearing of all foreign materials. Testing of gas mains and service lines shall be done with due regard for the safety of employees and the public during the test. Persons not working on the test operations shall be kept out of the testing area while testing is proceeding. The test shall be made on the system as a whole or on sections that can be isolated. Joints in sections shall be tested prior to backfilling when trenches must be backfilled before the completion of other pipeline sections. The test shall continue for at least 24 hours from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the pipe has been subjected to the full test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. The temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship  $T(1)P(2)=T(2)P(1)$ , in which T and P denote absolute

temperature and pressure, respectively, and the numbers denote initial and final readings. During the test, the entire system shall be completely isolated from all compressors and other sources of air pressure. Each joint shall be tested by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. The testing instruments shall be approved by the Contracting Officer. All labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection at all times during the tests. The Contractor shall maintain safety precautions for air pressure testing at all times during the tests.

-- End of Section --

**Amdt #0001**

SECTION 05210A

STEEL JOISTS  
01/02

PART 1 GENERAL

1.1 REFERENCES

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

STEEL JOIST INSTITUTE (SJI)

SJI Specs & Tables (August 2002) Standard Specifications and Load Tables for Steel Joists and Joist Girders

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Steel Joists; G, AO

Detail drawings shall include fabrication and erection details, specifications for shop painting, and identification markings of joists.

SD-07 Certificates

Steel Joists;

Certificates stating that the steel joists have been designed and manufactured in accordance with SJI Specs & Tables. Complete engineering design computations may be submitted in lieu of the certification.

1.3 GENERAL REQUIREMENTS

Steel joists are designated on the drawings in accordance with the standard designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and provided all other specified requirements are met.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition and stored

off the ground in a well drained location, protected from damage, and easily accessible for inspection and handling.

## PART 2 PRODUCTS

### 2.1 OPEN WEB STEEL JOISTS

#### \*1

Open web steel joists shall conform to SJI Specs & Tables, K-Series. Joists shall be designed to support the loads given in the standard load tables of SJI Specs & Tables. Joists shall also be designed to resist a net uplift of 10 psf. **Joist manufacturer shall supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.**

### 2.2 ACCESSORIES AND FITTINGS

Accessories and fittings, including end supports and bridging, shall be in accordance with the standard specifications under which the members were designed.

### 2.3 SHOP PAINTING

Joists and accessories shall be shop painted with a rust-inhibiting primer paint. For joists which will be finish painted under Section 09900 PAINTING, GENERAL, the primer paint shall be limited to a primer which is compatible with the specified finish paint.

## PART 3 EXECUTION

### 3.1 ERECTION

Installation of joists shall be in accordance with the standard specification under which the member was produced. Joists shall be handled in a manner to avoid damage. Damaged joists shall be removed from the site, except when field repair is approved and such repairs are satisfactorily made in accordance with the manufacturer's recommendations. Joists shall be accurately set, and end anchorage shall be in accordance with the standard specification under which the joists were produced. For spans over 40 ft through 60 ft one row of bridging nearest midspan shall be bolted diagonal bridging; for spans over 60 ft bolted diagonal bridging shall be used instead of welded horizontal bridging. Joist bridging and anchoring shall be secured in place prior to the application of any construction loads. Any temporary loads shall be distributed so that the carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging during construction or in the completed work. Abraded, corroded, and field welded areas shall be cleaned and touched up with the same type of paint used in the shop painting.

-- End of Section --

**Amdt #0001**

SECTION 06410

CUSTOM CASEWORK

**12/95**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI A 135.4 (1985) Basic Hardboard
- ANSI A208.1 (1999) Wood Particleboard
- ANSI A 208.2 (1994) Medium Density Fiberboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D 1037 (1991) Evaluating the Properties of Wood-Base Fiber and Particle Panel Materials

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

- AWI-02 (1988) Architectural Woodwork Quality Standards, Guide Specifications, and Quality Certification Program

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

- BHMA A156.9 (1994) Cabinet Hardware
- BHMA A156.11 (1991) Cabinet Locks
- BHMA A156.18 (1993) Materials and Finishes

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

- NHLA (2003) Rules for Measurement and Inspection of Hardwood and Cypress

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA LD 3 (1991) High-Pressure Decorative Laminates

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section

01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings; G, A/O.

Custom Casework.

Drawings shall show each type of casework, counters, cabinets, and related items, and shall clearly indicate the complete layout of the cabinets and accessories, component profiles, hardware locations, and pertinent details of construction, fabrication and attachments.

SD-03 Product Data

Custom Casework.

Manufacturer's catalog data, including standard color charts.

Hardware;

Manufacturer's catalog data, including cut sheets for each hardware item.

SD-04 Samples

Custom Casework;

Samples shall be submitted with the drawings. In lieu of individual samples, complete minimum size casework may be furnished as samples. Mock-up units are not acceptable. Samples shall include the following items:

- a. Door and drawer fronts - one of each type, with hardware mounted.
- b. Countertop and backsplash - one section, 4-inches wide, containing both.

Plastic Laminate;

- a. Plastic laminate color samples, 3 by 6 inches.

SD-06 Test Reports

Swell test of countertop substrate or core material based on two 12 x 12 inch samples of actual material proposed for use.

SD-08 Manufacturer's Instructions

Custom Casework.

Manufacturer's instructions shall include assembling, installation, finishing, and maintenance instructions.

1.3 DELIVERY, HANDLING, AND STORAGE

The Contractor shall protect materials from damage during delivery, when stored, and during construction. Damaged and defective materials shall be removed and replaced with new. Cabinet work shall be constructed, or delivered and brought into the building, only after the building has dried out, following the installation of wet materials, and when there is no danger of damage to materials due to excessive moisture. Mill-fabricated

cabinets and casework shall be delivered to the project unsealed and ready to receive the specified finish, or with a factory-applied durable finish, as applicable. Mill-fabricated cabinets and casework, scheduled to receive paint finish, shall be delivered to the project with one mill-applied coat of clear sealer or a prime coat of a type compatible with the final finish.

Mill-fabricated cabinets and casework, scheduled to receive a stain or clear, natural finish, shall be delivered to the project with one coat of an approved stain-sealer or clear sealer of a type compatible with the final finish specified in Section 09900 PAINTS AND COATINGS.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

Casework, including cabinets and counters, shall be flush overlay design. Casework shall be custom grade, and unless otherwise specified, shall be built to the quality standards specified in AWI-02 for cabinets and casework. Design shall be as indicated on the drawings.

#### 2.1.1 Softwood Lumber

Softwood lumber shall comply with PS 20 and be graded in accordance with AWI custom grade, average moisture content of 8 percent.

#### 2.1.2 Hardwood Lumber

Hardwood lumber shall comply with NHLA and be graded in accordance with AWI premium grade; average moisture content of 8 percent.

#### 2.1.3 Plywood

##### 2.1.3.1 Softwood Plywood

Softwood plywood shall comply with PS-1 and be graded in accordance with AWI, core materials of veneer, lumber or particleboard, type of glue recommended for application; face veneer and cuts as specified in paragraph "Fabrication - Opaque Finish Casework."

#### 2.1.4 Particleboard

Wood particleboard shall be a mat-formed particleboard conforming to ANSI A208.1, Type I (interior) medium density, Grade 1-M-2 or M-3. Board shall be laminated construction, composed of large wood flakes at the core and finer wood flakes at each surface. Flakes shall be coated and bonded with urea-formaldehyde resin under heat and pressure-formed into boards. When tested in accordance with ASTM D 1037 and in addition to complying with the properties listed in ANSI A208.1, water absorption shall not exceed 15 percent in 24 hours, swelling thickness shall not exceed 6 percent in 24 hours, and maximum moisture content shall not exceed 7 percent for all particleboard used except particleboard in countertops with sinks. Wood particleboard intended for use as exposed or semi-exposed shelving or casework shall be sanded and sealed on both surfaces; exposed edges shall be trimmed with 3/4- by 3/8-inch solid poplar, birch, or oak, with tongue-and-groove joint or butt joint glued to the particleboard with water-resistant glue.

##### 2.1.4.1 Thermoset Decorative Overlay Covered Particleboard

Thermoset decorative overlay covered particleboard shall comply with ANSI A

208.1 Grade M-2 or M-3, composed of wood chips, medium density, and shall be surfaced with thermofused melamine.

#### 2.1.5 Medium Density Fiberboard

Fiberboard shall meet or exceed the requirements of ANSI A 208.2, Grade MD.

#### 2.1.6 Hardboard

Hardboard shall be tempered hardboard and shall meet or exceed the requirements of ANSI A 135.4, shall be minimum 1/4 inch thick and shall be smooth on one side.

##### 2.1.6.1 Thermoset Decorative Overlay Covered Hardboard

Thermoset decorative overlay covered hardboard shall comply with ANSI A 135.4; pressed wood fiber with resin binder, tempered grade, and shall be 1/4 inch thick, smooth one side and surfaced with thermofused melamine.

#### 2.1.7 Construction

##### 2.1.7.1 Counter and Cabinet Bases

Bases shall be constructed of 2-inch thick wood framing, members cut to fit, with toe space of the indicated height and depth. Cross rails shall be provided at cabinet ends, points of concentrated loads, and intervals not to exceed 24 inches.

##### 2.1.7.2 Doors and Drawer Fronts

Door design shall be solid flush face. Flush doors shall be hardwood plywood with matching solid hardwood edges. Lipped doors shall be hardwood plywood with lumber core. Drawer fronts shall be at least 3/4-inch thick solid wood or edge-banded hardwood plywood with veneer species to match cabinet. Doors and drawer fronts, including edges, shall be covered with shop-applied plastic laminate.

##### 2.1.7.3 Countertops and Backsplashes

Countertops and backsplashes shall be constructed of plywood, Grade B-D or better, or medium density fiberboard and covered with shop-applied plastic laminate. Countertops shall be at least 3/4-inch thick. Backsplash shall be plywood, Grade B-D or better, 3/4-inch thick. Unless otherwise indicated, backsplashes shall be not less than 4 inches high.

#### 2.1.8 Fasteners and Adhesives

##### 2.1.8.1 Nails

Nails shall be steel casing nails with flat countersunk cupped head and diamond point.

##### 2.1.8.2 Adhesives

Adhesives shall be moisture- and mold-resistant. Adhesive shall also be contact type for adhering plastic laminate sheets.

##### 2.1.8.3 Wood Screws

Wood screws shall be carbon steel or brass. Wood screws exposed to view shall be brass with an oval head with cross recess drive and finishing washers.

## 2.2 CABINET HARDWARE

Cabinet finish hardware shall conform to the types and styles of BHMA A156.9.

Screws and attachments shall be finished to match the hardware item. Finishes shall be in accordance with BHMA A156.18 and shall match that of the builders' hardware specified in Section 08700 BUILDERS' HARDWARE unless otherwise specified. Hardware concealed behind doors shall be manufacturer's standard zinc, anachrome or chrome plate.

### 2.2.1 Shelf Supports

Shelf supports and rests shall comply with BHMA 156.9.

#### 2.2.1.1 Flush-Applied Supports

Flush-applied, adjustable shelf supports shall be B04071, with 1/2-inch increment adjustment slots and with provision for screw or manufacturer's standard 1/2 inch long narrow crown staple fastening 6 inches on vertical center.

#### 2.2.1.2 Shelf Rests

Shelf rests shall be Type B04081, nickel plated. Rests shall have a minimum projection of 3/4-inch and a minimum width of 9/16-inch. Shelf rests for use in drilled holes shall be B04013, with 1/4-inch diameter pin, 3/8-inch long, overall length 1-1/4 inches.

### 2.2.2 Cabinet Hinges

Cabinet hinges shall be wrought steel or brass, designated size and finish and shall conform to BHMA A156.9, as follows:

#### 2.2.2.1 1 3/8 Inch Thick Teacher's Cabinet Doors

Full Mortise, loose-pin hinges shall be A8133, 3-knuckle, button tip, wrought steel.

#### 2.2.2.2 Flush Overlay 3/4 Inch Thick Doors

Concealed hinges for flush overlay doors shall be B01612, 180 degree opening.

### 2.2.3 Cabinet Catches

#### 2.2.3.1 1 3/8 Inch Thick Teacher's Cabinet Doors

Catch shall be E09101 mortised in top rail of each door leaf.

#### 2.2.3.2 Flush Overlay 3/4 Inch Thick Doors

Cabinet catches shall be B83171, magnetic catches, steel case, minimum 6-pound pull.

### 2.2.4 Pulls

Door and drawer pulls shall be B02011 4-inch centers, with minimum 1 inch finger clearance, screw attached from inside of door or drawer.

#### 2.2.5 Drawer Slides

Drawer slides shall be B85051, ball bearing full extension drawer slides for attachment to each side of drawer. Slides shall have positive stops and levers to allow removal of drawer when depressed. Rubber stops shall be provided at striking points.

##### 2.2.5.1 Standard Drawers

Unless otherwise noted, provide slides rated for 75 lb. loading.

##### 2.2.5.2 File Drawers

Provide 150 lb. rated slides at drawers noted on the drawings as "FILE DRAWER".

#### 2.2.6 Locks

Locks shall conform to BHMA A156.11 and shall be all brass, pin-tumbler type, as follows:

- a. Drawer locks and 3/4-inch cabinet door locks shall be type E07041, surface mounted, 5 or more pin tumblers, 7/8-inch diameter cylinder, 3/8-inch throw dead bolt with brass strike.
- b. Door lock for active leaf of 1 5/8 inch thick Teacher's cabinet shall be E0161.

#### 2.2.7 Flush Slide Bolts

Head and foot flush slide bolts for inactive leaf of 1 3/8 inch Teacher's cabinet door shall be L04201 with mortise strike plate.

### 2.3 PLASTIC LAMINATES

#### 2.3.1 CounterTops, Edges, and Backsplashes

Countertop surface, edge, and backsplash shall be covered with high-pressure plastic laminate, general-purpose type, conforming to NEMA LD 3, Type GP50. Provide BK20 backing sheet at all knee spaces. Color, pattern, and finish of exposed laminate shall be as indicated in Section 09915 COLOR SCHEDULE.

#### 2.3.2 Vertical Surfaces

Plastic laminate surfaces for drawer and counter fronts, exposed-to-view ends, and doors shall be high-pressure plastic laminate, general purpose type, conforming to NEMA LD 3, Type GP38. Color, pattern, and finish shall be as indicated in Section 09915 COLOR SCHEDULE.

### 2.4 FABRICATION

#### 2.4.1 General

Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings. Fit shelves, doors, drawer

fronts and other exposed and semi-exposed edges with veneer matching face finish as scheduled. Use one piece for full length only. Cap exposed plastic laminate finish edges with material of same finish and pattern. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Apply laminate backing sheet to reverse side of plastic wood laminate finished surfaces. If veneer core plywood drawer sides, backs, and subfronts are used, assemble using dovetail or French dovetail construction. Fabricate drawers with bottoms set into sides, back, and front 1/4 inch.

Construction shall be plumb, square, and true; accurately milled and fabricated to details with clean-cut profiles and lines. Accurately size the cabinets, counters, and casework to the indicated dimensions. Surfaces shall be flat, true, free of planer marks or other mars, and smoothly sanded. Select best wood pieces with most uniform grain and color for exposed surfaces. Where possible, conceal fastenings; where not possible, locate fastenings in inconspicuous places. Where nailing is permitted on exterior exposed faces, countersink nailheads. Do not fasten with exposed nails in hardwood. Mortise, tenon, spline, house, joint, block, nail, screw, glue, or bolt together, as approved, in manner to provide rigidity, to avoid swelling or shrinking, and to insure work to remain in place without warping, splitting, and opening of joints.

#### 2.4.2 Laminated Plastic-Covered Casework

Fabricate in accordance with AWI Section 400, reveal overlay style.

##### 2.4.2.1 Materials

Fabricate from the following materials:

- a. Body Members: Thermoset covered particleboard for member normally concealed from view and laminated plastic covered for members normally exposed to view.
- b. Stiles and Rails: Poplar or Alder. Medium density particleboard and fiberboard shall not be used for stiles and rails.
- c. Shelves: Thermoset covered particleboard.
- d. Backs: Thermoset covered tempered hardboard.
- e. Drawer Sides, Backs and Subfronts: Poplar, Alder or 7-ply birch or maple plywood.
- f. Drawer Bottoms: Thermoset decorative overlay covered hardboard.
- g. Drawer Fronts: Medium density particleboard or fiberboard.
- h. Doors: Medium density particleboard or fiberboard.

#### 2.4.3 Plastic Laminate Covered Countertops

Fabricate in accordance with AWI Section 400C. Core for countertops without sinks shall be plywood or medium density fiberboard. Core countertops with sinks shall be shop sanded, exterior grade, veneer core

plywood, water resistant particleboard or water resistant fiberboard. Water resistance shall be tested in conformance with ASTM D 1037 with a thickness swell factor of 5 percent or less and a 24 hour water absorption factor of 10 percent or less. Exposed finish shall be GP-50 high pressure decorative laminate and backing sheet shall be BK-20. Locate counter butt joints minimum 2 feet from sink cut-outs. Mechanically fasten back splash to countertops. Provide grommet at each knee space. Coordinate location with utilities.

\*1

## 2.5 AIR VENTILATION GRILLE

Grille shall be gray plastic to match color of fabric wrapped tackboards and shall fit in an open area of 1 1/2 inches high by 19 3/8 inches wide with a 7/16 inch wide, flange 1/16 inch thick. Grille shall be 9/16 inches deep and shall be screw mounted to millwork. Blades shall be fixed at an angle of approximately 30 degrees from horizontal and shall be supported by 3 vertical stabilizers spaced equally across the width of the grille. The grille shall provide between 13.5 and 14 square inches of ventilation area.

## PART 3 EXECUTION

### 3.1 GENERAL

Casework shall be installed only when temperature and humidity conditions approximate the interior conditions that will exist when the building is occupied. The relative humidity in the building at the time of installation of materials shall be within the limits recommended by AWI. Casework shall be installed level, plumb, and true to line, and shall be attached to the walls or floors with concealed toggle bolts. Countertops, accessories, and hardware shall be installed as indicated. Closure and filler strips and finish moldings shall be provided as required. Make neat, close-fitting cut-outs for indicated sinks, plumbing, and other items projecting through tops. Carefully locate cut-outs for pipes, plumbing fixtures, inserts, appliances, outlet boxes, fixtures and fittings so that edges of holes will be covered by escutcheons. The inner edge of sink cut-outs shall be painted with a coat of semigloss enamel paint; sink flanges shall be set in a bed of sealant. Prior to final acceptance, the Contractor shall align all doors, adjust all hardware, and leave cabinets in a clean and neat condition.

#### 3.1.1 Cleats and Nailers

Furnish and securely install cleats, nailers, strips, blocking, hangers, anchors, moldings, and the like, required to neatly and securely install cabinets, counters, and casework.

