AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF PAGES
N/A	1	45

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. *(If applicable)*
0002	AUG 12, 2003	N/A	SPEC. NO. 1312

6. ISSUED BY CODE

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
SACRAMENTO, CALIFORNIA 95814-2922

7. ADMINISTERED BY *(If other than Item 6)* CODE

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS,LOS ANGELES DISTRICT
P.O. BOX 532711
LOS ANGELES, CALIFORNIA 90053-2325

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)*

CODE FACILITY CODE

(√) X

9A. AMENDMENT OF SOLICITATION NO.
DACA09-03-B-0009

9B. DATED *(SEE ITEM 11)*
N/A

10A. MODIFICATION OF CONTRACTS/ORDER NO.
N/A

10B. DATED *(SEE ITEM 13)*
N/A

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☒ is extended, ☐ is not extended.

Offers 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 1 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)*
N/A

NOTE: ITEM 13 BELOW IS N/A.

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. N/A
	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)* N/A

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

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

UAV Training Facility
Ft. Huachuca, AZ

NOTE: The Bid Opening is hereby extended to : 28 AUGUST 2003.

2 Encl

1. Revised Pages: Attachment No. 5, Section 02532, Section 11311, Section 11312, 13851-8, 13851-18, 16375-20, 16375-21, 16375-214, 16415-25
2. Revised Drawings: See Attachment No. 5 Drawing List (23 Drawings Revised)

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)*	
15B. CONTRACTOR/OFFEROR *(Signature of person authorized to sign)*	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY *(Signature of Contracting Officer)*	16C. DATE SIGNED