#### 3.1.2 Counters

Conceal fastenings where practicable, fit the counter neatly, install in a rigid and substantial manner, and scribe to adjoining surfaces. Provide counter sections in the longest lengths practicable; keep joints in tops to a minimum; and where joints are necessary, provide tight hairline joints drawn up with concealed-type heavy pull-up bolts. Joints shall be a minimum of 2 feet away from any sink. Glue joints with water-resistant glue and, in addition, make rigid and substantial with concealed screws, bolts, or other approved fastenings.

#### 3.1.3 Nailing

Exposed nailing shall be countersunk finishing nails; the countersunk holes shall be filled with a matching wood filler or putty. Staples shall not be permitted in exposed cabinet or casework.

#### 3.1.4 Finishing

Exposed wood surfaces shall be machine sanded at the mill to the specified standard and then shall receive a final sanding at the site to a smooth clean finish, free of machine or tool marks, abrasions, raised grain, or similar imperfections.

##### 3.1.4.1 Finishing Materials

Materials for site finishing of casework scheduled to receive opaque and transparent finishes are specified in Section 09900 PAINTS AND COATINGS.

#### 3.2 APPLICATION OF PLASTIC LAMINATE

Plastic laminate shall be a continuous sheet of the longest length practicable. Joints in the surface sheeting shall be tight and flush, and held to a practical minimum number. Apply with contact type adhesive, type as recommended by the manufacturer of the laminate, applied to both surfaces. The edging and trim shall consist of strips of laminate cut and fitted to all exposed edges with approved contact adhesive. Exposed edges shall be rounded to 1/32-inch radius.

-- End of Section --

**Amdt #0001**

SECTION 09510

ACOUSTICAL CEILINGS

**07/02**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 366/A 366M	(1997e1) Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A 641/A 641M	(1998) Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 633	(1998e1) Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C 423	(2001) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C 635	(2000) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	(1996) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C 834	(2000e1) Latex Sealants
ASTM E 580	(2000) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint
ASTM E 795	(2000) Mounting Test Specimens During Sound Absorption Tests
ASTM E 1264	(1998) Acoustical Ceiling Products
ASTM E 1477	(1998a) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers

U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04

(1998) Seismic Design for Buildings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Approved Detail Drawings;

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

### SD-03 Product Data

Acoustical Ceiling Systems;

Manufacturer's descriptive data, catalog cuts, and installation instructions. Submittals which do not provide adequate data for the product evaluation will be rejected.

### SD-04 Samples

Acoustical Units.

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

### SD-06 Test Reports

Ceiling Attenuation Class and Test;

Reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified sound transmission requirements.

### SD-07 Certificates

Acoustical Units;

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

## 1.3 GENERAL REQUIREMENTS

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

### 1.3.1 Ceiling Sound Absorption

Determine the NRC in accordance with ASTM C 423 Method of Test.

### 1.3.2 Light Reflectance

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

## 1.4 DELIVERY AND STORAGE

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

## 1.5 ENVIRONMENTAL REQUIREMENTS

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

## 1.6 SCHEDULING

Interior finish work using materials with high water content shall be complete and dry before ceiling installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

## 1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided. Standard performance guarantee or warranty shall contain an agreement to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system. Provide manufacturer's 15 year system warranty for Type C1 through C4 units to withstand conditions up to 90 degrees F and 90 percent relative humidity without visible sag when installed in manufacturer's suspension system.

## 1.8 EXTRA MATERIALS

Furnish one full box of spare tiles of each type specified. Tiles shall be from the same lot as those installed.

## PART 2 PRODUCTS

### 2.1 ACOUSTICAL UNITS

Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. Acoustical units shall conform to ASTM E 1264, Class A, and the following requirements:

### 2.1.1 Types C1 and C2 Units for Exposed-Grid System

Type: IV, Form 1 or 2 (non-asbestos mineral fiber with membrane-faced overlay).

Minimum NRC: .80 when tested on mounting Type E-400 of ASTM E 795.

Pattern: C.

Nominal size: 24 by 24 inches.

Edge detail: Square.

Finish: Factory-applied washable white vinyl.

Minimum LR coefficient: LR-1, 0.75 or greater.

Minimum CAC: 25-29.

Flame Spread: Class A, 25 or less

### 2.1.2 Unit Acoustical Absorbers

Absorbers shall be individually mounted sound absorbing plaques composed of glass fibers or non-asbestos mineral fibers and having a NRC range of not less than 0.60 - 0.70 when tested in accordance with ASTM C 423 and reported as a 4 frequency average.

## 2.2 SUSPENSION SYSTEM

### \*1

Suspension system shall be standard exposed-grid, direct hung, standard width flange, and shall conform to ASTM C 635 for intermediate-duty systems. A system shall meet requirements of acoustical panel manufacturer to obtain 15 year panel warranty. Surfaces exposed to view shall be aluminum or steel with a factory-applied white baked-enamel finish. Wall molding shall have a flange of not less than 15/16 inch. Mitered corners shall be provided. Suspended ceiling framing system shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. The suspension system shall have a maximum deflection of 1/360 of span length. Seismic details shall conform to the guidance in TI 809-04 and **Section 3, Light to Moderate Seismic Disturbance, in ASTM E 580.**

### 2.2.1 Wall Closures

Wall closures shall be of same material and finish as suspension system and shall be a standard product of the suspension system manufacturer.

## 2.3 HANGERS

Hangers and attachment shall support a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

### 2.3.1 Wires

Wires shall conform to ASTM A 641/A 641M, Class 1, 0.106 inches in diameter, spaced not more than 4 feet on center on main load carrying suspension members.

### 2.3.2 Straps

Straps shall be 1 by 3/16 inch galvanized steel conforming to ASTM A 653/A 653M, with a light commercial zinc coating or ASTM A 366/A 366M with an electrodeposited zinc coating conforming to ASTM B 633, Type RS.

### 2.3.3 Rods

Rods shall be 3/16 inch diameter threaded steel rods, zinc or cadmium coated.

## 2.4 ACCESS PANELS

Access panels shall match adjacent acoustical units and shall be installed for removal and replacement without damage. Panel shall be not less than 12 by 24 inches or more than 24 by 24 inches.

a. An identification plate of 0.032 inch thick aluminum, 3/4 inch in diameter, stamped with the letters "AP" and finished the same as the unit, shall be attached on the suspension grid near one corner of each access panel.

b. Identify ceiling access panel by a number utilizing white identification plates or plastic buttons with contrasting numerals. The plates or buttons shall be of minimum 1 inch diameter. Provide a typewritten card framed under glass listing the code identification numbers and corresponding system descriptions listed above. Mount the framed card where directed and furnish a duplicate card to the Contracting Officer. Code identification system shall be as follows:

- 1 Heating water valves
- 2 Air conditioning duct system

## 2.5 FINISHES

Acoustical units and suspension system members shall have manufacturer's standard textures, patterns and finishes as specified. Ceiling suspension system components shall be treated to inhibit corrosion.

## 2.6 COLORS AND PATTERNS

Colors and patterns for acoustical units and suspension system components shall be as specified in Section 09915 COLOR SCHEDULE.

## 2.7 ACOUSTICAL SEALANT

Acoustical sealant shall conform to ASTM C 834, nonstaining.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Areas where acoustical units will be cemented shall be free of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Interior finish work such as concrete,

ceramic tile, and bedding, taping and texturing of gypsum wall board shall be completed and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and approved prior to the start of acoustical ceiling installation. Acoustical work shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work. Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a subsuspension system shall be installed, so that all hanger wires will be plumb.

### 3.1.1 Suspension System

Suspension system shall be installed in accordance with ASTM C 636 and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking.

#### 3.1.1.1 Plumb Hangers

Hangers shall be plumb and shall not press against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, hangers shall be provided at a minimum of four hangers per fixture and located not more than 6 inches from each corner of each fixture. See Section 16415a ELECTRICAL WORK for additional lighting installation requirements.

#### 3.1.1.2 Splayed Hangers

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

\*1

#### 3.1.1.3 Seismic Restraints

**Do not pin end of main and cross runners to the closure angle in accordance with ASTM E 580 3.2.5.**

### 3.1.2 Wall Molding and Closures

Wall molding shall be provided where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Wall molding shall be secured not more than 3 inches from ends of each length and not more than 16 inches on centers between end fastenings. Wall closures shall be provided at each window to close the gap between the window head and the ceiling. Wall closures shall be attached to the wall in accordance with the manufacturer's written instructions.

### 3.1.3 Acoustical Units

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held

in place with manufacturer's standard hold-down clips when within 10 feet horizontally of an exterior door.

#### 3.1.4 Caulking

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings. See Section 07900a JOINT SEALING.

#### 3.2 CEILING ACCESS PANELS

Ceiling access panels shall be located directly under the items which require access.

#### 3.3 CLEANING

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

#### 3.4 RECLAMATION PROCEDURES

Ceiling tile, designated for recycling by the Contracting Officer, shall be neatly stacked on 4 by 4 foot pallets not higher than 4 foot. Panels shall be completely dry. Pallets shall then be shrink wrapped and symmetrically stacked on top of each other without falling over. Disposal shall be in accordance with Section 01572 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

-- End of Section --

**Amdt #0001**

SECTION 10800

TOILET ACCESSORIES  
07/02

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Finishes.  
Accessory Items; G, RE

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, operation instructions, and cleaning instructions.

SD-04 Samples

Finishes.  
Accessory Items.

One sample of each accessory proposed for use. Approved samples may be incorporated into the finished work, provided they are identified and their locations noted.

SD-07 Certificates

Accessory Items

Submit for each type of accessory specified, attesting that the items meet the specified requirements.

1.2 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area protected from construction damage and vandalism.

1.3 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated in accordance with paragraph SCHEDULE. Each accessory item shall be complete with the necessary mounting plates and shall be of sturdy construction with corrosion resistant surface.

#### 2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall have oval heads, be of tamperproof design, and shall be finished to match the accessory.

#### 2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

<u>Metal</u>	<u>Finish</u>
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

#### 2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

##### 2.2.1 Grab Bar (GB)

Grab bar shall be 18 gauge, 1-1/4 inches OD Type 304 stainless steel. Grab bar GB1 shall be 36 inches long with both ends returning to the wall. Grab bar GB2 shall be 42 inches long with both ends returning to the wall. Concealed mounting flange shall have mounting holes concealed. Grab bar shall have satin finish. Installed bars shall be capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation. Space between wall and grab bar shall be 1-1/2 inch.

##### 2.2.2 Paper Towel Dispenser (PTD)

Paper towel dispenser shall be designed for C-fold and multi-fold paper towels with the dispenser slot on the bottom and shall be constructed of not less than 0.269 inch Type 304 stainless steel, and shall be surface mounted. Towel dispensers above sinks in classrooms shall be approximately 11 inches wide, 4 inches deep and 8 inches tall and shall be designed to hold approximately 200 C-fold towels and 350 multi-fold towels. Towel dispensers in all other spaces shall be approximately 11 inches wide, 4 inches deep and 15 1/4 inches tall and shall be designed to hold approximately 400 C-fold towels and 525 multi-fold towels. Locking mechanism shall be tumbler key lock.

##### 2.2.3 Towel Pin (TP)

Towel pin shall have concealed wall fastenings, and a pin integral with or permanently fastened to wall flange. Maximum projection shall be 4 inches.

Design shall be consistent with design of other accessory items. Finish shall be satin.

#### 2.2.4 Toilet Tissue Dispenser, Jumbo (TTDJ)

Toilet tissue dispenser shall be surface mounted with 2 rolls of jumbo tissue. Cabinet shall be fabricated of high-impact plastic body and transparent plastic front cover. Cover shall have key lock.

\*1

#### 2.2.5 Electric Hand Dryer

Electric hand dryer shall have a series commutated, through-flow discharge, vacuum type powered 5/8 HP, 120 volt, 12.5 amp, 60 Hz, 20,000 RPM motor, and shall provide constant air velocities of 16,000 LFM at the outlet, and 14,000 LFM at the average hand position of 4 inches below outlet. It shall have an automatic resetting thermostat that will open when the air flow is restricted and close when air flow is resumed. It shall have a 900 watt air heater capable of heating the air stream up to 135 degrees. Infrared sensor automatically turns dryer on when hands are held under air outlet. Removal of hands causes dryer to stop within 2 seconds, and the electronic sensor shuts off dryer after 35 seconds if hands are not removed or an inanimate object is placed across the air outlet. Dryer shall be 11 3/4 inches wide by 12 11/16 inches high by 6 11/16 inches deep, and shall have a one piece, heavy duty, rust resistant, rib-reinforced, die-cast zinc alloy cover mounted to a wall plate with tamperproof bolts. Mount dryers at 31" AFF to highest operable part. Cover shall be finished with an electrostatically applied, chip resistant, white paint.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Surfaces of fastening devices exposed after installation shall have the same finish as the attached accessory. Exposed screw heads shall be oval. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

##### 3.1.1 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Accessories without backplates shall have concealed fasteners. Unless indicated or specified, install accessories with sheet metal screws, resin filled screen anchors equal to Hilti HIT G20, or other approved fasteners as required by the construction. Toggle bolts shall not be used in hollow masonry. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required by the construction. Fasten accessories mounted on gypsum board walls without solid backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.

#### 3.2 CLEANING

Material shall be cleaned in accordance with manufacturer's

recommendations. Alkaline or abrasive agents shall not be used.  
 Precautions shall be taken to avoid scratching or marring of surfaces.

3.3 SCHEDULE

3.3.1 Kingsolver, Mudge, and Pierce Elementary Schools

Accessories Required

Room or Space	GB1	GB2	TP	TTDJ	PTD
Classrooms 102 and 103					1
Classroom 104					2
Toilets 105, 106, 107, & 108	1	1	1	1	

-- End of Section --

**Amdt #0001**

SECTION 13080

SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT  
09/03

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM A 36/A 36M	(2001) Carbon Structural Steel
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 153/A 153M	(2001a) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 307	(2002) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 500	(2001a) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 563	(2000) Carbon and Alloy Steel Nuts
ASTM A 572/A 572M	(2001) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 603	(1998) Zinc-Coated Steel Structural Wire Rope
ASTM A 653/A 653M	(2002a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASME INTERNATIONAL (ASME)

ASME B18.2.1	(1996) Square and Hex Bolts and Screws, Inch Series
ASME B18.2.2	(1987; R 1999) Square and Hex Nuts

INTERNATIONAL CODE COUNCIL (ICC)

IBC Section 1621	(2000) International Building Code Architectural, Mechanical and Electrical Component Seismic Design Requirements
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KENTUCKY OFFICE OF HOUSING, BUILDINGS AND CONSTRUCTION (KOHBC)

Kentucky Building Code (2003) Chapter 16, Structural Loads

## 1.2 SYSTEM DESCRIPTION

### 1.2.1 General Requirements

**\*1**

The requirements for seismic protection measures described in this section shall be applied to the mechanical equipment and systems outlined in Section 15070A SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT, the electrical equipment and systems outlined in Section 16415A ELECTRICAL WORK INTERIOR, and the miscellaneous equipment and systems listed below. Seismic protection requirements shall be in accordance with IBC Section 1621 and as modified by Chapter 16 of the 2003 Kentucky Building Code (Kentucky Office of Housing, Building and Construction) and additional data furnished by the Contracting Officer, and shall be provided in addition to any other requirements called for in other sections of these specifications. The design for seismic protection shall be based on a Seismic Use Group I building occupancy and on site response coefficients for  $S_{MS} = 0.36$  and  $S_{M1} = 0.23$ . Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads.

### 1.2.2 Miscellaneous Equipment and Systems

The bracing for the following miscellaneous equipment and systems shall be developed by the Contractor in accordance with the requirements of this specification:

**\*1**

- Storage cabinets
- Shelving
- Partitions
- Ceilings
- TV Brackets
- Light Fixtures

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

**\*1**

SD-02 Shop Drawings

- Bracing; G, AO
- Equipment Requirements; G, AO

**\*1**

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-03 Product Data

- Bracing; G, AO

Equipment Requirements; G, AO

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

1.4 EQUIPMENT REQUIREMENTS

1.4.1 Rigidly Mounted Equipment

\*1

The following specific items of equipment: water heaters **and** light fixtures to be furnished under this contract shall be constructed and assembled to withstand the seismic forces specified in IBC Section 1621.

PART 2 PRODUCTS

2.1 BOLTS AND NUTS

Squarehead and hexhead bolts, and heavy hexagon nuts, ASME B18.2.1, ASME B18.2.2, or ASTM A 307 for bolts and ASTM A 563 for nuts. Bolts and nuts used underground and/or exposed to weather shall be galvanized in accordance with ASTM A 153/A 153M.

2.2 SWAY BRACING

Material used for members listed in this section and on the drawings, shall be structural steel conforming with the following:

- a. Plates, rods, and rolled shapes, ASTM A 36/A 36M or ASTM A 572/A 572M, Grade 503.
- b. Wire rope, ASTM A 603.
- c. Tubes, ASTM A 500, Grade B.
- d. Pipes, ASTM A 53/A 53M, Type E or S, Grade B.
- e. Light gauge angles, less than 1/4 inch thickness, ASTM A 653/A 653M.

PART 3 EXECUTION

3.1 BRACING

Bracing shall conform to the arrangements shown or required. Trapeze-type hanger shall be secured with not less than two 1/2 inch bolts.

\*1

3.2 NOT USED

\*1

3.3 NOT USED

\*1

3.3.1 NOT USED

\*1

3.3.2 NOT USED

\*1  
3.3.2.1 NOT USED

\*1  
3.3.2.2 NOT USED

\*1  
3.3.2.3 NOT USED

\*1  
3.4 NOT USED

\*1  
3.4.1 NOT USED

\*1  
3.4.2 NOT USED

\*1  
3.5 NOT USED

\*1  
3.5.1 NOT USED

\*1  
3.5.2 NOT USED

\*1  
3.5.3 NOT USED

\*1  
3.5.4 NOT USED

3.6 EQUIPMENT SWAY BRACING

3.6.1 Suspended Equipment and Light Fixtures

\*1  
Equipment sway bracing shall be provided for items supported from overhead roof structural systems, including light fixtures, **water heaters**, and TV brackets. Braces shall consist of angles, rods, wire rope, bars, or pipes arranged as shown and secured at both ends with not less than 1/2 inch bolts. Sufficient braces shall be provided for equipment to resist a horizontal force as specified in IBC Section 1621 without exceeding safe working stress of bracing components. The Contractor shall provide, for approval, specific force calculations in accordance with IBC Section 1621 for the equipment in the project. Details of equipment bracing shall be submitted for acceptance. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

\*1  
3.6.2 NOT USED

\*1  
3.6.2.1 NOT USED

**\*1**

3.6.2.2 **NOT USED**

-- End of Section --

**Amdt #0001**

SECTION 15070A

SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT

**01/02**

PART 1 GENERAL

1.1 REFERENCES

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

INTERNATIONAL CODE COUNCIL (ICC)

IBC Section 1621 (2000) International Building Code  
Architectural, Mechanical and Electrical  
Component Seismic Design Requirements

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

The requirements for seismic protection measures described in this section shall be applied to the mechanical equipment and systems listed below. Structural requirements shall be in accordance with Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

1.2.2 Mechanical Equipment

Mechanical equipment to be seismically protected shall include the following items to the extent required on the drawings or in other sections of these specifications:

**\*1**

Water Heaters

**\*1**

1.2.3 **NOT USED**

1.2.4 Contractor Designed Bracing

The Contractor shall design the bracing in accordance with IBC Section 1621 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads. Loadings determined using IBC Section 1621 are based on strength design; therefore, AISC 325 Specifications shall be used for the design. The bracing for all mechanical equipment and systems as specified above shall be developed by the Contractor.