SCHEDULE OF DRAWINGS

SEQ. NO.	SHT. NO.	DRAWING TITLE	SEQ. NO.	SHT. NO.	DRAWING TITLE	SEQ. NO.	SHT. NO.	DRAWING TITLE	SEQ. NO.	SHT. NO.	DRAWING TITLE
		GENERAL	43	C1.52	NEW MAINTENANCE FACILITY, PAVING &	84	A3.03	MAINTENANCE OPERATIONS BUILDING SECTIONS	119	S5.06	TYPICAL STEEL COLUMN AND CMU WALL
1	G1.00	TITLE SHEET			GRADING PLAN	85	A3.04	AIB ANNEX SECTION AT SKYLIGHT			CONNECTION DETAILS
2	G2.00	SCHEDULE OF DRAWINGS	44	C1.53	NEW MAINTENANCE FACILITY, PARKING AREA, PAVING	86	A4.00	AIB ANNEX ENLARGED TOILET PLAN AND ELEVATIONS	120	S5.07	ENTRY CANOPY SECTION AND DETAILS
3	G2.01	SCHEDULE OF DRAWINGS			& GRADING PLAN	87	A4.01	MAINTENANCE FACILITY #2 AND MAINT. OPS. FACILITY	121	S5.08	FOUNDATION SECTIONS
4	G3.00	SITE AND VICINITY MAPS	45	C1.54	NEW AIB PARKING, PAVING & GRADING PLAN			TOILET PLANS AND ELEVATIONS	122	S5.09	TYPICAL CMU PILASTER DETAILS
			46	C1.55	NEW AIB BUILDING PAVING & GRADING PLAN	88	A4.02	FLIGHT OPERATIONS BUILDING ENLARGED TOILET			
		SURVEYS	47	C1.60	UTILITY PLAN, INDEX SHEET			PLAN & ELEVS.			PLUMBING
5	V1.00	INDEX	48	C1.61	RUGGE-HAMILTON, UTILITY PLAN	89	A5.00	SIGN SCHEDULES AND DETAILS	123	P0.00	PLUMBING LEGENDS, ABBREVIATIONS AND SYMBOLS
6	V1.01	TOPOGRAPHY	49	C1.62	NEW AIB ANNEX, UTILITY PLAN	90	A5.01	SIGN DETAILS	124	P1.01	HOT AND COLD WATER PLAN, WASTE PLAN, AIB ANNEX
7	V1.02	TOPOGRAPHY	50	C2.01	PROFILES	91	A5.02	ROOF DETAILS	125	P1.02	WASTE PLAN, FLIGHT OPERATIONS BUILDING
8	V1.03	TOPOGRAPHY	51	C2.02	PROFILES	92	A5.03	ROOF DETAILS	126	P1.02A	HOT COLD AND GAS PLAN, FLIGHT OPERATIONS BUILDING
9	V1.04	TOPOGRAPHY	52	C2.03	PROFILES	93	A5.04	CEILING AND MISCELLANEOUS DETAILS	127	P1.03	HOT, COLD AND GAS PLAN, WASTE PLAN
10	V1.05	TOPOGRAPHY	53	C5.01	PAVING DETAILS	94	A5.05	DOOR DETAILS			MAINTENANCE OPERATIONS BUILDING
11	V1.06	TOPOGRAPHY	54	C5.02	SITE DETAILS	95	A5.06	DOOR DETAILS	128	P1.04	HOT, COLD AND GAS PLAN, WASTE PLAN
12	V1.07	TOPOGRAPHY	55	C5.03	SITE DETAILS	96	A5.07	MISCELLANEOUS DETAILS			MAINTENANCE FACILITY #2 FLOOR PLAN
13	V1.08	TOPOGRAPHY	56	C5.04	UTILITY DETAILS	97	A5.08	MISCELLANEOUS DETAILS	129	P3.00	PLUMBING DETAILS
14	V1.09	TOPOGRAPHY	57	C5.05	FENCE DETAILS	98	A5.09	SEALANT DETAILS	130	P6.00	PLUMBING EQUIPMENT SCHEDULES
15	V1.10	TOPOGRAPHY	58	C5.06	GATE DETAILS	99	A6.00	AIB ANNEX EXTERIOR COLOR/FINISH SCHEDULE			
16	V1.11	TOPOGRAPHY				100	A6.01	RUGGE-HAMILTON EXTERIOR COLOR/FINISH SCHEDULE			MECHANICAL
17	V1.12	TOPOGRAPHY			LANDSCAPE ARCHITECTURE			& ABBREVIATIONS	131	M0.00	HVAC LEGENDS, ABBREVIATIONS AND SYMBOLS
18	V1.13	TOPOGRAPHY	59	L1.00	LANDSCAPE LAYOUT PLAN	101	A6.02	INTERIOR COLOR/FINISH SCHEDULE	132	M1.01	HVAC PLAN, AIB ANNEX
19	V1.14	TOPOGRAPHY	60	L1.01	LANDSCAPE ENTRY LAYOUT PLAN			AIB ANNEX & MAINTENANCE BUILDING #2	133	M1.02	HVAC PLAN, FLIGHT OPERATIONS BUILDING
20	V1.15	TOPOGRAPHY	61	L2.00	LANDSCAPE IRRIGATION LAYOUT PLAN	102	A6.03	INTERIOR COLOR/FINISH SCHEDULE	134	M1.03	HVAC PLAN, MAINTENANCE OPERATIONS BUILDING
21	V1.16	TOPOGRAPHY	62	L3.00	LANDSCAPE PLANTING PLAN			FLIGHT OPERATIONS BUILDING & MAINTENANCE	135	M1.04	HVAC PLAN, MAINTENANCE FACILITY #2
22	V1.17	TOPOGRAPHY	63	L5.00	LANDSCAPE IRRIGATION DETAILS I			OPERATIONS BUILDING	136	M3.00	AIB ANNEX MECHANICAL SECTION