**\*1**

1.2.5 **NOT USED**

**\*1**

1.2.5.1 **NOT USED**

\*1  
1.3 NOT USED

\*1  
1.3.1 NOT USED

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

\*1  
Contractor Designed Bracing; G, AO.

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-03 Product Data

\*1  
Contractor Designed Bracing; G, AO.

Copies of the design calculations with the drawings. Calculations shall be approved, certified, stamped and signed by a registered Professional Engineer. Calculations shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

\*1  
SD-07 Certificates; NOT USED

PART 2 PRODUCTS

\*1  
2.1 NOT USED

\*1  
2.2 NOT USED

\*1  
2.3 NOT USED

\*1  
2.4 NOT USED

2.5 SWAY BRACING MATERIALS

Sway bracing materials (e.g. rods, plates, rope, angles, etc.) shall be as specified in Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

PART 3 EXECUTION

\*1  
3.1 NOT USED

\*1  
3.2 NOT USED

\*1  
3.3 NOT USED

\*1  
3.3.1 NOT USED

\*1  
3.4 NOT USED

\*1  
3.5 NOT USED

\*1  
3.6 SWAY BRACES FOR **WATER HEATERS**

Sway braces shall be provided to prevent movement of the **water heaters** under seismic loading. Braces shall be provided in both the longitudinal and transverse directions, relative to the axis of the **water heater**. The bracing shall not interfere with thermal expansion requirements for the pipes **attached to the water heater** as described in other sections of these specifications.

\*1  
3.6.1 NOT USED

\*1  
3.6.2 NOT USED

\*1  
3.6.3 NOT USED

\*1  
3.6.4 NOT USED

\*1  
3.7 NOT USED

\*1  
3.7.1 NOT USED

\*1  
3.7.2 NOT USED

-- End of Section --

**Amdt #0001**

SECTION 15400A

PLUMBING, GENERAL PURPOSE  
09/03

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.10.3	(2001) Gas Water Heaters Vol.III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous
ANSI Z21.22	(1999; A 2001) Relief Valves for Hot Water Supply Systems
ANSI Z21.56	(2001) Gas-Fired Pool Heaters
ANSI Z124.3	(1995) Plastic Lavatories
ANSI Z124.5	(1997) Plastic Toilet (Water Closet) Seats

ASTM INTERNATIONAL (ASTM)

ASTM A 105/A 105M	(2002) Carbon Steel Forgings for Piping Applications
ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(2001b) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 515/A 515M	(2001) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516/A 516M	(2001) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 53/A 53M	(2002) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings
ASTM A 74	(1998) Cast Iron Soil Pipe and Fittings

ASTM A 888	(1998e1) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B 152/B 152M	(2000) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 306	(2002) Copper Drainage Tube (DWV)
ASTM B 32	(2000e1) Solder Metal
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM B 42	(2002) Seamless Copper Pipe, Standard Sizes
ASTM B 43	(1998) Seamless Red Brass Pipe, Standard Sizes
ASTM B 584	(2000) Copper Alloy Sand Castings for General Applications
ASTM B 75	(2002) Seamless Copper Tube
ASTM B 813	(2000e1) Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B 88	(2002) Seamless Copper Water Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM C 564	(1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 920	(2002) Elastomeric Joint Sealants
ASTM D 2000	(2001) Rubber Products in Automotive Applications
ASTM D 2235	(2001) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2564	(2002) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2661	(2002) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2665	(2002a) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2822	(1991; R 1997e1) Asphalt Roof Cement
ASTM D 2855	(1996; R 2002) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

ASTM D 3122	(1995; R 2002) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings
ASTM D 3138	(2002) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3308	(2001) PTFE Resin Skived Tape
ASTM D 3311	(1994) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM E 1	(2001) ASTM Thermometers
ASTM F 1760	(2001) Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F 409	(2002) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 477	(2002e1) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 493	(1997) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 628	(2001) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core
ASTM F 891	(2000e1) Coextruded Poly (Vinyl chloride) (PVC) Plastic Pipe with a Cellular Core

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

ASHRAE 90.1	(2001; various Errata) Energy Standard for Buildings Except Low-Rise Residential Buildings
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AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	(2001) Water Pressure Reducing Valves
ASSE 1005	(1999) Water Heater Drain Valves
ASSE 1010	(1996) Water Hammer Arresters

ASSE 1012 (2002) Backflow Preventers with Intermediate Atmospheric Vent

ASSE 1013 (1999) Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers

ASSE 1018 (2001) Trap Seal Primer Valves, Water Supply Fed

ASSE 1037 (1990) Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300 (1999) Hypochlorites

AWWA B301 (1999) Liquid Chlorine

AWWA C203 (2002; A C203a-99) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

AWWA C606 (1997) Grooved and Shouldered Joints

AWWA C651 (1999) Disinfecting Water Mains

AWWA C652 (2002) Disinfection of Water-Storage Facilities

AWWA C700 (2002) Cold-Water Meters - Displacement Type, Bronze Main Case

AWWA C701 (2002) Cold-Water Meters - Turbine Type, for Customer Service

AWWA EWW (1998) Standard Methods for the Examination of Water and Wastewater

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8 (1992) Filler Metals for Brazing and Braze Welding

AWS B2.2 (1991) Brazing Procedure and Performance Qualification

ASME INTERNATIONAL (ASME)

ASME A112.1.2 (1991; R 2002) Air Gaps in Plumbing Systems

ASME A112.14.1 (1975; R 1998) Backwater Valves

ASME A112.19.2M (1998) Vitreous China Plumbing Fixtures

ASME A112.36.2M (1991; R 2002) Cleanouts

ASME A112.6.1M (1997; R 2002) Floor Affixed Supports for

Off-the-Floor Plumbing Fixtures for Public  
Use

ASME A112.6.3	(2000) Floor and Trench Drains
ASME B1.20.1	(1983; R 2001) Pipe Threads, General Purpose, Inch
ASME B16.12	(1998) Cast Iron Threaded Drainage Fittings
ASME B16.15	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(2002) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2002) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2002) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2002) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 400, 600, 900, 1500, and 2500
ASME B16.29	(2002) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(1998) Malleable Iron Threaded Fittings
ASME B16.34	(1996) Valves Flanged, Threaded, and Welding End
ASME B16.4	(1998) Gray Iron Threaded Fittings
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings
ASME B31.1	(2001) Power Piping
ASME B31.5	(2001) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2000) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME CSD-1	(2002) Control and Safety Devices for Automatically Fired Boilers

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2000) Hubless Cast Iron Soil Pipe and
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Fittings for Sanitary and Storm Drain,  
Waste, and Vent Piping Applications

CISPI 310 (1997) Coupling for Use in Connection with  
Hubless Cast Iron Soil Pipe and Fittings  
for Sanitary and Storm Drain, Waste, and  
Vent Piping Applications

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015 (1994; R 1995) Copper Tube Handbook

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH  
(FCCCHR)

FCCCHR Manual (9th Edition) Manual of Cross-Connection  
Control

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 (2003) Accessible and Usable Buildings and  
Facilities

ICC IPC (2000) International Plumbing Code

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

MSS SP-110 (1996) Ball Valves Threaded,  
Socket-Welding, Solder Joint, Grooved and  
Flared Ends

MSS SP-25 (1998) Standard Marking System for Valves,  
Fittings, Flanges and Unions

MSS SP-58 (1993) Pipe Hangers and Supports -  
Materials, Design and Manufacture

MSS SP-67 (2002) Butterfly Valves

MSS SP-69 (2002) Pipe Hangers and Supports -  
Selection and Application

MSS SP-70 (1998) Cast Iron Gate Valves, Flanged and  
Threaded Ends

MSS SP-71 (1997) Gray Iron Swing Check Valves,  
Flanged and Threaded Ends

MSS SP-72 (1999) Ball Valves with Flanged or  
Butt-Welding Ends for General Service

MSS SP-73 (1991; R 1996) Brazing Joints for Copper  
and Copper Alloy Pressure Fittings

MSS SP-78 (1998) Cast Iron Plug Valves, Flanged and  
Threaded Ends

MSS SP-80 (1997) Bronze Gate, Globe, Angle and Check

Valves

MSS SP-85 (1994) Cast Iron Globe & Angle Valves,  
Flanged and Threaded Ends

NACE INTERNATIONAL (NACE)

NACE RP0169 (2002) Control of External Corrosion on  
Underground or Submerged Metallic Piping  
Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (2002) Installation of Air Conditioning  
and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF 14 (2003) Plastics Piping Components and  
Related Materials

NSF 61 (2002e) Drinking Water System Components -  
Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA-01 (1998) Plastic Pipe in Fire Resistive  
Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201 (1992) Water Hammer Arresters

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508 (1997) Hose Clamp Specifications

UNDERWRITERS LABORATORIES (UL)

UL 174 (1996; Rev thru Oct 1999) Household  
Electric Storage Tank Water Heaters

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

PL 93-523 (1974; A 1999) Safe Drinking Water Act

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

10 CFR 430 Energy Conservation Program for Consumer  
Products

40 CFR 50.12 National Primary and Secondary Ambient Air  
Quality Standards for Lead

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;  
submittals not having a "G" designation are for information only or as  
otherwise designated. When used, a designation following the "G"

designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System; G, AO

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operations of each system. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

Electrical Work; G, AO

Complete electrical schematic lineless or full line interconnection and connection diagram for each piece of mechanical equipment having more than one automatic or manual electrical control device.

SD-03 Product Data

Welding

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

Plumbing Fixture Schedule

Catalog cuts of specified plumbing fixtures system and system location where installed.

Vibration-Absorbing Features; G, AO

Details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications.

Plumbing System

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

SD-06 Test Reports

Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate

the final position of controls.

Test of Backflow Prevention Assemblies; G, AO.

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests.

#### SD-07 Certificates

##### Materials and Equipment

Where materials or equipment are specified to comply with requirements of AGA, ASME, or NSF proof of such compliance shall be included. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

##### Bolts

Written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

#### SD-10 Operation and Maintenance Data

##### Plumbing System; G, AO.

Six copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

### 1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening.

### 1.4 ELECTRICAL WORK

Motors, motor controllers and motor efficiencies shall conform to the requirements of Section 16415A ELECTRICAL WORK, INTERIOR. Electrical motor-driven equipment specified herein shall be provided complete with motors. Equipment shall be rated at 60 Hz, single phase, ac unless otherwise indicated. Where a motor controller is not provided in a motor-control center on the electrical drawings, a motor controller shall be as indicated. Motor controllers shall be provided complete with properly sized thermal-overload protection in each ungrounded conductor, auxiliary contact, and other equipment, at the specified capacity, and including an allowable service factor.

## 1.5 PERFORMANCE REQUIREMENTS

### 1.5.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record. Structural members shall be welded in accordance with Section 05090A WELDING, STRUCTURAL.

### 1.5.2 Cathodic Protection and Pipe Joint Bonding

Cathodic protection and pipe joint bonding systems shall be in accordance with Section 13110A CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

## 1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC.

## 1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

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#### 1.7.1 Excavation Requirements

**Before excavating, reference Section 01110N SUMMARY OF WORK for excavation procedures and requirements.**

## PART 2 PRODUCTS

### 2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal

"NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF 61, Section 8.

End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF 61, Section 9. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

#### 2.1.1 Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used under ground. Joints and gasket materials shall conform to the following:

- a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A 74, AWWA C606. For hubless type: CISPI 310
- b. Coupling for Steel Pipe: AWWA C606.
- c. Couplings for Grooved Pipe: Ductile Iron ASTM A 536 (Grade 65-45-12). Malleable Iron ASTM A 47/A 47M, Grade 32510. Copper ASTM A 536.
- d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
- f. Brazing Material: Brazing material shall conform to AWS A5.8, BCuP-5.
- g. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.
- h. Solder Material: Solder metal shall conform to ASTM B 32.
- i. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.
- j. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe, ASTM D 3308.
- k. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C 564.
- l. Rubber Gaskets for Grooved Pipe: ASTM D 2000, maximum temperature 230 degrees F.

- m. Flexible Elastomeric Seals: ASTM D 3139, ASTM D 3212 or ASTM F 477.
- n. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A 183.
- o. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D 3138.
- p. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D 2235.
- q. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.
- r. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F 493.
- s. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193/A 193M.
- t. Plastic Solvent Cement for Styrene Rubber Plastic Pipe: ASTM D 3122.

#### 2.1.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

- a. Water Hammer Arrester: PDI WH 201.
- b. Copper, Sheet and Strip for Building Construction: ASTM B 370.
- c. Asphalt Roof Cement: ASTM D 2822.
- d. Hose Clamps: SAE J1508.
- e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.
- f. Metallic Cleanouts: ASME A112.36.2M.
- g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.
- h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines:  
AWWA C203.
- i. Hypochlorites: AWWA B300.
- j. Liquid Chlorine: AWWA B301.
- k. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.

1. Thermometers: ASTM E 1. Mercury shall not be used in thermometers.

### 2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS.

## 2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

## 2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves	ANSI Z21.22

Description	Standard
for Hot Water Supply Systems	
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1  Safety Code No., Part CW, Article 5

#### 2.3.1 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

#### 2.3.2 Wall Hydrants

Wall hydrants with vacuum-breaker backflow preventer shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through the wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 3/4 inch exposed hose thread on spout and 3/4 inch male pipe thread on inlet.

#### 2.3.3 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

#### 2.3.4 Thermostatic Mixing Valves

Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 5 degrees F of any setting.

#### 2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with ICC IPC. Fixtures for use by the physically handicapped shall be in accordance with ICC A117.1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings.

Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature. Plumbing fixtures shall be as indicated in paragraph PLUMBING FIXTURE SCHEDULE.

#### 2.4.1 Lavatories

Vitreous china lavatories shall be provided with two integral molded lugs on the back-underside of the fixture and drilled for bolting to the wall in a manner similar to the hanger plate.

#### 2.4.2 Automatic Flushing System

Required for lavatories and water closets in toilet rooms.

Flushing system shall consist of solenoid-activated flush valve with light beam sensor. Flush valve for water closet shall include an override pushbutton. Flushing devices shall be provided as described in paragraph FIXTURES AND FIXTURE TRIMMINGS.

#### 2.5 BACKFLOW PREVENTERS

Backflow preventers shall be approved and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced pressure principle assemblies, and atmospheric (nonpressure) type vacuum breakers, shall be tested, approved, and listed in accordance with FCCCHR Manual. Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Air gaps in plumbing systems shall conform to ASME A112.1.2.

#### 2.6 DRAINS

##### 2.6.1 Floor and Shower Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage

pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. Between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3.

## 2.7 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409 or copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

## 2.8 WATER HEATERS

Water heater types and capacities shall be as indicated. Each water heater shall have replaceable anodes. Each primary water heater shall have controls with an adjustable range that includes 90 to 160 degrees F. Each gas-fired water heater and booster water heater shall have controls with an adjustable range that includes 120 to 180 degrees F. Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and standby heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 500 gallons storage capacity need not meet the standard loss requirement if the tank surface area is insulated to R-12.5 and if a standing light is not used. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases. A factory pre-charged expansion tank shall be installed on the cold water supply to each water heater. Expansion tanks shall be specifically designed for use on potable water systems and shall be rated for 200 degrees F water temperature and 150 psi working pressure. The expansion tank size and acceptance volume shall be as indicated.

### 2.8.1 Automatic Storage Type

Heaters shall be complete with control system, and shall have ASME rated combination pressure and temperature relief valve.

#### 2.8.1.1 Electric Type

Electric type water heaters shall conform to UL 174 with dual heating elements. Each element shall be 4.5 KW. The elements shall be wired so that only one element can operate at a time.

## 2.9 DOMESTIC WATER SERVICE METER

Cold water meters 2 inches and smaller shall be positive displacement type conforming to AWWA C700. Cold water meters 2-1/2 inches and larger shall be turbine type conforming to AWWA C701. Meter register may be round or straight reading type.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Plastic pipe shall not be installed in air plenums. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA-01. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A full port ball valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

#### 3.1.1 Water Pipe, Fittings, and Connections

##### 3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

##### 3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

##### 3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

#### 3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

#### 3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 3/4 inch hose bibb with renewable seat and full port ball valve ahead of hose bibb. At other low points, 3/4 inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

#### 3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

#### 3.1.1.7 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 4 inches in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

#### 3.1.1.8 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to ASSE 1010. Vertical capped pipe columns will not be permitted.

#### 3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

##### 3.1.2.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

##### 3.1.2.2 Mechanical Couplings

Grooved mechanical joints shall be prepared according to the coupling manufacturer's instructions. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, or narrow-land micrometer. Groove width and dimension of groove from end of the pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

##### 3.1.2.3 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

##### 3.1.2.4 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

#### 3.1.2.5 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

#### 3.1.2.6 Copper Tube and Pipe

- a. Brazed. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.
- b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.
- c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC IPC.

#### 3.1.2.7 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

#### 3.1.2.8 Other Joint Methods

#### 3.1.3 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric

waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

#### 3.1.4 Corrosion Protection for Buried Pipe and Fittings

Ductile iron, cast iron, and steel pipe, fittings, and joints shall have a protective coating. Additionally, ductile iron, cast iron, and steel pressure pipe shall have a cathodic protection system and joint bonding. The cathodic protection system, protective coating system, and joint bonding for cathodically protected pipe shall be in accordance with Section 13110A CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE). Coatings shall be selected, applied, and inspected in accordance with NACE RP0169 and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

#### 3.1.5 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

##### 3.1.5.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for supply, drainage, waste and vent pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C 920 and with a primer, backstop material and surface preparation as specified in Section 07900A JOINT SEALING. The annular space between pipe and

sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and masonry wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07840 FIRESTOPPING.

#### 3.1.5.2 Flashing Requirements

Pipes passing through roof shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

#### 3.1.5.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

#### 3.1.5.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

- a. A standard roof coupling for threaded pipe up to 6 inches in diameter.
- b. A tack-welded or banded-metal rain shield around the pipe.

#### 3.1.5.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07900A JOINT SEALING.

#### 3.1.6 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07840 FIRESTOPPING.

#### 3.1.7 Supports

##### 3.1.7.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

##### 3.1.7.2 Pipe Supports and Structural Bracing, Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as specified in Section 15070A SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT. Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided. Material used for supports shall be as specified in Section 05120 STRUCTURAL STEEL.

##### 3.1.7.3 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Type 39 saddles shall be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.
- h. Type 40 shields shall:
  - (1) Be used on insulated pipe less than 4 inches.
  - (2) Be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or less.
  - (3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 8 pcf or greater.
- i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 120 degrees F for PVC and 180 degrees F for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.
- j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 15 feet nor more than 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.
- k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:
  - (1) On pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.
  - (2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
  - (3) On pipe 4 inches and larger carrying medium less than 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

1. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.
- m. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.
- n. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

#### 3.1.7.4 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

#### 3.1.8 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

#### 3.1.9 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass

or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron.

### 3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

#### 3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 6 inches above the top of the tank or water heater.

#### 3.2.2 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

#### 3.2.3 Expansion Tank

A pre-charged expansion tank shall be installed on the cold water supply between the water heater inlet and the cold water supply shut-off valve. The Contractor shall adjust the expansion tank air pressure, as recommended by the tank manufacturer, to match incoming water pressure.

### 3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

#### 3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be

permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

### 3.3.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed 39 inches above the floor, except at water closets intended for use by the physically handicapped where flushometer valves shall be mounted at approximately 30 inches above the floor and arranged to avoid interference with grab bars. In addition, for water closets intended for handicap use, the flush valve handle shall be installed on the wide side of the enclosure.

### 3.3.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 31 inches above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 42 inches above floor. Wall-hung service sinks shall be mounted with rim 28 inches above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with ICC A117.1.

### 3.3.4 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

#### 3.3.4.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

#### 3.3.4.2 Support for Concrete-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the concrete wall using through bolts and a back-up plate.

#### 3.3.4.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

### 3.3.5 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect

or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with ICC IPC at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

### 3.3.6 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced, but the minimum size shall be 16"x12". Access panels shall be as specified in Section 05500A MISCELLANEOUS METAL.

### 3.3.7 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 2 inches above the flood rim of the funnel to provide an acceptable air gap.

### 3.3.8 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311. Traps for acid-resisting waste shall be of the same material as the pipe.

## 3.4 VIBRATION-ABSORBING FEATURES

Mechanical equipment, including compressors and pumps, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors. Isolation unit installation shall limit vibration to 30 percent of the lowest equipment rpm.

## 3.5 IDENTIFICATION SYSTEMS

### 3.5.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded

chain, or plastic straps designed for that purpose.

### 3.5.2 Pipe Color Code Marking

Color code marking of piping shall be as specified in Section 09900 PAINTS AND COATINGS.

### 3.6 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

### 3.7 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09900 PAINTS AND COATINGS.

### 3.8 TESTS, FLUSHING AND DISINFECTION

#### 3.8.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with ICC IPC, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure to the Contracting Officer for approval.

- a. Drainage and Vent Systems Test. The final test shall include a smoke test.
- b. Building Sewers Tests.
- c. Water Supply Systems Tests.

##### 3.8.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies. Gauges shall be tested annually for accuracy in accordance with the University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14). Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of

## Gauges

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

### 3.8.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

### 3.8.3 System Flushing

#### 3.8.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration.

#### 3.8.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 50.12 Part 141.80(c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

### 3.8.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

- a. Time, date, and duration of test.

- b. Water pressures at the most remote and the highest fixtures.
- c. Operation of each fixture and fixture trim.
- d. Operation of each valve, hydrant, and faucet.
- e. Pump suction and discharge pressures.
- f. Temperature of each domestic hot-water supply.
- g. Operation of each floor and roof drain by flooding with water.
- h. Operation of each vacuum breaker and backflow preventer.
- i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.
- j. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2 hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

#### 3.8.5 Disinfection

After operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. System shall be flushed as specified, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Except as herein specified, water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being disinfected shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6 hour period, no less than 50 ppm chlorine residual shall remain in the tank. If after the 24 hour and 6 hour holding periods, the residual solution contains less than 25 ppm and 50 ppm chlorine respectively, flush the piping and tank with potable water, and repeat the above procedures until the required residual chlorine levels are satisfied.

The system including the tanks shall then be flushed with clean water until the residual chlorine level is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. Samples of water in disinfected containers shall be obtained from several locations selected by the Contracting Officer. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA EWW. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. Disinfection shall be repeated until tests indicate the absence of coliform organisms

(zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

### 3.9 PLUMBING FIXTURE SCHEDULE

#### WATER CLOSET 'WC'

Siphon-jet, elongated bowl, top supply spud, ASME A112.19.2M, floor mounted. Floor flange shall be copper alloy, cast iron, or plastic.

Gasket shall be wax type.

Seat - ANSI Z124.5, Type A, black plastic, elongated, open front.

Flushometer Valve - ASSE 1037, large diaphragm type with non-hold-open feature, backcheck angle control stop, and vacuum breaker. Minimum upper chamber inside diameter of not less than 2-5/8 inches at the point where the diaphragm is sealed between the upper and lower chambers. The maximum water use shall be 1.6 gallons per flush. Automatic flush valves shall be as indicated in paragraph Automatic Flushing System.

#### LAVATORY "L"

Manufacturer's standard sink depth, vitreous china ASME A112.19.2M, ledge back rectangular.

Faucet - Faucets shall meet the requirements of NSF 61, Section 9. Faucets shall be single center set type. Faucets shall have metal replaceable cartridge control unit or metal cartridge units with diaphragm which can be replaced without special tools. Valves and handles shall be copper alloy. Connection between valve and spout for center-set faucet shall be of rigid metal tubing. Flow shall be limited to 0.25 gallon per cycle at a flowing water pressure of 80 psi if a metering device or fitting is used that limits the period of water discharge such as a foot switch or fixture occupancy sensor. If a metering device is not used, the flow shall be limited to 2.5 gpm at a flowing pressure of 80 psi.

The supply faucet shall be equipped with electronic eye motion detector for automatic actuation of faucet. Provide with thermostatic mixing valve below lav, with 24V control transformer for single lav. All control components shall be recessed in the wall.

Drain - Strainer shall be copper alloy or stainless steel. See paragraph FIXTURES for optional plastic accessories.

#### CLASSROOM SINK "SA"

countertop 21 inches wide x 16 inches deep acid-resistant plastic ANSI Z124.3. Thickness of sinks shall be manufacturer's standard. Drain shall be stainless steel.

Faucet and Spout - Cast or wrought copper alloy, without top or bottom brace, with backflow preventer. Faucets shall have replaceable seat and the washer shall rotate onto the seat. Strainers shall have internal threads.

Handles - Cast copper alloy, wrought copper alloy, or stainless steel, single lever type.

#### BUBBLER

Cast or wrought copper alloy, lever type, no lead chrome with polyester elastomer mouth guard.

#### 3.10 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

#### 3.11 PERFORMANCE OF WATER HEATING EQUIPMENT

Standard rating condition terms are as follows:

EF = Energy factor, overall efficiency.

ET = Thermal efficiency with 70 degrees F delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).

SL = Standby loss in W/sq. ft. based on 80 degrees F delta T, or in percent per hour based on nominal 90 degrees F delta T.

HL = Heat loss of tank surface area.

V = Storage volume in liters

##### 3.11.1 Storage Water Heaters

###### 3.11.1.1 Electric

- a. Storage capacity of 120 gallons or less, and input rating of 12 kW or less: minimum energy factor (EF) shall be 0.95-0.00132V per 10 CFR 430.

3.12 TABLES

TABLE I  
 PIPE AND FITTING MATERIALS FOR  
 DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE					
		A	B	C	D	E	F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark.	X	X	X	X	X	
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A 888. Pipe and fittings shall be marked with the CISPI trademark.		X	X	X	X	
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X		X	X		
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X	X	
5	Grooved pipe couplings, ferrous and non-ferrous pipe ASTM A 536 and ASTM A 47/A 47M	X	X		X	X	
6	Ductile iron grooved joint fittings for ferrous pipe ASTM A 536 and ASTM A 47/A 47M for use with Item 5	X	X		X	X	
7	Bronze sand casting grooved joint pressure fittings for non-ferrous pipe ASTM B 584, for use with Item 5	X	X		X	X	
8	Wrought copper grooved joint pressure fittings for non-ferrous pipe ASTM B 75 C12200, ASTM B 152/B 152M, C11000, ASME B16.22 ASME B16.22 for use with Item 5	X	X				
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X	X	
10	Steel pipe, seamless galvanized, ASTM A 53/A 53M, Type S, Grade B	X			X	X	
11	Seamless red brass pipe, ASTM B 43		X	X			

TABLE I  
 PIPE AND FITTING MATERIALS FOR  
 DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE					
		A	B	C	D	E	F
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X	
13	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 14				X	X	
14	Seamless copper pipe, ASTM B 42				X		
15	Cast bronze threaded fittings, ASME B16.15				X	X	
16	Copper drainage tube, (DWV), ASTM B 306	X*	X	X*	X	X	
17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X	
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X	
19	Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe and fittings ASTM D 2661, ASTM F 628	X	X	X	X	X	X
20	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D 2665, ASTM F 891, (Sch 40) ASTM F 1760	X	X	X	X	X	X

SERVICE:

- A - Underground Building Soil, Waste and Storm Drain
- B - Aboveground Soil, Waste, Drain In Buildings
- C - Underground Vent
- D - Aboveground Vent
- E - Interior Rainwater Conductors Aboveground
- F - Corrosive Waste And Vent Above And Belowground
- \* - Hard Temper

TABLE II  
 PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe and Fitting Materials	SERVICE			
		A	B	C	D
1	Seamless copper water tube, ASTM B 88, ASTM B 88M	X**	X**	X**	X***
2	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X
3	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5, 7 and 8	X	X	X	X

A - Cold Water Service Aboveground

B - Hot and Cold Water Distribution 180 degrees F Maximum Aboveground

C - Compressed Air Lubricated

D - Cold Water Service Belowground

Indicated types are minimum wall thicknesses.

\*\* - Type L - Hard

\*\*\* - Type K - Hard temper with brazed joints only or type K-soft temper  
 without joints in or under floors

\*\*\*\* - In or under slab floors only brazed joints

TABLE III  
 STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING  
 EQUIPMENT

A. STORAGE WATER HEATERS

FUEL	STORAGE CAPACITY GALLONS	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE
Elect.	120 max.	12 kW max.	10 CFR 430	EF=0.95-0.00132V minimum
Elect.	120 min. OR	12 kW min.	ASHRAE 90.1 (Addenda B)	SL=1.9 W/sq. ft. minimum
Gas	100 max.	75,000 Btu/h max.	10 CFR 430	EF=0.62-0.0019V minimum
Gas	100 min. OR	75,000 Btu/h	ANSI Z21.10.3	ET=77 percent; SL=1.3+38/V max.
Oil	50 max.	105,000 Btu/h	10 CFR 430	EF=0.59-0.0019V minimum
Oil	51 min. OR	105,000 Btu/h	10 CFR 430	EC=83 percent; SL=1.3+38/V maximum

B. Unfired Hot Water Storage, instantaneous water heater, and pool heater.

Volumes and inputs: maximum HL shall be 6.5 Btu/h/sq. ft.

C. Instantaneous Water Heater

Gas	All	All	ANSI Z21.10.3	ET=80 percent
Oil	All	All	ANSI Z21.10.3	EC=83 percent

D. Pool Heater

Gas or Oil	All	All	ANSI Z21.56	ET=78 percent
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TERMS:

- EF = Energy factor, overall efficiency.
- ET = Thermal efficiency with 70 degrees F delta T.
- EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).
- SL = Standby loss in W/sq. ft. based on 80 degrees F delta T, or in percent per hour based on nominal 90 degrees F delta T.
- HL = Heat loss of tank surface area
- V = Storage volume in gallons

-- End of Section --

**Amdt #0001**

SECTION 16375A

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND  
**02/02**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI C119.1 (1986; R 1997) Sealed Insulated  
Underground Connector Systems Rated 600  
Volts
- ANSI C80.1 (1995) Rigid Steel Conduit - Zinc Coated
- ANSI O5.1 (1992) Specifications and Dimensions for  
Wood Poles

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A 48 (1994ae1) Gray Iron Castings
- ASTM B 3 (1995) Soft or Annealed Copper Wire
- ASTM B 8 (1999) Concentric-Lay-Stranded Copper  
Conductors, Hard, Medium-Hard, or Soft
- ASTM C 478 (1997) Precast Reinforced Concrete Manhole  
Sections
- ASTM C 478M (1997) Precast Reinforced Concrete Manhole  
Sections (Metric)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE C2 (1997) National Electrical Safety Code
- IEEE Std 100 (1997) IEEE Standard Dictionary of  
Electrical and Electronics Terms
- IEEE Std 81 (1983) Guide for Measuring Earth  
Resistivity, Ground Impedance, and Earth  
Surface Potentials of a Ground System  
(Part 1) \31.00\$\F

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA FB 1 (1993) Fittings, Cast Metal Boxes, and  
Conduit Bodies for Conduit and Cable  
Assemblies

NEMA TC 6	(1990) PVC and ABS Plastic Utilities Duct for Underground Installation
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 70	(2002) National Electrical Code
UNDERWRITERS LABORATORIES (UL)	
UL 1242	(1996; Rev Mar 1998) Intermediate Metal Conduit
UL 467	(1993; Rev thru Apr 1999) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru Dec 1998) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors
UL 514A	(1996; Rev Dec 1999) Metallic Outlet Boxes
UL 6	(1997) Rigid Metal Conduit
UL 651	(1995; Rev thru Oct 1998) Schedule 40 and 80 Rigid PVC Conduit

## 1.2 GENERAL REQUIREMENTS

### 1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

**\*1**

### 1.2.2 **Seismic Requirements**

**Seismic restraints shall conform to Section 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.**

#### a. Seismic Parameters

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Electrical Distribution System; G, AO

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams manufacturers standard installation drawings and other information necessary to define

the installation and enable the Government to check conformity with the requirements of the contract drawings.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be included with the detail drawings. Approved departures shall be made at no additional cost to the Government.

As-Built Drawings; G, AO

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall provide three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction.

The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within 10 calendar days from the time the drawings are returned to the Contractor.

SD-03 Product Data

Nameplates

Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material and Equipment; G, AO

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

SD-06 Test Reports

Field Testing; G, AO

A proposed field test plan, 20 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Operating Tests; G, AO

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings, including a separate

section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The condition specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

#### Cable Installation; G, AO

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

- a. Site layout drawing with cable pulls numerically identified.
- b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.
- c. The cable manufacturer and type of cable.
- d. The dates of cable pulls, time of day, and ambient temperature.
- e. The length of cable pull and calculated cable pulling tensions.
- f. The actual cable pulling tensions encountered during pull.

#### SD-07 Certificates

##### Material and Equipment

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA

standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

#### Cable Installer Qualifications

The Contractor shall provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. A resume shall be provided showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements. Wood poles held in storage for more than 2 weeks shall be stored in accordance with ANSI O5.1. Handling of wood poles shall be in accordance with ANSI O5.1, except that pointed tools capable of producing indentations more than 1 inch in depth shall not be used. Metal poles shall be handled and stored in accordance with the manufacturer's instructions.

## PART 2 PRODUCTS

### 2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

### 2.2 CABLES

Cables shall be single conductor type unless otherwise indicated.

#### 2.2.1 Low-Voltage Cables

Cables shall be rated 600 volts and shall conform to the requirements of NFPA 70, and must be UL listed for the application or meet the applicable section of either ICEA or NEMA standards.

##### 2.2.1.1 Conductor Material

Underground cables shall be annealed copper complying with ASTM B 3 and ASTM B 8. Intermixing of copper and aluminum conductors is not permitted.

#### 2.2.1.2 Insulation

Insulation must be in accordance with NFPA 70, and must be UL listed for the application or meet the applicable sections of either ICEA, or NEMA standards.

#### 2.2.1.3 In Duct

Cables shall be single-conductor cable, in accordance with NFPA 70.

### 2.3 CABLE JOINTS AND CONNECTORS

#### 2.3.1 Low-Voltage Cable Splices

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A and UL 486B.

Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

### 2.4 CONDUIT AND DUCTS

Duct lines shall be concrete-encased, thin-wall type.

#### 2.4.1 Metallic Conduit

Intermediate metal conduit shall comply with UL 1242. Rigid galvanized steel conduit shall comply with UL 6 and ANSI C80.1. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

#### 2.4.2 Nonmetallic Ducts

##### 2.4.2.1 Concrete Encased Ducts

UL 651 Schedule 40 or NEMA TC 6 Type EB.

##### 2.4.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

### 2.5 MANHOLES, HANDHOLES, AND PULLBOXES

Manholes, handholes, and pullboxes shall be as indicated. Strength of manholes, handholes, and pullboxes and their frames and covers shall

conform to the requirements of IEEE C2. Precast-concrete manholes shall have the required strength established by ASTM C 478, ASTM C 478M. Frames and covers shall be made of gray cast iron and a machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with ASTM A 48, Class 30B, minimum. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be fabricated from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least 10,000 psi and a flexural strength of at least 5,000 psi. Pullbox and handhole covers in sidewalks, and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

## 2.6 GROUNDING AND BONDING

### 2.6.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used.

### 2.6.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

**\*1**

### 2.7 **Not Used**

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section 16415A ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section 02300 EARTHWORK. Concrete work shall have minimum 3000 psi compressive strength and conform to the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

#### 3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable.

#### 3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

### 3.2 CABLE AND BUSWAY INSTALLATION

The Contractor shall obtain from the manufacturer an installation manual or

set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, etc. The Contractor shall then perform pulling calculations and prepare a pulling plan which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS.

### 3.2.1 Cable Installation Plan and Procedure

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

#### 3.2.1.1 Cable Inspection

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

#### 3.2.1.2 Duct Cleaning

Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is 1/4 inch less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of 2 times or until less than a volume of 8 cubic inches of debris is expelled from the duct.

#### 3.2.1.3 Duct Lubrication

The cable lubricant shall be compatible with the cable jacket for cable that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

#### 3.2.1.4 Cable Installation

The Contractor shall provide a cable feeding truck and a cable pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manilla rope followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct. For cable installation in cold weather, cables shall be kept at 50 degrees F temperature for at least 24 hours before installation.

#### 3.2.1.5 Cable Installation Plan

The Contractor shall submit a cable installation plan for all cable pulls in accordance with the detail drawings portion of paragraph SUBMITTALS. Cable installation plan shall include:

- a. Site layout drawing with cable pulls identified in numeric order

of expected pulling sequence and direction of cable pull.