23	V1.18	TOPOGRAPHY	64	L5.01	LANDSCAPE IRRIGATION DETAILS II	103	A6.04	DOOR SCHEDULES	137	M4.00	CONTROL LEGEND
24	V1.19	TOPOGRAPHY	65	L5.02	LANDSCAPE DETAILS I	104	A6.05	WINDOW SCHEDULE AND WINDOW DETAILS	138	M4.01	VAV SYSTEM CONTROLS SCHEMATIC, LADDER DIAGRAM
25	V1.20	TOPOGRAPHY	66	L5.03	LANDSCAPE DETAILS II						AND EQUIPMENT SCHEDULE
26	V1.21	TOPOGRAPHY						INTERIOR DESIGN	139	M4.02	EVAPORATIVE UNIT CONTROLS SCHEMATIC, LADDER
27	V1.22	TOPOGRAPHY			ARCHITECTURAL	105	I1.00	CERAMIC WALL TILE & FLOOR PATTERNS			DIAGRAM AND EQUIPMENT SCHEDULE
28	V1.23	TOPOGRAPHY	67	A1.00	AIB ANNEX FLOOR PLAN	106	I1.01	VINYL COMPOSITION TILE FLOOR PATTERNS	140	M4.02A	EVAPORATIVE UNIT CONTROLS SCHEMATIC, LADDER
29	V1.24	TOPOGRAPHY	68	A1.01	MAINTENANCE FACILITY #2 FLOOR PLAN						DIAGRAM AND EQUIPMENT SCHEDULE
30	V1.25	TOPOGRAPHY	69	A1.02	FLIGHT OPERATIONS BUILDING FLOOR PLAN			STRUCTURAL	141	M4.03	CHILLED WATER CONTROLS SCHEMATIC, LADDER
31	V1.26	TOPOGRAPHY	70	A1.03	MAINTENANCE OPERATIONS BUILDING FLOOR PLAN	107	S0.01	GENERAL STRUCTURAL NOTES AND DESIGN LOADS			DIAGRAM AND EQUIPMENT
32	V1.27	TOPOGRAPHY	71	A1.04	AIB ANNEX ROOF PLAN	108	S0.02	GENERAL STRUCTURAL NOTES AND ABBREVIATIONS	142	M4.04	MISCELLANEOUS CONTROLS
33	V1.28	TOPOGRAPHY	72	A1.05	MAINTENANCE FACILITY #2 ROOF PLAN	109	S1.00	FOUNDATION FLOOR PLAN AIB ANNEX	143	M5.00	HVAC DETAILS
34	V1.29	TOPOGRAPHY	73	A1.06	FLIGHT OPERATIONS BUILDING AND MAINTENANCE	110	S1.01	PRE-ENGINEERED MAINTENANCE FACILITY #2	144	M5.01	HVAC DETAILS
					FACILITY #2 ROOF PLANS			FOUNDATION FLOOR PLAN	145	M5.02	HVAC DETAILS
		CIVIL	74	A1.07	AIB ANNEX REFLECTED CEILING PLAN	111	S1.02	PRE-ENGINEERED FLIGHT OPERATIONS BUILDING	146	M5.03	HVAC DETAILS
35	C1.30	LEGEND AND ABBREVIATIONS	75	A1.08	MAINTENANCE FACILITY #2 REFLECTED CEILING PLAN			FOUNDATION FLOOR PLAN	147	M6.00	HVAC SCHEDULES
36	C1.32	RUGGE-HAMILTON DEMOLITION PLAN	76	A1.09	FLIGHT OPERATIONS BUILDING AND MAINTENANCE	112	S1.03	PRE-ENGINEERED MAINTENANCE OPERATIONS	148	M6.01	HVAC SCHEDULES
37	C1.40	SITE PLAN, INDEX SHEET			FACILITY #2 REFLECTED CEILING PLANS			BUILDING FOUNDATION FLOOR PLAN	149	M6.02	HVAC SCHEDULES
38	C1.41	RUGGE-HAMILTON, NEW MAINTENANCE FACILITY	77	A2.00	AIB ANNEX ELEVATIONS	113	S1.04	ROOF FRAMING PLAN AIB ANNEX			
		SITE PLAN	78	A2.01	MAINTENANCE FACILITY #2 ELEVATIONS	114	S5.01	TYPICAL CONCRETE DETAILS			FIRE PROTECTION
39	C1.42	RUGGE-HAMILTON, PARKING SITE PLAN	79	A2.02	FLIGHT OPERATIONS BUILDING ELEVATIONS	115	S5.02	TYPICAL CONCRETE MASONRY UNITS (CMU)	150	FP1.00	FIRE PROTECTION LEGEND, SCHEDULES AND NOTES
40	C1.43	AIB ANNEX BUILDING, SITE PLAN	80	A2.03	MAINTENANCE OPERATIONS BUILDING ELEVATIONS	116	S5.03	TYPICAL COLD-FORMED DETAILS & MISCELLANEOUS	151	FP1.01	FIRE PROTECTION PLAN, PRE-ENGINEERED
41	C1.50	PAVING & GRADING, INDEX SHEET	81	A3.00	AIB ANNEX BUILDING SECTIONS			FRAMING DETAILS			MAINTENANCE FACILITY #2
42	C1.51	NEW FLIGHT OPERATIONS BUILDING, PAVING	82	A3.01	MAINTENANCE FACILITY #2 BUILDING SECTIONS	117	S5.04	TYPICAL STEEL DECK DETAILS	152	FP1.02	FIRE PROTECTION PLAN, FLIGHT OPERATIONS BUILDING
		AND GRADING PLAN	83	A3.02	FLIGHT OPERATIONS BUILDING SECTIONS	118	S5.05	TYPICAL CONCRETE MASONRY (CMU)			