- b. List of cable installation equipment.
- c. Lubricant manufacturer's application instructions.
- d. Procedure for resealing cable ends to prevent moisture from entering cable.
- e. Cable pulling tension calculations of all cable pulls.
- f. Cable percentage conduit fill.
- g. Cable sidewall thrust pressure.
- h. Cable minimum bend radius and minimum diameter of pulling wheels used.
- i. Cable jam ratio.
- j. Maximum allowable pulling tension on each different type and size of conductor.
- k. Maximum allowable pulling tension on pulling device.

### 3.2.2 Duct Line

Low-voltage cables shall be installed in duct lines where indicated. Cable splices in low-voltage cables shall be made in manholes and handholes only, except as otherwise noted. Neutral and grounding conductors shall be installed in the same duct with their associated phase conductors.

**\*1**

### 3.2.3 **Not Used**

## 3.3 DUCT LINES

### 3.3.1 Requirements

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in manholes or handholes.

### 3.3.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer

shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

### 3.3.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with NFPA 70, except that electrical duct bank configurations for ducts 6 inches in diameter shall be determined by calculation and as shown on the drawings. The separation between adjacent electric power and communication ducts shall conform to IEEE C2. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point, except railroad and airfield crossings, tops of concrete encasements shall be not less than the cover requirements listed in NFPA 70. At railroad and airfield crossings, duct lines shall be encased with concrete and reinforced as indicated to withstand specified surface loadings. Tops of concrete encasements shall be not less than 5 feet below tops of rails or airfield paving unless otherwise indicated. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least 6 inches vertically.

### 3.3.4 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

#### 3.3.4.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

### 3.3.5 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a 5 mil brightly colored plastic tape, not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1 mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches below finished grade levels of such lines.

### 3.4 MANHOLES, HANDHOLES, AND PULLBOXES

#### 3.4.1 General

Manholes shall be constructed approximately where shown. The exact location of each manhole shall be determined after careful consideration has been given to the location of other utilities, grading, and paving. The location of each manhole shall be approved by the Contracting Officer before construction of the manhole is started. Manholes shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. The Contractor may at his option utilize monolithically constructed precast-concrete manholes having the required strength and inside dimensions as required by the drawings or specifications. In paved areas, frames and covers for manhole and handhole entrances in vehicular traffic areas shall be flush with the finished surface of the paving. In unpaved areas, the top of manhole covers shall be approximately 1/2 inch above the finished grade. Where existing grades that are higher than finished grades are encountered, concrete assemblies designed for the purpose shall be installed to elevate temporarily the manhole cover to existing grade level. All duct lines entering manholes must be installed on compact soil or otherwise supported when entering a manhole to prevent shear stress on the duct at the point of entrance to the manhole. Duct lines entering cast-in-place concrete manholes shall be cast in-place with the manhole. Duct lines entering precast concrete manholes through a precast knockout penetration shall be grouted tight with a portland cement mortar. PVC duct lines entering precast manholes through a PVC endbell shall be solvent welded to the endbell. A cast metal grille-type sump frame and cover shall be installed over the manhole sump. A cable-pulling iron shall be installed in the wall opposite each duct line entrance.

**\*1**

#### 3.4.2 Not Used

#### 3.4.3 Handholes

Handholes shall be located approximately as shown. Handholes shall be of the type noted on the drawings and shall be constructed in accordance with the details shown.

**\*1**

#### 3.4.4 Not Used

#### 3.4.5 Ground Rods

A ground rod shall be installed at the manholes, handholes and pullboxes. Ground rods shall be driven into the earth before the manhole floor is poured so that approximately 4 inches of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.

### 3.5 PAD-MOUNTED EQUIPMENT INSTALLATION

Pad-mounted equipment, has been installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of

this document.

### 3.5.1 Transformer Concrete Pads

#### 3.5.1.1 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

**\*1**

#### 3.5.2 **Not Used**

### 3.6 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated, and shall be connected to the first applicable termination point in each building. Interfacing with building interior conduit systems shall be at conduit stubouts terminating 5 feet outside of a building and 2.5 feet below finished grade as specified and provided under Section 16415A ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed with caulking compound to prevent entrance of moisture or gases into buildings.

### 3.7 GROUNDING

Metallic frames and covers of handholes and pull boxes shall be grounded by use of a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

#### 3.7.1 Grounding Electrodes

Grounding electrodes shall be installed as shown on the drawings and as follows:

- a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade.
- b. Additional electrodes - When the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors to achieve the specified ground resistance. The additional electrodes will be a single extension-type rod, 3/4 inch diameter, up to 30 feet long, coupled and driven with the first rod. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

#### 3.7.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

### 3.7.3 Grounding and Bonding Conductors

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

### 3.7.4 Manhole, Handhole, or Concrete Pullbox Grounding

Ground rods installed in manholes, handholes, or concrete pullboxes shall be connected to cable racks, cable-pulling irons, the cable shielding, metallic sheath, and armor at each cable joint or splice by means of a No. 4 AWG braided tinned copper wire. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of 2 inches above and 6 inches below concrete penetrations. Grounding electrode conductors shall be neatly and firmly attached to manhole or handhole walls and the amount of exposed bare wire shall be held to a minimum.

## 3.8 FIELD TESTING

### 3.8.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 20 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field test reports shall be signed and dated by the Contractor.

### 3.8.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

### 3.8.3 Ground-Resistance Tests

The resistance of each grounding electrode shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.

b. Multiple rod electrodes - 25 ohms.

#### 3.8.4 Low-Voltage Cable Test

Low-voltage cable, complete with splices, shall be tested for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible combinations conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. The minimum value of insulation shall be:

$R$  in megohms = (rated voltage in kV + 1) x 1000/(length of cable in feet

Each cable failing this test shall be repaired or replaced. The repaired cable shall be retested until failures have been eliminated.

#### 3.9 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

**Amdt #0001**

SECTION 16415A

ELECTRICAL WORK, INTERIOR  
**06/02**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C78.1	(1991; C78.1a; R 1996) Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics
ANSI C78.1350	(1990) Electric Lamps - 400-Watt, 100-Volt, S51 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1351	(1989) Electric Lamps - 250-Watt, 100-Volt S50 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1352	(1990) Electric Lamps - 1000-Watt, 250-Volt, S52 Single-Ended High-Pressure Sodium Lamps
ANSI C78.1355	(1989) Electric Lamps - 150-Watt, 55-Volt S55 High-Pressure Sodium Lamps
ANSI C78.1375	(1996) 400-Watt, M59 Single-Ended Metal-Halide Lamps
ANSI C78.1376	(1996) 1000-Watt, M47 Metal-Halide Lamps
ANSI C78.2A	(1991) 18 & 26- Watt, Compact Fluorescent Quad Tube Lamps **
ANSI C82.1	(1997) Specifications for Fluorescent Lamp Ballasts \ \$18.00\$ \ F \ X Addenda D & E

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 1	(1995) Hard-Drawn Copper Wire
ASTM B 8	(1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 709	(2000) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits
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IEEE Std 81 (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1) \F31.00\F

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1997) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA AB 1 (1993) Molded Case Circuit Breakers and Molded Case Switches

NEMA ICS 6 (1993) Industrial Control and Systems, Enclosures

NEMA LE 4 (1987) Recessed Luminaires, Ceiling Compatibility

NEMA MG 1 (1998) Motors and Generators

NEMA MG 10 (1994) Energy Management Guide for Selection and Use of Polyphase Motors

NEMA OS 1 (1996) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

NEMA PB 1 (1995) Panelboards

NEMA RN 1 (1998) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

NEMA WD 1 (1999) General Requirements for Wiring Devices

NEMA WD 6 (1997) Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2000) Life Safety Code

NFPA 70 (2002) National Electrical Code

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

47 CFR 18 Industrial, Scientific, and Medical Equipment

UNDERWRITERS LABORATORIES (UL)

UL 1 (2000) Flexible Metal Conduit

UL 1004 (1994; Rev thru Nov 1999) Electric Motors

UL 1242 (1996; Rev Mar 1998) Intermediate Metal Conduit

UL 1570	(1995; Rev thru Nov 1999) Fluorescent Lighting Fixtures
UL 1572	(1995; Rev thru Nov 1999) High Intensity Discharge Lighting Fixtures
UL 20	(1995; Rev thru Oct 1998) General-Use Snap Switches
UL 360	(1996; Rev thru Oct 1997) Liquid-Tight Flexible Steel Conduit
UL 467	(1993; Rev thru Apr 1999) Grounding and Bonding Equipment
UL 486A	(1997; Rev thru Dec 1998) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486C	(1997; Rev thru Aug 1998) Splicing Wire Connectors
UL 486E	(1994; Rev thru Feb 1997) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
UL 489	(1996; Rev thru Dec 1998) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 50	(1995; Rev thru Nov 1999) Enclosures for Electrical Equipment
UL 510	(1994; Rev thru Apr 1998) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514A	(1996; Rev Dec 1999) Metallic Outlet Boxes
UL 514B	(1997; Rev Oct 1998) Fittings for Cable and Conduit
UL 6	(1997) Rigid Metal Conduit
UL 67	(1993; Rev thru Oct 1999) Panelboards
UL 797	(1993; Rev thru Mar 1997) Electrical Metallic Tubing
UL 83	(1998; Rev thru Sep 1999) Thermoplastic-Insulated Wires and Cables
UL 844	(1995; Rev thru Mar 1999) Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
UL 869A	(1998) Reference Standard for Service Equipment

UL 924	(1995; Rev thru Oct 97) Emergency Lighting and Power Equipment
UL 943	(1993; Rev thru May 1998) Ground-Fault Circuit-Interrupters
UL Elec Const Dir	(1999) Electrical Construction Equipment Directory

## 1.2 GENERAL

### 1.2.1 Rules

The installation shall conform to the requirements of NFPA 70 and NFPA 101, unless more stringent requirements are indicated or shown.

### 1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible.

Lighting fixtures, outlets, and other equipment and materials shall be carefully coordinated with mechanical or structural features prior to installation and positioned according to architectural reflected ceiling plans; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change. The Contractor shall coordinate the electrical requirements of the mechanical work and provide all power related circuits, wiring, hardware and structural support, even if not shown on the drawings.

### 1.2.3 Special Environments

#### 1.2.3.1 Weatherproof Locations

Wiring, Fixtures, and equipment in designated locations shall conform to NFPA 70 requirements for installation in damp or wet locations.

#### 1.2.3.2 Ducts, Plenums and Other Air-Handling Spaces

Wiring and equipment in ducts, plenums and other air-handling spaces shall be installed using materials and methods in conformance with NFPA 70 unless more stringent requirements are indicated in this specification or on the contract drawings.

### 1.2.4 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

### 1.2.5 Nameplates

#### 1.2.5.1 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The front of each panelboard, motor control center, switchgear, and switchboard shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 1/4 inch  
High Letters

Minimum 1/8 inch  
High Letters

Panelboards  
Safety Switches  
Equipment Enclosures

Control Devices

Each panel, section, or unit in motor control centers, switchgear or similar assemblies shall be provided with a nameplate in addition to nameplates listed above, which shall be provided for individual compartments in the respective assembly, including nameplates which identify "future," "spare," and "dedicated" or "equipped spaces."

#### 1.2.6 As-Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish 2 sets of as-built drawings to the Contracting Officer.

#### 1.2.7 Recessed Light Fixtures (RLF) Option

The Contractor has the option to substitute inch-pound (I-P) RLF to metric RLF. This option shall be coordinated with Section 09510A ACOUSTICAL CEILINGS.

#### 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Interior Electrical Equipment; G, AO.

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams, and other information necessary to define the installation. Detail drawings shall show the rating of items and systems and how the components of an item and system are assembled, function together, and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission.

Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall show physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded. Detail drawings shall as a minimum include:

- a. Single line electrical diagrams including primary, metering, sensing and relaying, control wiring, and control logic.
- b. Sway bracing for suspended luminaires.

Structural drawings showing the structural or physical features of major equipment items, components, assemblies, and structures, including foundations or other types of supports for equipment and conductors. These drawings shall include accurately scaled or dimensioned outline and arrangement or layout drawings to show the physical size of equipment and components and the relative arrangement and physical connection of related components. Weights of equipment, components and assemblies shall be provided when required to verify the adequacy of design and proposed construction of foundations or other types of supports. Dynamic forces shall be stated for switching devices when such forces must be considered in the design of support structures. The appropriate detail drawings shall show the provisions for leveling, anchoring, and connecting all items during installation, and shall include any recommendations made by the manufacturer.

Electrical drawings including single-line and three-line diagrams, and schematics or elementary diagrams of each electrical system; internal wiring and field connection diagrams of each electrical device when published by the manufacturer; wiring diagrams of cabinets, panels, units, or separate mountings; interconnection diagrams that show the wiring between separate components of assemblies; field connection diagrams that show the termination of wiring routed between separate items of equipment; internal wiring diagrams of equipment showing wiring as actually provided for this project. Field wiring connections shall be clearly identified.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons why, shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Government.

SD-03 Product Data

Device Coordination Study

Manufacturer's Catalog; G, AO.

Data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists; G, AO.

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each item.

Installation Procedures; G, AO.

Installation procedures for rotating equipment, transformers, switchgear, battery systems, voltage regulators, and grounding resistors. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test devices and equipment.

As-Built Drawings; G, AO.

The as-built drawings shall be a record of the construction as installed. The drawings shall include all the information shown on the contract drawings, deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full-sized set of prints marked to reflect all deviations, changes, and modifications. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction.

The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

Onsite Tests; G, AO.

A detailed description of the Contractor's proposed procedures for on-site tests.

SD-06 Test Reports

Factory Test Reports; G, AO.

Six copies of the information described below in 8 1/2 x 11 inch binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The conditions specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

Field Test Plan; G, AO.

A detailed description of the Contractor's proposed procedures for onsite test submitted 20 days prior to testing the installed system. No field test will be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Field Test Reports; G, AO.

Six copies of the information described below in 8 1/2 x 11 inch binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The conditions specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.
- h. Final position of controls and device settings.

SD-07 Certificates

Materials and Equipment

The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment

conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Items which are required to be listed and labeled in accordance with Underwriters Laboratories must be affixed with a UL label that states that it is UL listed. No exceptions or waivers will be granted to this requirement. Materials and equipment will be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

#### 1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with NFPA 70, recommendations of the manufacturer, and as shown.

#### 1.5 SEISMIC REQUIREMENTS

Seismic details shall conform to Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

### PART 2 PRODUCTS

Products shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

#### 2.1 CABLES AND WIRES

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

##### 2.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to meet manufacturer's requirements.

##### 2.1.2 Aluminum Conductors

Aluminum conductors shall not be used.

### 2.1.3 Insulation

Unless indicated otherwise, or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN, THHN, or THW conforming to UL 83, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW, THW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

### 2.1.4 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

### \*1

### 2.2 NOT USED

## 2.3 CIRCUIT BREAKERS

### 2.3.1 MOLDED-CASE CIRCUIT BREAKERS

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489. Circuit breakers may be installed in panelboards, switchboards, enclosures, motor control centers, or combination motor controllers.

#### 2.3.1.1 Construction

Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper and aluminum conductors in accordance with UL 486E. Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible. When breaker is off or tripped it shall have a brightly color indicator.

#### 2.3.1.2 Ratings

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards and switchboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1. Ratings shall be coordinated with system X/R ratio.

#### 2.3.1.3 Thermal-Magnetic Trip Elements

Thermal magnetic circuit breakers shall be provided as shown. Automatic

operation shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection.

#### 2.3.2 HACR Circuit Breakers

Circuit breakers 60 amperes or below, 240 volts, 1-pole or 2-pole, intended to protect multi-motor and combination-load installations involved in heating, air conditioning, and refrigerating equipment shall be marked "Listed HACR Type."

#### 2.4 CONDUIT AND TUBING

##### 2.4.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797

##### 2.4.2 Flexible Conduit, Steel

General-purpose type, UL 1; liquid tight, UL 360.

##### 2.4.3 Intermediate Metal Conduit

UL 1242.

##### 2.4.4 PVC Coated Rigid Steel Conduit

NEMA RN 1.

##### 2.4.5 Rigid Metal Conduit

UL 6.

#### 2.5 CONDUIT AND DEVICE BOXES AND FITTINGS

##### 2.5.1 Boxes, Metallic Outlet

NEMA OS 1 and UL 514A.

##### 2.5.2 Fittings for Conduit and Outlet Boxes

UL 514B.

##### 2.5.3 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

#### 2.6 CONNECTORS, WIRE PRESSURE

##### 2.6.1 For Use With Copper Conductors

UL 486A.

#### 2.7 ELECTRICAL GROUNDING AND BONDING EQUIPMENT

UL 467.

##### 2.7.1 Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length of the sectional type driven full length into the earth.

#### 2.7.2 Ground Bus

The ground bus shall be bare conductor or flat copper in one piece, if practicable.

#### 2.8 ENCLOSURES

NEMA ICS 6 or NEMA 250, unless otherwise specified.

##### 2.8.1 Cabinets and Boxes

Cabinets and boxes with volume greater than 100 cubic inches shall be in accordance with UL 50, hot-dip, zinc-coated, if sheet steel.

#### 2.9 LIGHTING FIXTURES, LAMPS, BALLASTS, EMERGENCY EQUIPMENT, CONTROLS AND ACCESSORIES

The following specifications are supported and supplemented by information and details on the drawings. Additional fixtures, if shown, shall conform to this specification. Lighting equipment installed in classified hazardous locations shall conform to UL 844. Lamps, lampholders, ballasts, transformers, electronic circuitry and other lighting system components shall be constructed according to industry standards. Equipment shall be tested and listed by a recognized independent testing laboratory for the expected installation conditions. Equipment shall conform to the standards listed below.

##### 2.9.1 Lamps

Lamps shall be constructed to operate in the specified fixture, and shall function without derating life or output as listed in published data. Lamps shall meet the requirements of the Energy Policy Act of 1992.

- a. Fluorescent lamps shall be and shall have color temperature 4,000 degrees Kelvin. They shall be designed to operate with the ballasts and circuitry of the fixtures in which they will be used. Fluorescent lamps, including spares, shall be manufactured by one manufacturer to provide for color and performance consistency. Fluorescent lamps shall comply with ANSI C78.1. Fluorescent tube lamp efficiencies shall meet or exceed the following requirements.

T8, 32 watts	(4' lamp)	2800 lumens
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(1) Linear fluorescent lamps, unless otherwise indicated, shall be 4 feet long 32 watt T8, 265 mA, with minimum CRI of 75. Lamps of other lengths or types shall be used only where specified or shown. Lamps shall deliver rated life when operated on rapid start ballasts.