US Army Corps of Engineers
Sacramento District

REVISED DRAWINGS 8/08/03 CH

Designed by: J. NEUMYER
Dwn by: JFN
Reviewed by: J. SAX
Submitted by: /s/ Ralph Buell
Date: 07/02/03
Design file no: 223-25-624
Plot date: 05/25/03
Dwg scale: 1:1

DEPARTMENT OF THE ARMY
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SACRAMENTO, CALIFORNIA
SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 J STREET
SACRAMENTO, CA 95814-2922

FT. HUACHUCA ARIZONA
UAV TRAINING FACILITIES
SCHEDULE OF DRAWINGS

Sheet reference number: G2.00

AM-01

SCHEDULE OF DRAWINGS

SEQ. NO.	SHT. NO.	DRAWING TITLE	SEQ. NO.	SHT. NO.	DRAWING TITLE	SEQ. NO.	SHT. NO.	DRAWING TITLE	SEQ. NO.	SHT. NO.	DRAWING TITLE
		FIRE PROTECTION (CONTINUED)	181	E1.23	AIB ANNEX FIRE ALARM, IDS, AND PA FLOOR PLAN	215	E6.08	AIB ANNEX CABLE AND TRANSFORMER SCHEDULES			
153	FP1.03	FIRE PROTECTION PLAN, PRE-ENGINEERED	182	E1.24	AIB ANNEX LIGHTNING PROTECTION & GROUNDING PLAN			AND DETAILS			
		MAINTENANCE OPERATIONS BUILDING	183	E5.01	RUGGE-HAMILTON ELECTRICAL/COMMUNICATIONS	216	E6.09	AIB ANNEX PANEL SCHEDULES			
154	FP1.04	MAINTENANCE FACILITY #2			SITE DETAILS I	217	E6.10	AIB ANNEX FIRE ALARM RISER DIAGRAM			
155	FP5.00	FIRE PROTECTION DETAILS	184	E5.02	RUGGE-HAMILTON ELECTRICAL/COMMUNICATIONS	218	E6.11	AIB ANNEX CARD ACCESS CONTROL, IDS AND PA			
					SITE DETAILS II			RISER DIAGRAMS			
		ELECTRICAL	185	E5.03	RUGGE-HAMILTON GROUNDING DETAILS	219	E6.12	AIB ANNEX TELECOMMUNICATIONS RISER DIAGRAM			
156	E0.01	RUGGE-HAMILTON ELECTRICAL LEGEND	186	E5.04	RUGGE-HAMILTON LIGHTNING PROTECTION DETAILS						
157	E0.02	RUGGE-HAMILTON ELECTRICAL LEGEND & ABBREVIATIONS	187	E5.05	RUGGE-HAMILTON COMMUNICATIONS DETAILS I						
158	E0.03	AIB ANNEX ELECTRICAL LEGEND AND ABBREVIATIONS	188	E5.06	RUGGE-HAMILTON COMMUNICATIONS DETAILS II						
159	E1.01	ELECTRICAL SITE KEY PLAN	189	E5.07	RUGGE-HAMILTON LIGHTING FIXTURE SCHEDULE						
160	E1.02	RUGGE-HAMILTON ELECTRICAL SITE PLAN			AND DETAILS 1						
161	E1.03	RUGGE-HAMILTON FLIGHT OPERATIONS ELECTRICAL	190	E5.08	RUGGE-HAMILTON LIGHTING FIXTURE DETAILS I						
		SITE PLAN 1	191	E5.09	RUGGE-HAMILTON LIGHTING FIXTURE DETAILS II						
162	E1.04	RUGGE-HAMILTON MAINTENANCE OPERATIONS ELECTICAL	192	E5.10	AIB ANNEX ELECTRICAL AND COMMUNICATIONS SITE						
		SITE PLAN			DETAILS						
163	E1.05	RUGGE-HAMILTON MAINTENANCE FACILITY #2	193	E5.11	AIB ANNEX COMMUNICATIONS MANHOLE DETAILS						
		ELECTRICAL SITE PLAN	194	E5.12	AIB ANNEX PADMOUNTED AIR SWITCH AND ELECTRICAL						
164	E1.06	AIB ANNEX COMMUNICATIONS UPGRADE RUGGE-HAMILTON			MANHOLE DETAILS						
		ROAD SITE PLAN	195	E5.13	AIB ANNEX POWER DETAILS						
165	E1.07	AIB ANNEX ELECTRICAL AND COMMUNICATIONS SITE PLAN	196	E5.14	AIB ANNEX INSTRUCTOR'S CONTROL CONSOLE POWER						
166	E1.08	AIB ANNEX COMMUNICATIONS UPGRADE			CONTROL DETAILS						
		BLACK TOWER ROAD SITE PLAN II	197	E5.15	AIB ANNEX POWER AND COMMUNICATIONS SIMULATOR						
167	E1.09	AIB ANNEX COMMUNICATIONS UPGRADE			MULTI-OUTLET FLOOR BOX DETAILS						
		BLACK TOWER ROAD SITE PLAN I	198	E5.16	AIB ANNEX POWER AND COMMUNICATIONS CLASSROOM						
168	E1.10	AIB ANNEX BUILDING COMMUNICATIONS UPGRADE			MULTI-OUTLET WALL/FLOOR BOX DETAILS						
		PIONEER ROAD SITE PLAN	199	E5.17	AIB ANNEX FIRE ALARM AIR SAMPLING PIPING DETAILS						
169	E1.11	RUGGE-HAMILTON MAINTENANCE FACILITY #2	200	E5.18	AIB ANNEX LIGHTNING PROTECTION AND						
		POWER & SIGNAL FLOOR PLAN			GROUNDING DETAILS						
170	E1.12	RUGGE-HAMILTON MAINTENANCE OPERATIONS	201	E5.19	AIB ANNEX SIMULATOR ROOM FLUOURESCENT LIGHTING						
		POWER & SIGNAL FLOOR PLAN			CONTROL DETAILS						
171	E1.13	RUGGE-HAMILTON FLIGHT OPERATIONS 1	202	E5.20	AIB ANNEX SIMULATOR ROOM INCANDESCENT SPOT						
		POWER & SIGNAL FLOOR PLAN			LIGHTING CONTROL DETAILS						
172	E1.14	RUGGE-HAMILTON MAINTENANCE FACILITY #2	203	E5.21	AIB ANNEX LIGHTING FIXTURE SCHEDULE AND DETAILS						
		LIGHTING FLOOR PLAN	204	E5.22	AIB ANNEX LIGHTING FIXTURE DETAILS I						
173	E1.15	RUGGE-HAMILTON MAINTENANCE OPERATIONS	205	E5.23	AIB ANNEX LIGHTING FIXTURE DETAILS II						
		LIGHTING FLOOR PLAN	206	E5.24	RUGGE-HAMILTON LIGHTING FIXTURE DETAILS III						
174	E1.16	RUGGE-HAMILTON FLIGHT OPERATIONS	207	E6.00	RUGGE-HAMILTON ELECTRICAL ONE-LINE DIAGRAM						
		LIGHTING FLOOR PLAN	208	E6.01	RUGGE-HAMILTON PANEL-BOARD SCHEDULES						
175	E1.17	RUGGE-HAMILTON MAINTENANCE FACILITY #2	209	E6.02	RUGGE-HAMILTON LIFT STATION ELECTRICAL ONE-LINE						
		LIGHTNING PROTECTION AND STATIC GROUNDING PLAN			DIAGRAM 1						
176	E1.18	RUGGE-HAMILTON MAINTENANCE OPERATIONS	210	E6.03	RUGGE-HAMILTON LIFT STATION CONTROL DIAGRAM						
		LIGHTNING PROTECTION PLAN	211	E6.04	RUGGE-HAMILTON FIRE ALARM RISER DIAGRAM						
177	E1.19	RUGGE-HAMILTON FLIGHT OPERATIONS	212	E6.05	RUGGE-HAMILTON IDS, PA AND IC RISER DIAGRAMS						
		LIGHTNING PROTECTION PLAN	213	E6.06	RUGGE-HAMILTON TELECOMMUNICATIONS RISER						
178	E1.20	AIB ANNEX POWER FLOOR PLAN			DIAGRAM						
179	E1.21	AIB ANNEX COMMUNICATIONS FLOOR PLAN	214	E6.07	AIB ANNEX POWER ONE-LINE DIAGRAM						
180	E1.22	AIB ANNEX LIGHTING FLOOR PLAN									