(2) Small compact fluorescent lamps shall be twin, double, or triple tube configuration as shown with bi-pin or four-pin snap-in base and shall have minimum CRI of 85. They shall deliver rated life when operated on ballasts as shown. 18 and 26 watt double tube lamps shall comply with ANSI C78.2A. Minimum starting temperature shall be 32 degrees F for twin tube lamps and for

double and triple twin tube lamps without internal starter; and 15 degrees F for double and triple twin tube lamps with internal starter.

(3) Long compact fluorescent lamps shall be 18, 27, 39, 40, 50, or 55 watt bi-axial type as shown with four-pin snap-in base; shall have minimum CRI of 85; and shall have a minimum starting temperature of 50 degrees F. They shall deliver rated life when operated on rapid start ballasts.

- b. High intensity discharge lamps, including spares, shall be manufactured by one manufacturer in order to provide color and performance consistency. High intensity discharge lamps shall be designed to operate with the ballasts and circuitry of the fixtures in which they will be used and shall have wattage, shape and base as shown. High intensity discharge lamps, unless otherwise shown, shall have medium or mogul screw base and minimum starting temperature of -20 degrees F. Metal halide lamps, unless otherwise shown, shall have minimum CRI of 65; color temperature of 4,300 degrees Kelvin; shall be -BU configuration if used in base-up position; and shall be -H or high output configuration if used in horizontal position. Lamps shall comply with all applicable ANSI C78.1350, ANSI C78.1351, ANSI C78.1352, ANSI C78.1355, ANSI C78.1375, and ANSI C78.1376.

#### 2.9.2 Ballasts and Transformers

Ballasts or transformers shall be designed to operate the designated lamps within their optimum specifications, without derating the lamps. Lamp and ballast combinations shall be certified as acceptable by the lamp manufacturer.

- a. Fluorescent ballasts shall comply with ANSI C82.1 and shall be mounted integrally within fluorescent fixture housing unless otherwise shown. Ballasts shall have maximum current crest factor of 1.7; high power factor; Class A sound rating; maximum operating case temperature of 77 degrees F above ambient; and shall be rated Class P. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture. A single ballast may be used to serve multiple fixtures if they are continuously mounted, identically controlled and factory manufactured for that installation with an integral wireway.

(1) Compact fluorescent ballasts shall comply with IEEE C62.41 Category A transient voltage variation requirements and shall be mounted integrally within compact fluorescent fixture housing unless otherwise shown. Ballasts shall have minimum ballast factor of 0.95; maximum current crest factor of 1.6; high power factor; maximum operating case temperature of 77 degrees F above ambient; shall be rated Class P; and shall have a sound rating of Class A. Ballasts shall meet FCC Class A specifications for EMI/RFI emissions. Ballasts shall operate from nominal line voltage of 120 volts at 60 Hz and maintain constant light output over a line voltage variation of + 10%. Ballasts shall have an end-of-lamp-life detection and shut-down circuit. Ballasts shall be UL listed and shall contain no PCBs. Ballasts shall contain potting to secure PC board, provide lead strain relief, and provide a moisture barrier.

(2) Electronic fluorescent ballasts shall comply with 47 CFR 18 for electromagnetic interference. Ballasts shall withstand line transients per IEEE C62.41, Category A. Ballasts shall have total harmonic distortion between 10 and 20%; minimum frequency of 20,000Hz; filament voltage between 2.5 and 4.5 volts; maximum starting inrush current of 20 amperes; and shall comply with the minimum Ballast Efficacy Factors shown in the table below. Minimum starting temperature shall be 50 degrees F. Ballasts shall carry a manufacturer's full warranty of three years, including a minimum \$10 labor allowance per ballast.

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS

LAMP TYPE	TYPE OF STARTER & LAMP	NOMINAL OPERATIONAL VOLTAGE	NUMBER OF LAMPS	MINIMUM BALLAST EFFICACY FACTOR
32W T8	rapid start	120 or 277 V	1	2.54
	linear & U-tubes		2	1.44
			3	0.93
			4	0.73

2.9.3 Fixtures

Fixtures shall be in accordance with the size, shape, appearance, finish, and performance shown. Unless otherwise indicated, lighting fixtures shall be provided with housings, junction boxes, wiring, lampholders, mounting supports, trim, hardware and accessories for a complete and operable installation. Recessed housings shall be minimum 20 gauge cold rolled or galvanized steel as shown. Extruded aluminum fixtures shall have minimum wall thickness of 0.125 inches. Plastic lenses shall be 100% virgin acrylic or as shown. Glass lenses shall be tempered. Heat resistant glass shall be borosilicate type. Conoid recessed reflector cones shall be Alzak with clear specular low iridescent finish.

- a. Fluorescent fixtures shall comply with UL 1570. Recessed ceiling fixtures shall comply with NEMA LE 4. Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Marking shall be readily visible to service personnel, but not visible from normal viewing angles. Fluorescent fixture lens frames on recessed and surface mounted troffers shall be one assembly with mitered corners. Parabolic louvers shall have a low iridescent finish and 45 degree cut-off. Louver intersection joints shall be hairline type and shall conceal mounting tabs or other assembly methods. Louvers shall be free from blemishes, lines or defects which distort the visual surface. Integral ballast and wireway compartments shall be easily accessible without the use of special tools. Housings shall be constructed to include grounding necessary to start the lamps. Open fixtures shall be equipped with a sleeve, wire guard, or other positive means to prevent lamps from falling. Medium bi-pin lampholders shall be twist-in type with positive locking position. Long compact fluorescent fixtures and fixtures utilizing U-bend lamps shall have clamps or secondary lampholders to support the free ends of the lamps.

- b. High intensity discharge fixture shall comply with UL 1572. Recessed ceiling fixtures shall comply with NEMA LE 4. Reflectors shall be anodized aluminum. Fixtures for horizontal lamps shall have position oriented lampholders. Lampholders shall be pulse-rated to 5,000 volts. Fixtures indicated as classified or rated for hazardous locations or special service shall be designed and independently tested for the environment in which they are installed. Recessed lens fixtures shall have extruded aluminum lens frames. Ballasts shall be integral to fixtures and shall be accessible without the use of special tools. Remote ballasts shall be encased and potted. Lamps shall be shielded from direct view with a UV absorbing material such as tempered glass, and shall be circuited through a cut-off switch which will shut off the lamp circuit if the lens is not in place.
- c. Emergency lighting fixtures and accessories shall be constructed and independently tested to meet the requirements of applicable codes. Batteries shall be Nicad or equal with no required maintenance, and shall have a minimum life expectancy of five years and warranty period of three years.
- d. Exit Signs

Exit signs shall be ENERGY STAR compliant, thereby meeting the following requirements. Input power shall be less than 5 watts per face. Letter size and spacing shall adhere to NFPA 101. Luminance contrast shall be greater than 0.8. Average luminance shall be greater than  $15 \text{ cd/m}^2$  measured at normal (0 degree) and 45 degree viewing angles. Minimum luminance shall be greater than  $8.6 \text{ cd/m}^2$  measured at normal and 45 degree viewing angles. Maximum to minimum luminance shall be less than 20:1 measured at normal and 45 degree viewing angles. The manufacturer warranty for defective parts shall be at least 5 years.

## 2.10 MOTORS, AC, FRACTIONAL AND INTEGRAL

Motors, ac, fractional and integral horsepower, 500 hp and smaller shall conform to NEMA MG 1 and UL 1004 for motors; NEMA MG 10 for energy management selection of polyphase motors.

### 2.10.1 Rating

The horsepower rating of motors should be limited to no more than 125 percent of the maximum load being served unless a NEMA standard size does not fall within this range. In this case, the next larger NEMA standard motor size should be used.

## 2.11 PANELBOARDS

Dead-front construction, NEMA PB 1 and UL 67.

## 2.12 RECEPTACLES

### 2.12.1 Heavy Duty Grade

NEMA WD 1. Devices shall conform to all requirements for heavy duty receptacles.

### 2.12.2 Ground Fault Interrupters

UL 943, Class A or B.

### 2.12.3 NEMA Standard Receptacle Configurations

NEMA WD 6.

a. Duplex, 20-Ampere, 125 Volt

20-ampere, non-locking: NEMA type 5-20R.

### 2.13 Service Entrance Equipment

UL 869A.

### 2.14 SPLICE, CONDUCTOR

UL 486C.

### 2.15 SNAP SWITCHES

UL 20.

### 2.16 TAPES

#### 2.16.1 Plastic Tape

UL 510.

#### 2.16.2 Rubber Tape

UL 510.

### 2.17 WIRING DEVICES

NEMA WD 1 for wiring devices, and NEMA WD 6 for dimensional requirements of wiring devices.

### 2.18 SECONDARY CLOCKS

The existing master time/program clock is a Simplex 6400 master control clock system located as shown on the drawings. Provide analog secondary clocks. The analog clock shall be available for operation from a (120V 60 Hz AC source) or from a 24V 60 Hz AC source). Each clock shall be powered by a 60 Hz synchronous motor. The clock shall have a standard 12-hour display with black numerals at least 1-1/4" (3.17 cm) high. The hour and minute hands shall be furnished in black; the sweep second hand shall be red. The clock case shall be all-metal, finish in satin aluminum enamel. The dial shall be white and shall be impervious to discoloration. The clock shall be supplied with a sway-proof hanger for secure wall mounting. The surface-mounted clock shall require a standard 2-gang electrical wall box for installation. The double-faced clock shall be equipped with a universal bracket (for wall mount or ceiling mount).

### 2.19 PUBLIC ADDRESS/INTERCOM SYSTEM

#### 2.19.1 Speakers

New ceiling mounted speakers shall consist of a 5-ounce magnet speaker

complete with 25V/70V line matching transformer, assembled to a Baffle. The circulator baffle shall be 12-7/8" (32.70 cm) in diameter. It shall be constructed of 22-gauge cold-rolled steel, with a baked-on white epoxy finish which shall be virtually mar-proof. The assembly shall be screw-mounted in any standard backbox. The speaker shall be a 8" 12-7/8" (32.70 cm), 8-ohms, cone-type with the following specifications: frequency response shall be 65 to 17,000 Hz; ceramic magnet weight shall be at least 5 ounces (141.75 g); axial sensitivity shall be 93dB at 4' with 1 watt input; normal wattage rating shall be 8 watts RMS; "whizzer" cone for extended high frequency; voice coil impedance shall be 8 ohms and shall measure 0.75" (6.88 cm). The speaker shall be equipped with a universal line matching transformer for a 25V or 70V output line with taps at 5/16, 5/8, 1-1/4, 2-1/2 and 5 watts.

**\*1**

**2.19.2 Speaker Cables**

Speaker cable shall be a two-pair cable. Cable shall consist of: NEC type CM; tinned copper conductors; PVC insulated; overall aluminum-polyester shield; 22 AWG stranded tinned copper drain wire; nominal capacitance of 35 pF/ft between conductors; nominal capacitance of 50 pF/ft. between one conductor and other conductors connected to shield. Connect to spare termination blocks and connect the new components into the existing PA system.

**2.19.3 Installer**

The Contractor shall provide documentation demonstrating that its sound system installer has been regularly engaged in the installation of P.A./intercom for a minimum of three years immediately preceding commencement of this contract. Such documentation shall specifically include proof of satisfactory performance on at least three projects similar to that required by these specifications, including the names and telephone numbers of using agency points of contact for each of these projects. Documentation shall indicate the type of each system installed and include a written certificate that each system has performed satisfactorily in the manner specified for a period of not less than 12 months following completion. All such data shall be submitted 30 days prior to commencement of installation for approval of the Contracting Officer.

**2.20 MASTER ANTENNA TELEVISION SYSTEM**

The master antenna television system is existing and shall remain.

**2.20.1 Standard Products**

Equipment and materials shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

**2.20.2 Identical Items**

Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

### 2.20.3 Headend Equipment

The headend equipment is existing and is located in Media Center as shown on the plans.

### 2.20.4 Cable Distribution System

The cable distribution system shall consist of coaxial cables, user interfaces, signal taps and splitters, RF amplifiers, power supplies, and ancillary hardware as required to meet the system requirements specified.

### 2.20.5 Submittals

Government approval is required for submittals with a "G" designation. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-01 Data

#### Spare Parts; G, AO

Spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 1 month prior to the date of beneficial occupancy. The data shall include a suggested list of spare parts and supplies, with current unit prices and source of supply.

#### Testing; G, AO

Test reports in booklet form showing all field tests performed to adjust each component and all acceptance tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls. Specifically, a Television shall be taken into each classroom and all system signals shall be verified in order for the work to be accepted.

### 2.20.6 Delivery and Storage

Components shall be delivered in original packages with labels intact and identification clearly marked. Components shall be protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

### 2.20.7 Environmental Conditions

System components located inside buildings shall conform to the specified performance when subjected to any combination of the following environmental conditions:

Temperature: At 40 to 100 degrees F.

Relative humidity: From 0 to 100 percent (no water condensation).

### 2.20.8 Coaxial Cable

Coaxial cable shall be used to connect headend equipment to the user interface. Allowable losses between components and user interface dictated by system design and construction considerations shall determine the size

and type of coaxial cable. Cables less than 0.500 inchOD shall be PVC jacketed and shall have a braided copper or aluminum outer conductor with 65 plus or minus 5 percent braid coverage. The inner conductor shall be copper clad steel wire or solid copper and an aluminum foil bonded to the outside of the dielectric. The cable shall have a polyethylene foam dielectric unless used in plenum applications. Where cabling is to be placed in plenum, ducts and other air-handling spaces the cable shall meet NFPA 70.

#### 2.20.9 Electrical Characteristics

The following types of cables are acceptable for use in the distribution system. The cables shall as a minimum conform to the following specifications:

Cables less than 0.500 inch OD:

Acceptable Type	Max Attenuation at 68 Degrees F (dB/100 Ft)				
	Frequency (MHz)				
	55	216	300	50	890
RG-6	1.05	3.05	3.55	4.40	6.51

Characteristic:

Impedance 75 plus or minus 2 ohms

Capacitance: 17 picofarads per foot

Velocity of Propagation: 81 plus or minus 3 percent

#### 2.20.10 Signal Splitter (4-Way)

The cable distribution system shall utilize signal power splitters, directional couplers, and isolation taps as required to meet the system performance requirements. Signal splitters shall have a power throughput capability of 6 amperes minimum when amplifiers are to be powered through the cable. All signal splitters shall be contained in rugged weatherproof anodized aluminum or other noncorrosive metal housing with brass connector ports. In addition to the above specifications, the splitters shall as a minimum conform to the following specifications:

Impedance: 75 ohms unbalanced  
Return Loss: 17 dB  
RFI Shielding: 100 dB  
Isolation: 25 dB

#### 2.20.11 TV Cable Outlets

Outlets with plates shall be wall mounted and shall not protrude from the face of the wall more than 1/4 inch. Each outlet shall have an attenuation of less than 0.1 dB and a VSWR of less than 1.15 to 1. Cable Connectors shall be 75 ohm Type "F" self-terminating units. All metallic portions of connectors shall be composed of anodized brass, beryllium copper or phosphorus bronze. Outlet connector shall be Type "F" female plug.

#### 2.20.12 Installation

Interior installations shall comply with NFPA 70. All system components shall be installed in accordance with the manufacturer's specifications and recommendations.

#### 2.20.13 Distribution System

The Contractor shall configure the distribution system components in a manner consistent with the manufacturer's specifications. The distribution system design and placement shall conform to available cable routing and proposed equipment locations as shown on the facility layout drawings.

#### 2.20.14 Testing

The Contracting Officer shall be notified 30 days before systems are ready for acceptance tests. The acceptance tests shall not be conducted prior to the system having experienced 60 days of satisfactory operation, the last 20 days of which shall have been with no component failures. The acceptance tests shall be performed in accordance with the approved Test Plan and conform to NCTA-02 and conducted in the presence of the Contracting Officer. All instruments, personnel, and transportation required for the tests shall be provided by the Contractor.

### PART 3 EXECUTION

#### 3.1 GROUNDING

Grounding shall be in conformance with NFPA 70, the contract drawings, and the following specifications.

##### 3.1.1 Ground Rods

The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods not less than 6 feet on centers, or if sectional type rods are used, 3 additional sections may be coupled and driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

##### 3.1.2 Grounding Conductors

A green equipment grounding conductor, sized in accordance with NFPA 70 shall be provided, regardless of the type of conduit. Equipment grounding bars shall be provided in all panelboards. The equipment grounding conductor shall be carried back to the service entrance grounding connection or separately derived grounding connection. All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70. When switches, or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor

junction with a short jumper.

### 3.2 WIRING METHODS

Wiring shall conform to NFPA 70, the contract drawings, and the following specifications. Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid zinc-coated steel conduit electrical metallic tubing intermediate metal conduit. Where cables and wires are installed in cable trays, they shall be of the type permitted by NFPA 70 for use in such applications. Wire fill in conduits shall be based on NFPA 70 for the type of conduit and wire insulations specified.

#### 3.2.1 Conduit and Tubing Systems

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be 1/2 inch. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. Electrical metallic tubing (EMT) may be installed only within buildings. EMT may be installed in concrete and grout in dry locations. EMT installed in concrete or grout shall be provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Penetrations of above grade floor slabs, time-rated partitions and fire walls shall be firestopped in accordance with Section 07840A FIRESTOPPING. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70. Raceways shall not be installed under the firepits of boilers and furnaces and shall be kept 6 inches away from parallel runs of flues, steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding. Wiring installed in underfloor raceway system shall be suitable for installation in wet locations.

##### 3.2.1.1 Pull Wires

A pull wire shall be inserted in each empty raceway in which wiring is to be installed if the raceway is more than 50 feet in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 150 feet in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 200 pounds per square inch tensile strength. Not less than 10 inches of slack shall be left at each end of the pull wire.

##### 3.2.1.2 Conduit Stub-Ups

Where conduits are to be stubbed up through concrete floors, a short elbow shall be installed below grade to transition from the horizontal run of conduit to a vertical run. A conduit coupling fitting, threaded on the inside shall be installed, to allow terminating the conduit flush with the finished floor. Wiring shall be extended in rigid threaded conduit to

equipment, except that where required, flexible conduit may be used 6 inches above the floor. Empty or spare conduit stub-ups shall be plugged flush with the finished floor with a threaded, recessed plug.

#### 3.2.1.3 Below Slab-on-Grade or in the Ground

Electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel or IMC. Rigid steel or IMC conduits installed below slab-on-grade or in the earth shall be field wrapped with 0.010 inch thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

#### 3.2.1.4 Installing in Slabs Including Slabs on Grade

Conduit installed in slabs-on-grade shall be rigid steel or IMC. Conduits shall be installed as close to the middle of concrete slabs as practicable without disturbing the reinforcement. Outside diameter shall not exceed 1/3 of the slab thickness and conduits shall be spaced not closer than 3 diameters on centers except at cabinet locations where the slab thickness shall be increased as approved by the Contracting Officer. Where conduit is run parallel to reinforcing steel, the conduit shall be spaced a minimum of one conduit diameter away but not less than one inch from the reinforcing steel.