US Army Corps of Engineers Sacramento District

Designed by: J NEUMYER
Dwn by: JFN
Reviewed by: J SAK
Submitted by: /S/ RALPH BUELL
Chief, Architectural Des. Sec.
Spec No.:
Date: 07/02/03
Design file no: 223-25-924
Drawing Code:
File name: W240-201XXX.dwg
Plot date: 06/20/03
Dwg scale: 1:1
Rev.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

Symbol | Description | Date | Approved
1 | REVISED DRAWINGS | 8/01/03 | GH

FT. HUACHUCA ARIZONA
UAV TRAINING FACILITIES
SCHEDULE OF DRAWINGS

Sheet reference number: G2.01

AM-01

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE WORK

SECTION 02532A

FORCE MAINS AND INVERTED SIPHONS; SEWER

-- End of Section Table of Contents --

SECTION 02532A

FORCE MAINS AND INVERTED SIPHONS; SEWER

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 PETROLEUM INSTITUTE (API)

API Spec 6D	(1994; Supple 1 Jun 1996; Supple 2 Dec 1997) Pipeline Valves (Gate, Plug, Ball, and Check Valves)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
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 2122	(1998) Determining Dimensions of Thermoplastic Pipe and Fittings
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 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 3035	(1995) Polyethylene (PE) Plastic Pipe

	(DR-PR) Based on Controlled Outside Diameter
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3308	(1997) PTFE Resin Skived Tape
ASTM D 3350	(1998a) Polyethylene Plastics Pipe and Fittings Materials
ASTM D 4101	(1999) Propylene Plastic Injection and Extrusion Materials
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C105	(1993) Polyethylene Encasement for Ductile-Iron Pipe Systems
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 C115	(1996) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C203	(1997) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C210	(1997) Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C500	(1993; C500a) Metal-Seated Gate Valves for Water Supply Service

AWWA C508	(1993; C508a) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C600	(1993) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C900	(1997; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA TRD	(1997) Thrust Restraint Design for Ductile Iron Pipe

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

MSS SP-78	(1998) Cast Iron Plug Valves, Flanged and Threaded Ends

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-06 Test Reports

Hydrostatic Tests; G.

Copies of test results.

1.3 DELIVERY AND STORAGE

Pipe, fittings and accessories, and pipe coatings shall not be damaged during delivery, handling, and storage.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

Piping less than 4 inches in diameter inside pump stations shall be galvanized steel. Piping for force mains4 inches in diameter and larger shall be PVC plastic. Piping 4 inches in diameter and larger inside pump stations shall be ductile iron pipe with bolted flange joints. Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 PE Pipe

ASTM D 3350 and ASTM D 3035, minimum pressure rating of 100 psi at 73.4 degrees F.

2.1.1.2 Polypropylene Pipe

ASTM D 2122 and ASTM D 4101.

2.1.1.3 PVC Pipe

b. PVC Pipe and Fittings 4 inches Diameter and Larger: AWWA C900, Class 150, with push-on joints.

2.1.2 Ductile Iron Pipe

a. Ductile Iron Pipe: AWWA C151, working pressure not less than 150 psi, unless otherwise shown or specified.

b. River Crossing Pipe: AWWA C151, minimum thickness Class 54 with joints in compliance with applicable requirements of AWWA C110.

c. Fittings, Mechanical: AWWA C110, rated for 150 psi.

d. Fittings, Push-On: AWWA C110 and AWWA C111, rated for 150 psi.

2.2 JOINTS

2.2.1 PE Piping

a. Heat Fusion Joints: ASTM D 2657.

b. Flanged Joints: ASME B16.1 or AWWA C207.

c. Mechanical Joints: ASME B16.1.

2.2.2 Polypropylene Piping

Heat Fusion Joints: ASTM D 2657.

2.2.3 PVC Piping

a. Screw Joint Fittings: ASTM D 2464, Schedule 80.

b. Push-On Joint Fittings: ASTM D 3139, with ASTM F 477gaskets.

c. Solvent Cement: ASTM D 2564.

d. Couplings for use with plain end pipe shall have centering rings or stops to ensure the coupling is centered on the joint.

2.3 VALVES

2.3.1 Gate Valves

Gate valves 3 inches and larger shall comply with AWWA C500. Valves for buried service shall be non-rising stem (NRS), 2 inch square nut operated with joints applicable to the pipe or installation. Buried valves shall be furnished with extension stems comprising socket, extension stem and operating nut, and shall be of an appropriate length to bring operating nut to within 6 inches of grade. One 4 foot "T" handle valve wrench shall be furnished for each quantity of 6 buried valves. Gate valves that are

exposed or installed inside shall be outside screw and yoke (OS&Y), handwheel operated with flange ends unless otherwise indicated. Gate valve operating nuts and handwheels shall have an arrow and the word "OPEN" cast in raised letters to indicate the direction of opening.

2.3.2 Check Valves

Check valves shall permit free flow of sewage forward and provide a positive check against backflow. Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. The body shall be iron. The manufacturer's name, initials, or trademark and also the size of the valve, working pressure, and direction of flow shall be directly cast on the body.

a. Ball Check Valves shall be iron body, shall have flanged ends, and shall be the non-slam type. Flanges shall be the 125 pound type complying with ASME B16.1. Ball shall be stainless steel unless otherwise specified.

b. Swing Check Valves shall comply with AWWA C508 and shall be iron body, bronze mounted, and shall have flanged ends. Flanges shall be the 125 pound type complying with ASME B16.1.

2.3.3 Air Release Valves

Air release valves shall be designed to permit release of air from an empty pipe during filling and shall be capable of discharging accumulated air in the line while the line is in operation and under pressure. Valves shall be attached by means of threaded pipe connections. Valves shall be vented to the atmosphere.

a. Manual Air Release Valves: Manual air release valves shall consist of a 3 inch gate valve and 3 inch ductile iron pipe and fittings. The valve shall be installed with its line of flow in the horizontal position.

b. Automatic Air Release Valve: Automatic air release valves shall be of the compound lever type capable of withstanding operating pressures of 150 psi. The valves shall have a 1/2 inch outlet. The body and cover of the valve shall be of iron with a stainless steel float. All internal parts shall be stainless steel or bronze. The valve shall be specifically adapted for use with sewage. Each valve shall be complete with hose and blow-off valves to permit backflushing without dismantling the valve.