#### 3.2.1.5 Changes in Direction of Runs

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment shall be prevented during the course of construction. Clogged raceways shall be cleared of obstructions or shall be replaced.

#### 3.2.1.6 Supports

Metallic conduits and tubing, and the support system to which they are attached, shall be securely and rigidly fastened in place to prevent vertical and horizontal movement at intervals of not more than 10 feet and within 3 feet of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, beam clamps, or ceiling trapeze. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structure. Loads shall not be applied to joist bridging. Attachment shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Cutting the main reinforcing bars in reinforced concrete beams or joists shall be avoided when drilling holes for support anchors. Holes drilled for support anchors, but not used, shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Raceways shall not be supported using wire or nylon ties. Raceways shall be independently supported from the structure. Upper raceways shall not be used as a means of support for lower raceways. Supporting means shall not

be shared between electrical raceways and mechanical piping or ducts. Cables and raceways shall not be supported by ceiling grids. Except where permitted by NFPA 70, wiring shall not be supported by ceiling support systems. Conduits shall be fastened to sheet-metal boxes and cabinets with two locknuts where required by NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

#### 3.2.1.7 Exposed Raceways

Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Raceways under raised floors and above accessible ceilings shall be considered as exposed installations in accordance with NFPA 70 definitions.

#### 3.2.1.8 Communications Raceways

Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirement that no length of run shall exceed 50 feet for 1/2 inch and 3/4 inch sizes, and 100 feet for 1 inch or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of 1 inch size or larger shall not be less than ten times the nominal diameter.

#### 3.2.2 Cables and Conductors

Installation shall conform to the requirements of NFPA 70. Covered, bare or insulated conductors of circuits rated over 600 volts shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 600 volts or less.

##### 3.2.2.1 Sizing

Unless otherwise noted, all sizes are based on copper conductors and the insulation types indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 100 feet long from panel to load, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG. Class 3 low-energy, remote-control and signal circuits shall be not less than No. 22 AWG.

##### 3.2.2.2 Use of Aluminum Conductors in Lieu of Copper

Aluminum conductors shall not be used.

##### 3.2.2.3 Cable Splicing

Splices shall be made in an accessible location. Crimping tools and dies shall be approved by the connector manufacturer for use with the type of connector and conductor.

- a. Copper Conductors, 600 Volt and Under: Splices in conductors No.

10 AWG and smaller diameter shall be made with an insulated, pressure-type connector. Splices in conductors No. 8 AWG and larger diameter shall be made with a solderless connector and insulated with tape or heat-shrink type insulating material equivalent to the conductor insulation.

#### 3.2.2.4 Conductor Identification and Tagging

Power, control, and signal circuit conductor identification shall be provided within each enclosure where a tap, splice, or termination is made.

Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

- a. Color coding shall be provided for service, feeder, branch, and ground conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in the same raceway or box, other neutral shall be white with colored (not green) stripe. The color coding for 3-phase and single-phase low voltage systems shall be as follows:

120/208-volt, 3-phase: Black(A), red(B), and blue(C).

- b. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 3 inches of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer.
- c. Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

### 3.3 BOXES AND SUPPORTS

Boxes shall be provided in the wiring or raceway systems where required by NFPA 70 for pulling of wires, making connections, and mounting of devices or fixtures. Pull boxes shall be furnished with screw-fastened covers. Indicated elevations are approximate, except where minimum mounting heights for hazardous areas are required by NFPA 70. Unless otherwise indicated, boxes for wall switches shall be mounted 48 inches above finished floors. Switch and outlet boxes located on opposite sides of fire rated walls shall be separated by a minimum horizontal distance of 24 inches. The total combined area of all box openings in fire rated walls shall not exceed 100 square inches per 100 square feet. Maximum box areas for individual boxes in fire rated walls vary with the manufacturer and shall not exceed the maximum specified for that box in UL Elec Const Dir. Only boxes listed in

UL Elec Const Dir shall be used in fire rated walls.

### 3.3.1 Box Applications

Each box shall have not less than the volume required by NFPA 70 for number of conductors enclosed in box. Boxes for metallic raceways shall be listed for the intended use when located in normally wet locations, when flush or surface mounted on outside of exterior surfaces, or when located in hazardous areas. Boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. Boxes for mounting lighting fixtures shall be not less than 4 inches square, or octagonal, except smaller boxes may be installed as required by fixture configuration, as approved. Cast-metal boxes with 3/32 inch wall thickness are acceptable. Large size boxes shall be NEMA 1 or as shown. Boxes in other locations shall be sheet steel except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit and tubing or nonmetallic sheathed cable system, when permitted by NFPA 70. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers.

### 3.3.2 Brackets and Fasteners

Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screw or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. Penetration of more than 1-1/2 inches into reinforced-concrete beams or more than 3/4 inch into reinforced-concrete joists shall avoid cutting any main reinforcing steel. The use of brackets which depend on gypsum wallboard or plasterboard for primary support will not be permitted. In partitions of light steel construction, bar hangers with 1 inch long studs, mounted between metal wall studs or metal box mounting brackets shall be used to secure boxes to the building structure. When metal box mounting brackets are used, additional box support shall be provided on the side of the box opposite the brackets. This additional box support shall consist of a minimum 12 inch long section of wall stud, bracketed to the opposite side of the box and secured by two screws through the wallboard on each side of the stud. Metal screws may be used in lieu of the metal box mounting brackets.

### 3.3.3 Mounting in Walls, Ceilings, or Recessed Locations

In walls or ceilings of concrete, tile, or other non-combustible material, boxes shall be installed so that the edge of the box is not recessed more than 1/4 inch from the finished surface. Boxes mounted in combustible walls or ceiling material shall be mounted flush with the finished surface. The use of gypsum or plasterboard as a means of supporting boxes will not be permitted. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be mounted flush with the top of a block to minimize cutting of the blocks, and boxes shall be located horizontally to avoid cutting webs of block. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided.

### 3.3.4 Installation in Overhead Spaces

In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 24 inches from the box.

### 3.4 DEVICE PLATES

One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having rounded or beveled edges. Plates on finished walls shall be of satin finish corrosion resistant steel or satin finish chromium plated brass. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1/16 inch. The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and provided with a hinged, gasketed cover, unless otherwise specified.

### 3.5 RECEPTACLES

#### 3.5.1 Duplex, 20-ampere, 125 volt

Duplex receptacles shall be rated 20 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of ivory to match color of switch handles in the same room or to harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Only the top receptacle of a duplex receptacle shall be wired for switching application. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided as required by NFPA 70 and as indicated on the drawings.

#### 3.5.2 Weatherproof Applications

Weatherproof receptacles shall be suitable for the environment, damp or wet as applicable, and the housings shall be labeled to identify the allowable use. Receptacles shall be marked in accordance with UL 514A for the type of use indicated; "Damp locations", "Wet Locations", "Wet Location Only When Cover Closed". Assemblies shall be installed in accordance with the manufacturer's recommendations.

##### 3.5.2.1 Damp Locations

Receptacles in damp locations shall be mounted in an outlet box with a gasketed, weatherproof, cast-metal cover plate (device plate, box cover) and a gasketed cap (hood, receptacle cover) over each receptacle opening. The cap shall be either a screw-on type permanently attached to the cover plate by a short length of bead chain or shall be a flap type attached to the cover with a spring loaded hinge.

#### 3.5.2.2 Wet Locations

Receptacles in wet locations shall be installed in an assembly rated for such use whether the plug is inserted or withdrawn, unless otherwise indicated. In a duplex installation, the receptacle cover shall be configured to shield the connections whether one or both receptacles are in use.

### 3.6 WALL SWITCHES

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall be ivory. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than one switch shall be installed in a single-gang position. Switches shall be rated 20-ampere 120-volt for use on alternating current only.

### 3.7 SERVICE EQUIPMENT

Service-disconnecting means shall be of the enclosed molded-case main circuit breaker located in panelboard. When service disconnecting means is a part of an assembly, the assembly shall be listed as suitable for service entrance equipment. Enclosures shall be sheet metal with hinged cover for surface mounting unless otherwise indicated.

### 3.8 PANELBOARDS AND LOADCENTERS

Circuit breakers and switches used as a motor disconnecting means shall be capable of being locked in the open position. Door locks shall be keyed alike. Nameplates shall be as approved. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering. Busses shall be copper.

#### 3.8.1 Panelboards

Panelboards shall be circuit breaker or fusible switch equipped as indicated on the drawings.

### 3.9 UNDERGROUND SERVICE

Unless otherwise indicated, interior conduit systems shall be stubbed out 5 feet beyond the building wall and 2 feet below finished grade, for interface with the exterior service lateral conduits. Outside conduit ends shall be bushed when used for direct burial service lateral conductors. Outside conduit ends shall be capped or plugged until connected to exterior conduit systems. Underground service lateral conductors will be extended to building service entrance and terminated in accordance with the requirements of Section 16375A ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and NFPA 70.

#### 3.10 MOTORS

Each motor shall conform to the hp and voltage ratings indicated, and shall have a service factor and other characteristics that are essential to the proper application and performance of the motors under conditions shown or specified. Three-phase motors for use on 3-phase 208-volt systems shall have a nameplate rating of 200 volts. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40 degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual horsepower ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

### 3.11 MOTOR-DISCONNECT MEANS

Each motor shall be provided with a disconnecting means when required by NFPA 70 even though not indicated. For single-phase motors, a single or double pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

### 3.12 LIGHTING FIXTURES, LAMPS AND BALLASTS

This paragraph shall cover the installation of lamps, lighting fixtures and ballasts in interior or building mounted applications.

#### 3.12.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps installed and used for working light during construction shall be replaced prior to turnover to the Government if more than 15% of their rated life has been used. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer. 10% spare lamps of each type, from the original manufacturer, shall be provided.

#### 3.12.2 Lighting Fixtures

Fixtures shall be as shown and shall conform to the following specifications and shall be as detailed on the drawings. Illustrations shown on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar designs and equivalent energy efficiency, light distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved. In suspended acoustical ceilings with fluorescent fixtures, the fluorescent emergency light fixtures shall be furnished with self-contained battery packs.

##### 3.12.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

#### 3.12.2.2 Ceiling Fixtures

Ceiling fixtures shall be coordinated with and suitable for installation in, on or from the ceiling as shown. Installation and support of fixtures shall be in accordance with NFPA 70 and manufacturer's recommendations. Where seismic requirements are specified herein, fixtures shall be supported as shown or specified. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling, in conformance with UL Elec Const Dir. Surface-mounted fixtures shall be suitable for fastening to the ceiling panel structural supports.

#### 3.12.2.3 Fixtures for Installation in Grid Type Ceilings

Fixtures for installation in grid type ceilings which are smaller than a full tile shall be centered in the tile. 1 by 4 foot fixtures shall be mounted along the grid rail as shown. Work above the ceiling shall be coordinated among the trades to provide the lighting layout shown. Fixtures mounted to the grid shall have trim exactly compatible with the grid. Contractor shall coordinate trims with ceiling trades prior to ordering fixtures. Metric fixtures shall be designed to fit the metric grid specified. Fixtures in continuous rows shall be coordinated between trades prior to ordering. Fixtures shall be mounted using independent supports capable of supporting the entire weight of the fixture. No fixture shall rest solely on the ceiling grid. Recessed fixtures installed in seismic areas should be installed utilizing specially designed seismic clips. See 13080 Seismic Protection for Miscellaneous Equipment. Junction boxes shall be supported at four points.

#### 3.12.2.4 Suspended Fixtures

Suspended fixtures shall be provided with swivel hangers or hand-straightens so that they hang plumb. Pendants, rods, or chains 4 feet or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degrees of separation. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 10 feet or as recommended by the manufacturer, whichever is less.

Suspended fixtures installed in seismic areas shall have 45% swivel hangers and shall be located with no obstructions within the 45% range in all directions. The stem, canopy and fixture shall be capable of 45% swing.

#### 3.12.3 Ballasts

Remote type ballasts or transformers, where indicated, shall be mounted in a well ventilated, easily accessible location, within the maximum operating distance from the lamp as designated by the manufacturer.

#### 3.12.4 Emergency Light Sets

Emergency light sets shall conform to UL 924 with the number of heads as indicated. Sets shall be permanently connected to the wiring system by conductors installed in short lengths of flexible conduit.

#### 3.13 EQUIPMENT CONNECTIONS

Wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits 6 feet or less in length shall be provided to all electrical equipment subject to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

#### 3.14 CIRCUIT PROTECTIVE DEVICES

The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they will function properly prior to the initial energization of the new power system under actual operating conditions.

#### 3.15 PAINTING AND FINISHING

Field-applied paint on exposed surfaces shall be provided under Section 09900 PAINTS AND COATINGS.

#### 3.16 REPAIR OF EXISTING WORK

The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Government.

#### 3.17 FIELD TESTING

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 30 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspection recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the Contractor.

##### 3.17.1 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

### 3.17.2 Ground-Resistance Tests

The resistance of each grounding electrode shall be measured using the fall-of-potential method defined in IEEE Std 81. Soil resistivity in the area of the grid shall be measured concurrently with the grid measurements.

Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.

### 3.17.3 Cable Tests

The Contractor shall be responsible for identifying all equipment and devices that could be damaged by application of the test voltage and ensuring that they have been properly disconnected prior to performing insulation resistance testing. An insulation resistance test shall be performed on all low and medium voltage cables after the cables are installed in their final configuration and prior to energization. The test voltage shall be 500 volts DC applied for one minute between each conductor and ground and between all possible combinations of conductors. The minimum value of resistance shall be:

$$R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 1000 / (\text{length of cable in feet})$$

Each cable failing this test shall be repaired or replaced. The repaired cable system shall then be retested until failures have been eliminated.

#### 3.17.3.1 Low Voltage Cable Tests

- a. Continuity test.
- b. Insulation resistance test.

### 3.17.4 Circuit Breaker Tests

#### 3.17.4.1 Circuit Breakers, Molded Case

- a. Insulation resistance test phase-to-phase, all combinations.
- b. Insulation resistance test phase-to-ground, each phase.
- c. Closed breaker contact resistance test.
- d. Manual operation of the breaker.

### 3.18 OPERATING TESTS

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph FIELD TEST REPORTS.

3.19 FIELD SERVICE

3.19.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHS format video tape of the entire training shall be submitted.

3.19.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of equipment, assist in the performance of the onsite tests, oversee initial operations, and instruct personnel as to the operational and maintenance features of the equipment.

3.20 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

-- End of Section --

**Amdt #0001**

SECTION 16710N

STRUCTURED TELECOMMUNICATIONS CABLING AND PATHWAY SYSTEM (AMDT 0001)  
**02/03**

PART 1 GENERAL

1.1 REFERENCES

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

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA) / ELECTRONIC  
INDUSTRIES ALLIANCE (EIA)

EIA-310-D	(1992) Cabinets, Racks, Panels, and Associated Equipment (ANSI/EIA/310-D)
EIA TIA-455-21-A	(1988) FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices
EIA TIA/EIA-492AAAA-A	(1998) 62.5-um Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (ANSI/TIA/EIA-492AAAA-A)
EIA TIA/EIA-526-7	(1998) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (ANSI/TIA/EIA-526-7)
EIA TIA/EIA-526-14A	(1998) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant (ANSI/TIA/EIA-526-14A)
EIA TIA/EIA-568-B.1	(2001; Addendum 2001) Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements (ANSI/TIA/EIA-568-B.1)
EIA TIA/EIA-568-B.2	(2001) Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components (ANSI/TIA/EIA-568-B.2)
EIA TIA/EIA-568-B.3	(2000; Addendum 2002) Optical Fiber Cabling Components Standard (ANSI/TIA/EIA-568-B.3)
EIA TIA/EIA-569-A	(1998; Addenda 2000, 2001) Commercial Building Standards for Telecommunications Pathways and Spaces (ANSI/TIA/EIA-569-A)
EIA TIA/EIA-606-A	(2002) Administration Standard for the Telecommunications Infrastructure (ANSI/TIA/EIA-606)

EIA TIA/EIA-607 (1994) Commercial Building Grounding and Bonding Requirements for Telecommunications (ANSI/TIA/EIA-607)

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 68.5 Establishment of Telephone Premises Wiring Attestation List

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-90-661 (2000) Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cable for Use in General Purpose and LAN Communications Wiring Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA WC 63.1 (2000) Twisted Pair Premise Voice and Data Communications Cables

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 444 (2002) Communications Cables

UL 467 (1993; R 2001) Grounding and Bonding Equipment

UL 514C (1996; R 2002) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

UL 910 (1998) Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air

UL 969 (1995; R 2001, Bul. 2001) Marking and Labeling Systems

UL 1863 (2000; Bul. 2001) Communications Circuit Accessories

1.2 RELATED REQUIREMENTS

Section 16415A, "Electrical Work, Interior" applies to this section with additions and modifications specified herein. The premises distribution shall consist of inside-plant horizontal, riser, and backbone cables and connecting hardware to transport telephone and data (including LAN) signals among equipment items in a building.

1.3 DEFINITIONS

1.3.1 Main Distribution Frame (MDF)

A physical structure at a central location for terminating permanent backbone cables to interconnect with service provider (SP) equipment at the activity minimum point of presence. The MDF generally includes vendor specific components to support voice and data circuits, building surge protector assemblies, main cross connect blocks, equipment support frames, and wood backboard (if MDF is wall mounted). The MDF is existing on this job.

#### 1.3.2 Building Distribution Frame (BDF)

A structure with terminations for connecting backbone, campus, and horizontal cabling. The BDF generally includes a cross connect, equipment support frame, and wooden backboard or terminal cabinet. The BDF shall include building protector assemblies when used for campus backbone or SP cabling. The BDF is existing on this job, contractor will be responsible for terminating a new 12 strand multi-mode fiber optic cable from a new IDF into the existing BDF.

#### 1.3.3 Intermediate Distribution Frame (IDF)

An intermediate termination point for horizontal wiring and cross connections within telecommunications closets or wiring closets. Contractor will be responsible for creating a new IDF in the new building. The IDF will be a fully enclosed "Data Cube" with 19" mounting rails.

#### 1.3.4 Telecommunications Closet

An enclosed space for telecommunications equipment, terminations, and cross-connect wiring for horizontal cabling.

#### 1.4 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

#### 1.5 SYSTEM DESCRIPTION

The structured telecommunications cabling and pathway system shall include permanently installed backbone and horizontal cabling, horizontal and backbone pathways, service entrance facilities, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting. The horizontal system includes the cabling and pathway between the telecommunications closet and the work area telecommunications outlet. The horizontal system shall be wired in a star topology with the IDF at the center or hub of the star. The backbone cabling and pathway system includes intrabuilding and interbuilding interconnecting cabling, pathway, and terminal hardware to provide connectivity between the MDF's, BDF's, and IDF's. The backbone system shall be wired in a star topology with the MDF at the center or hub of the star. Each network switch located in BDF's or IDF's will be connected to the MDF by fiber. Switches in BDF's or IDF's will not be connected to each other in the BDF or IDF. Each BDF and IDF must have adequate fiber to connect all switches to the MDF with 25% spare.