2.4 VALVE BOXES

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

2.5 VALVE VAULTS

Valve vaults shall be precast concrete units conforming to ASTM C 478.

2.6 MISCELLANEOUS MATERIALS

Miscellaneous materials shall comply with the following requirements:

2.6.1 Pipe Coatings and Linings

a. Steel, interior: AWWA C203 or AWWA C210.

b. Steel, exterior, buried: AWWA C203.

c. Steel, exterior, exposed: AWWA C210.

2.6.2 Joint Lubricants

Joint lubricants shall be as recommended by the pipe manufacturer.

2.6.3 Bolts, Nuts and Glands

AWWA C111.

2.6.4 Joint Compound

A stiff mixture of graphite and oil or inert filler and oil.

2.6.5 Joint Tape

ASTM D 3308.

2.6.6 Bond Wire

Bond wire type RHW or USE, Size 1/0 AWG, neoprene jacketed copper conductor shaped to stand clear of the joint.

PART 3 EXECUTION

3.1 INSTALLATION

Pipe, pipe fittings, and appurtenances shall be installed at the locations indicated. Excavation, trenching, and backfilling shall be as specified in Section 02316 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS.

3.1.1 Adjacent Facilities

Installation of force mains and inverted siphons near adjacent facilities shall be as specified in Section 02531 SANITARY SEWERS.

3.1.2 Cutting

Pipe shall be cut in a neat manner with mechanical cutters. Wheel cutters shall be used where practicable. Sharp and rough edges shall be ground smooth and loose material removed from the pipe before laying.

3.1.3 Laying

Except where otherwise authorized, pipe shall be laid with bells facing the direction of laying. Before lowering and while suspended, the pipe shall be inspected for defects. Defective material shall be rejected. Pipe shall be laid in compliance with the following:

d. Polyvinyl Chloride: Manufacturer's instructions.

e. Polyethylene: ASTM D 2774.

f. Polypropylene: ASTM D 2774.

3.1.4 Jointing

3.1.4.1 Joints for PE Pipe

Heat fusion joints shall comply with the manufacturer's instructions concerning equipment, temperature, melt time, heat coat, and joining time. Flanged and mechanical joints shall be made in compliance with the manufacturer's instructions.

3.1.4.2 Joints for Polypropylene Pipe

Heat fusion joints shall comply with the manufacturer's instructions concerning equipment, temperature, melt time, heat coat, and joining time.

3.1.4.3 Joints for PVC Pipe

a. 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 joint 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.

b. 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. The gasket shall remain in proper position in the bell or coupling while the joint is made.

c. Solvent-weld joints shall comply with the manufacturer's instructions.

3.1.4.4 Joints for Ductile Iron Pipe

Installation of mechanical and push-on type joints shall comply with AWWA C600 and the manufacturer's instructions. Installation of flanged joints shall comply with manufacturer's instructions.

3.1.5 Coating and Lining

Field coating of non-galvanized steel pipe shall comply with AWWA C203. The applied materials shall be tested by means of a spark-type electrical device in compliance with AWWA C203. Flaws and holidays in the coating or lining of the pipe and the pipe joints shall be repaired; the repaired areas shall be at least equal in thickness to the minimum required for the pipe.

3.1.6 PE Pipe Encasement

Encasement shall be in accordance with AWWA C105.

3.1.7 Installation of Valves

Prior to installation, valves shall be cleaned of all foreign matter and inspected for damage. Valves shall be fully opened and closed to ensure that all parts are properly operating. Valves shall be installed with the stem in the vertical position. .

3.1.8 Installation of Valve Boxes

Valve boxes shall be installed over each outside gate valve, unless otherwise indicated. Valve boxes shall be centered over the valve. Fill shall be carefully tamped around each valve box to a distance of 4 feet on all sides or to undisturbed trench face, if less than 4 feet.

3.1.9 Installation of Valve Vaults

Valve vaults shall be installed as indicated.

3.1.10 Drain Lines

Drain lines shall be installed where indicated. The drain line shall consist of a tee in the main line with a 4 inch diameter branch, a 4 inch diameter elbow, and a 4 inch gate valve.

3.1.11 Thrust Restraint

Thrust Restraint shall be as specified in Section 02510 WATER DISTRIBUTION SYSTEM. Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, shall be provided with thrust restraint. 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.

3.1.11.1 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 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 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.