#### 1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as

otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications drawings; G, AO

Distribution frames; G, AO

SD-03 Product Data

Telecommunications cabling (backbone and horizontal); G, AO

Patch panels; G, AO

Telecommunications outlet/connector assemblies; G, AO

Equipment support frame; G, AO

Building protector assemblies; G, AO

Connector blocks; G, AO

Protector modules; G, AO

SD-06 Test Reports

Telecommunications cabling testing; G, AO

Factory reel tests; G, AO

Furnish factory reel tests for optical fiber cables.

SD-07 Certificates

Contractor Qualifications; G, AO

Manufacturer Qualifications; G, AO

Test plan; G, AO

SD-10 Operation and Maintenance Data

Telecommunications cabling and pathway system Data Package 5; G

Submit operations and maintenance data in accordance with Section 01781, "Operation and Maintenance Data" and as specified herein.

1.7 ADDITIONAL SUBMITTAL REQUIREMENTS

1.7.1 Telecommunications Drawings

Provide registered communications distribution designer (RCDD) approved drawings complete with wiring diagrams and details required to prove that the distribution system shall properly support connectivity from the telecommunications equipment room to telecommunications work area outlets. Show the entrance facility and layout of cabling and pathway runs, cross

connect points, MDF, BDF, IDF, grounding system, terminating block arrangements and type. Drawings shall depict final telecommunications cabling configuration, including location, color coding, gage, pair assignment, polarization, and terminating blocks layout at cross connect points and patch panels after telecommunications cable installation. Provide a plastic laminated schematic of the as-installed telecommunications cable system showing cabling, BDF's, IDF's, MDF's, and equipment rooms keyed to floor plans by room number. Mount the laminated schematic near the MDF as directed by the Contracting Officer.

#### 1.7.2 Distribution Frames

Provide shop drawing showing layout of applicable equipment including existing incoming cable stub or connector blocks, building protector assembly, outgoing cable connector blocks and existing equipment locations, spaces and racks.

#### 1.7.3 Qualifications

##### 1.7.3.1 Minimum Contractor Qualifications

Prior to installation, submit data of provider's experience and qualifications. All work under this section shall be performed by and all equipment shall be provided by a certified Telecommunications Contractor, hereinafter referred to as the Contractor. The Contractor shall have the following qualifications in Telecommunications Systems installation:

- a. Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.
- b. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products.
- c. All installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installation Technicians or have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components. Include names and locations of two projects successfully completed using optical fiber and copper communications cabling systems. Include written certification from users that systems have performed satisfactorily for not less than 18 months. Include specific experience in installing and testing structured telecommunications distribution systems using optical fiber and Category 5e or Category 6 cabling systems.

##### 1.7.3.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of 3 years experience in producing the types of systems and equipment specified.

#### 1.7.4 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the UTP and

optical fiber components and accessories 60 days prior to the proposed test date. Include procedures for certification, validation, and testing.

#### 1.7.5 Additions to Operation and Maintenance Manuals

In addition to requirements of Data package 5 for the telecommunications cabling and pathway system, include the requirements of paragraph entitled "Telecommunications Drawings."

#### 1.8 DELIVERY AND STORAGE

Provide protection from weather, moisture, dirt, dust, and other contaminants for telecommunications cabling and pathway equipment placed in storage.

### PART 2 PRODUCTS

#### 2.1 COMPONENTS

UL or third party certified. Provide a complete system of telecommunications cabling and pathway components using star topology and support structures, pathways, and spaces complete with conduits, pull wires, wireways, cable trays, terminal boxes, outlets, cables, and junction boxes. Fixed cables and pathway systems for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70.

#### 2.2 PATHWAYS (BACKBONE AND HORIZONTAL)

EIA TIA/EIA-569-A. Pathway shall be conduit, cable tray, underfloor duct, access floor, and wireway installations. Provide grounding and bonding as required by EIA TIA/EIA-607. Cable tray wiring shall comply with NFPA 70.

##### 2.2.1 Work Area Pathways

Comply with EIA TIA/EIA-569-A.

#### 2.3 TELECOMMUNICATIONS CABLING

Cabling shall be UL listed for the application and shall comply with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3 and NFPA 70. Provide a labeling system for cabling as required by EIA TIA/EIA-606-A and UL 969. Cabling manufactured more than 12 months prior to date of installation shall not be used.

##### 2.3.1 Backbone Cabling

###### 2.3.1.1 Backbone Copper

ICEA S-90-661, EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2 and UL 444, copper backbone cable shall be solid conductor, 24 AWG, 100 ohm, 100-pair UTP (Unshielded twisted pair), NFPA 70 CMR rated formed into 25 pair binder groups covered with a gray thermoplastic jacket. NFPA 70 type CMP may be substituted for type CMR. Pair twist lengths and frequency per unit length shall be determined by the manufacturer. A minimum of two conductor twists per foot is required. Color coding shall comply with industry standards for 25 pair cables.

###### 2.3.1.2 Backbone Optical Fiber

EIA TIA/EIA-492AAAA-A, EIA TIA/EIA-492CAAA, EIA TIA/EIA-568-B.3, and NFPA 70. Optical fiber cable shall be 62.5/125-um, 12-fiber multimode a nonconductive optical fiber riser cable (OFNR) rating. Nonconductive optical fiber riser cable may be substituted for type nonconductive optical fiber plenum cable (OFNP). The cable jacket shall be orange.

### 2.3.2 Horizontal Cabling

Comply with NFPA 70, NEMA WC 63.1, ICEA S-90-661 and performance characteristics in EIA TIA/EIA-568-B.1.

#### 2.3.2.1 Horizontal Copper

EIA TIA/EIA-568-B.2, NFPA 70, UTP (unshielded twisted pair), 100 ohm. Provide four each individually twisted pair, 24 AWG conductors, Category 6 general purpose (CMG) rated, with a blue PVC jacket. Plenum or riser (CMR) cable may be substituted for general purpose cable.

#### 2.3.2.2 Horizontal Optical Fiber

EIA TIA/EIA-492AAAA-A, EIA TIA/EIA-492CAAA, EIA TIA/EIA-568-B.3, and NFPA 70. Optical fiber cable shall be 62.5/125-um, 12-fiber multimode with a nonconductive optical fiber riser cable (OFNR) rating. Nonconductive optical fiber riser cable may be substituted for type nonconductive optical fiber plenum cable (OFNP). The cable jacket shall be orange.

## 2.4 DISTRIBUTION FRAMES

Provide building distribution frames (BDF's), intermediate distribution frames (IDF's), and main distribution frames (MDF's) as shown on design drawings for terminating and cross connecting permanent cabling.

### 2.4.1 Equipment Support Frame

EIA-310-D.

- a. Cabinets, wall-mounted modular type, 16 gauge steel construction treated to resist corrosion. Cabinet shall have have lockable front door, louvered side panels, 250 CFM cabinet top mounted fan, ground lug, and top and bottom cable access. Cabinet shall be provided with 3/4 inch plywood backboard, fire-rated or covered with two coats of gray or a lighter color fire retardant paint and shall be compatible with 19 inch panel mounting. All cabinets shall be keyed alike. A duplex AC outlet shall be provided within the cabinet. An AC outlet will be provided in the cabinet compatible for connection to a government provided UPS.

### 2.4.2 Connector Blocks

Insulation displacement Type 110 for Category 6 or higher systems. Provide blocks for the number of horizontal and backbone cables terminated on the block.

### 2.4.3 Patch Panels

Provide ports for the number of horizontal and backbone cables terminated on the panel plus 25 percent spare. Provide pre-connectorized Optical fiber and copper patch cords for patch panels. Provide patch cords with

duplex SC/ST connectors as specified. Patch cords shall meet minimum performance requirements specified in EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3 for cables and hardware specified.

#### 2.4.3.1 Modular to 110 Block Patch Panel

EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3. Panels shall be third party verified and shall comply with EIA/TIA Category 6 requirements. Panel shall be constructed of 0.09 inch minimum aluminum and shall be compatible with an EIA 19 inch equipment rack. Panel shall provide 48 non-keyed, RJ-45 ports, wired to T568B. Patch panels shall terminate the building cabling on 110-style insulation displacement connectors and shall utilize a printed circuit board interface. The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

#### 2.4.3.2 Fiber Optic Patch Panel

Provide panel for maintenance and cross-connecting of optical fiber cables. Panel shall be constructed of 0.09 inch minimum aluminum and shall be compatible with a EIA 19 inch equipment rack. Each panel shall provide 24 ST multimode adapters. Adapters shall utilize metallic alignment sleeves. Provide dust cover for all unused adapters. The rear of each panel shall have a cable management tray a minimum of 8 inches deep with removable cover, incoming cable strain-relief and routing guides. Panels shall have each adapter factory numbered and be equipped with laminated plastic nameplates above each adapter.

### 2.5 TELECOMMUNICATIONS OUTLET BOXES

Standard type 4 inches square by 2 1/8 inches deep. Mount flush in finished walls at height indicated. Outlet boxes for wall-mounted telephones shall be 2 by 4 by 2 1/8 inches deep; mounted at a height of 48 inches above finished floor. Depth of boxes shall be large enough to allow manufacturers' recommended conductor bend radii. Electrical boxes for fiber optic telecommunication outlets shall be 4-11/16 inch square by 2-1/8 inches deep with minimum 3/8 inch deep single or two gang plaster ring as shown and installed using a minimum 1 inch conduit system.

### 2.6 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

#### 2.6.1 Outlet/Connector Copper

Outlet/connectors shall comply with FCC Part 68.5, EIA TIA/EIA-568-B.1, and EIA TIA/EIA-568-B.2. UTP Outlet/connectors shall be UL 1863 listed, non-keyed, 4-pair, constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with EIA/TIA Category 6 requirements. Outlet/connectors provided for Category 6 UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a 110-style PC board connector, color-coded for both T568A and T568B wiring. Each jack shall be wired T568B. UTP outlet/connectors shall comply with EIA TIA-455-21-A for 500 mating cycles. UTP outlet/connectors installed in outdoor or marine environments shall be jell-filled type containing an anti-corrosive, memory retaining compound.

#### 2.6.2 Optical Fiber Adapters

Optical fiber adapters shall be suitable for ST style connectors. Adapters

shall utilize metallic alignment sleeves. Provide dust cover for all adapters.

### 2.6.3 Cover Plates

Telecommunications cover plates shall comply with UL 514C, and EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3; flush design constructed of high impact thermoplastic material. Stenciled lettering for voice and data circuits shall be provided using thermal ink transfer process.

### 2.6.4 Optical Fiber Distribution Panel

Wall mounted optical fiber distribution panel (OFDP) shall be constructed of 0.12509 inch minimum anodized aluminum. Panel shall be divided into two sections, distribution and user. Distribution section shall have strain relief, routing guides and shall be lockable, user section shall have a cover for patch cord protection. Each panel shall provide 12 ST adapters. Adapters shall utilize metallic alignment sleeves. Provide dust covers for all adapters.

### 2.6.5 Optical Fiber Connectors

EIA TIA-455-21-A. Optical fiber connectors shall be ST, epoxyless crimp style compatible with 62.5/125 multimode fiber. The connectors shall utilize a zirconia ceramic ferrule. The connectors shall provide a maximum attenuation of 0.3 dB @ 1300 nm with less than a 0.2 dB change after 500 mating cycles.

### 2.7 BACKBOARDS

Provide void-free, interior grade plywood 3/4 inch thick 4 by 4 feet. Backboards shall be fire rated or covered with two coats of gray or a lighter color, nonconductive, fire-retardant paint. Do not cover the fire stamp on the backboard.

### 2.8 TERMINAL CABINETS

Construct of zinc-coated sheet steel, 36 by 24 by 6 inches deep. Trim shall be fitted with hinged door and locking latch. Doors shall be maximum size openings to box interiors. Boxes shall be provided with 5/8 inch backboard with two-coat varnish finish. Match trim, hardware, doors, and finishes with lighting panelboards. Provide label and identification systems for telecommunications wiring consistent with EIA TIA/EIA-606-A.

### 2.9 GROUNDING AND BONDING PRODUCTS

Comply with UL 467, EIA TIA/EIA-607, and NFPA 70. Components shall be identified as required by EIA TIA/EIA-606-A. Ground rods shall be in accordance with Section 16415A, "Electrical Work, Interior."

### 2.10 FIRESTOPPING MATERIAL

Provide in accordance with Section 07840, "Firestopping."

### 2.11 NAMEPLATES

Provide nameplates for equipment cabinet doors in accordance with schedule provided on drawings, or schools existing identification scheme.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware shall be installed in accordance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3, EIA TIA/EIA-569-A, NFPA 70, and UL standards as applicable. Cabling shall be connected in a star topology network. Pathways shall be installed in accordance with the following minimum clearance distances of 4 feet from motors, generators, frequency converters, transformers, x-ray equipment or uninterruptible power system, 12 in from power conduits, panelboards, and cable systems, 5 inches from fluorescent or high frequency lighting system fixtures.

DDESS standards call for 12 Category 6 LAN outlets to be installed in each new classroom. Cables from new classrooms will be extended from faceplates to a new equipment cabinet located as indicated on drawings. A 12 strand multimode fiber optic cable will be run from a new patchpanel in the equipment cabinet to a new patchpanel that will be located in an existing BDF or IDF as indicated on the drawings. All conductors of any installed media shall be fully terminated and tested in accordance with these specifications.

#### 3.1.1 Cabling

Install Category 6 UTP and optical fiber telecommunications cabling and pathway system as detailed in EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3. Screw terminals shall not be used. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not untwist Category 6 UTP cables more than one half inch from the point of termination to maintain cable geometry. Provide service loop on each end of the cable, 10 ft. in the telecommunications closet, 3.3 ft in the work area outlet for optical fiber and 12 inches for UTP. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable bend radii shall not be less than four times the cable diameter.

##### 3.1.1.1 Open Cable

Use only where specifically indicated on plans for use in cable trays, or below raised floors. Comply with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3. Do not exceed cable pull tensions recommended by the manufacturer.

- a. Plenum cable shall be used where open cables are routed through plenum areas. Plenum cables shall comply with flammability plenum requirements of NFPA 70 and shall comply with UL 910.

##### 3.1.1.2 Backbone Cable

- a. Copper Backbone Cable. Copper cable between MDF, BDF, and IDF closets shall not be used.

- b. Optical fiber Backbone Cable. Install backbone optical fiber in indicated pathways. Do not exceed manufacturer's recommended bending radii and pull tension. Prepare cable for pulling by cutting outer jacket 10 inches leaving strength members exposed for approximately 10 inches. Twist strength members together and attach to pulling eye. Vertical cable support intervals shall be in accordance with manufacturer's recommendations.

#### 3.1.1.3 Horizontal Cabling

Install horizontal cabling and pathway as indicated on drawings between MDF, BDF, IDF, telecommunications closet and telecommunications outlet assemblies at workstations.

#### 3.1.2 Pathway Installations

Comply with EIA TIA/EIA-569-A. Conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of electrical power equipment, flues, steam, and hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit is visible after completion of project. Run conduits in crawl spaces and under floor slabs as if exposed. Install no more than two 90 degree bends for a single horizontal cable run.

##### 3.1.2.1 NOT USED

##### 3.1.3 NOT USED

#### 3.1.4 Service Entrance Conduit, Overhead

Galvanized rigid steel or IMC from service entrance to service entrance fitting or weatherhead outside of building.

##### 3.1.5 NOT USED

#### 3.1.6 Cable Hooks

Install cable hooks in accordance with EIA TIA/EIA-569-A. Only CMP and OFNP type cable shall be installed in a plenum.

#### 3.1.7 Work Area Outlets

##### 3.1.7.1 Terminations

Terminate UTP cable in accordance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3 and wiring configuration as specified.

##### 3.1.7.2 Faceplates

As a minimum, each jack shall be labeled as to its function and a unique number to identify cable link. Numbering scheme shall be coordinated with government representative to match existing schemes.

##### 3.1.7.3 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 6 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not

be exceeded.

#### 3.1.7.4 Pull Cords

Pull cords shall be installed in all conduit serving telecommunications outlets which do not initially have cable installed.

#### 3.1.8 Telecommunications Closet Termination

Install termination hardware required for Category 6 and optical fiber system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

#### 3.1.9 Equipment Support Frames

Install in accordance with EIA TIA/EIA-569-A:

- a. Cabinets, wall-mounted modular type. Mount cabinet to plywood backboard per manufacturer's recommendations. Mount cabinet so height of highest panel does not exceed 94 inches above floor.

#### 3.1.10 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings in accordance with Section 07840, "Firestopping."

#### 3.1.11 Grounding and Bonding

In accordance with EIA TIA/EIA-607, and NFPA 70.

### 3.2 LABELING

#### 3.2.1 Labels

All labels shall be in accordance with EIA TIA/EIA-606-A.

#### 3.2.2 Cable

All cables shall be labeled using color labels on both ends with unencoded identifiers per EIA TIA/EIA-606-A.

#### 3.2.3 Termination Hardware

All workstation outlets and patch panel connections shall be labeled using color coded labels with unencoded identifiers as per EIA TIA/EIA-606-A.

### 3.3 TESTING

#### 3.3.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests in accordance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3.

##### 3.3.1.1 Inspection

Visually inspect cabling jacket materials for UL or third party certification markings. Visually inspect UTP and optical fiber jacket

materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for tip and ring pin assignments, and inspect cabling connections to confirm compliance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, and EIA TIA/EIA-568-B.3. Visually confirm Category 6 marking of outlets, wallplates, outlet/connectors, and patch panels.

#### 3.3.1.2 Verification Tests

UTP copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connected. Perform 250 MHz near end cross talk (NEXT) and attenuation tests for Category 6 systems installations.

Perform optical fiber end to end attenuation tests using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures.

Perform tests in accordance with EIA TIA/EIA-526-14A, Method B for horizontal, multimode optical fiber and EIA TIA/EIA-526-7, Method B for backbone, single mode optical fiber. Perform verification acceptance tests and factory reel tests.

#### 3.3.1.3 Performance Tests

- a. Category 6 Links. Perform UTP link tests in accordance with EIA TIA/EIA-568-B.1, EIA TIA/EIA-568-B.2, EIA TIA/EIA-568-B.3. Tests shall include wire map, length, attenuation, NEXT, and propagation delay.
- b. Optical fiber Links. Perform optical fiber end to end attenuation tests and reel tests at jobsite.

#### 3.3.1.4 Final Verification Tests

Perform verification tests for UTP and optical fiber systems after the complete telecommunications cabling and outlet/connectors are installed. Connect to the network interface device at the demarcation point.

-- End of Section --