3.1.11.2 Restrained Joints

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

3.1.12 Grout

Grout for exterior joint protection on concrete pipes shall be a mix of 1 part portland cement, 2 parts sand, and of sufficient liquid consistency to flow into the joint recess beneath the diaper. Grout for interior joint protection shall be a mix of 1 part portland cement and 1 part sand. A polyurethane foam loop, impregnated with portland cement, may be substituted for grout for exterior joints.

3.1.13 Bonded Joints

Where indicated, a metallic bond shall be provided at each joint, including joints made with flexible couplings or rubber gaskets, of ferrous-metallic piping to effect continuous conductivity. The bond shall be of the thermal-weld type.

3.2 HYDROSTATIC TESTS

The pipeline shall be subjected to both a pressure test and a leakage test. The method proposed for disposal of waste water from hydrostatic tests shall be approved by the Contracting Officer. Testing shall be the responsibility of the Contractor. The Contracting Officer shall be notified at least 7 days in advance of equipment tests. The final test report shall be delivered to the Contracting Officer within 30 days of the test.

3.2.1 Pressure Test

After the pipe has been installed, joints completed, thrust blocks have been in place for at least five days, and the trench has been partially backfilled, leaving the joints exposed for examination, the pipe shall be filled with water to expel all air. The pipeline shall be subjected to a test pressure of 100 psi or 150 percent of the working pressure, whichever is greater, for a period of at least one hour. Each valve shall be opened and closed several times during the test. The exposed pipe, joints, fitting, and valves shall be examined for leaks. Visible leaks shall be stopped or the defective pipe, fitting, joints, or valve shall be replaced.

3.2.2 Leakage Test

The leakage test may be conducted subsequent to or concurrently with the pressure test. The amount of water permitted as leakage for the line shall be placed in a sealed container attached to the supply side of the test pump. No other source of supply will be permitted to be applied to the pump or line under test. The water shall be pumped into the line by the test pump as required to maintain the specified test pressure as described for pressure test for a 2 hour period. Exhaustion of the supply or the inability to maintain the required pressure will be considered test failure. PE pipe can experience diametric expansion and pressure elongation during initial testing. The manufacturer shall be consulted prior to testing for special testing considerations. Allowable leakage shall be determined by the following I-P formula:

L = NDP/K Where:

L = Allowable leakage in gallons per hour.

N = Number of joints in length of pipeline tested.

D = Nominal diameter of the pipe in inches.

P = Square root of the test pressure in psig.

K = 7400 for pipe materials.

At the conclusion of the test, the amount of water remaining in the container shall be measured and the results recorded in the test report.

3.2.3 Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted until the results of the tests are within specified allowances, without additional cost to the Government.

-- End of Section --

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DIVISION 11 - EQUIPMENT

SECTION 11311

OIL/WATER SEPARATOR

SECTION 11311

OIL/WATER SEPARATOR

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 PETROLEUM INSTITUTE

API Publication 421	Design and Operation of Oil-Water Separators

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1997) Standard Specification for Carbon Structural Steel
ASTM E 165	(1995) Standard Test Method for Liquid Penetration Examination

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1996) Structural Welding Code - Steel

FEDERAL SPECIFICATIONS (FS)

FS SS-S-210	(Rev. A Reinst) Sealing Compound, Preformed Plastic for Expansion Joints and Pipe Joints

1.2 SYSTEM DESCRIPTION

The Contractor shall furnish and install an above grade prefabricated oil/water separator with an integral oil storage reservoir. The separator shall comply with the requirements of this specification and shall be approved by the Contracting Officer's representative. The separator shall be comprised of a tank with an inlet compartment, oil separation compartment with parallel plates, an integral oil storage compartment or area, and an outlet compartment. The tankage shall be rectangular in shape and shall be installed completely above grade. Cylindrical separators with manway access shall not be acceptable. The physical size and capacity of the separator required by these specifications may not match the manufacturer's stated nominal capacity. Oil/water/sediment separator design shall be in accordance with design principles commonly accepted for sedimentation or clarification chambers at wastewater treatment plants and API Publication 421.

1.2.1 Applications

The separator shall remove free oil (60 microns) and larger and suspended solids from oil-in-water mixtures originating from aircraft rinsing operations. The influent oil-in-water mixture will be pumped to the unit. The oil-water separator shall be sized or selected to treat the influent wastewater to meet treatment performance requirements. No separator shall be acceptable that requires the use of oleophilic filters, chemical additives, adsorbent additives, or any other motorized or chemical mechanical aid.

1.2.2 Influent Characteristics

Provide oil-water separator designed as specified above for a maximum nominal flow of 120 gallons per minute (gpm). Design flows shall not assume the provision of any flow restriction device; flow restriction devices are specifically prohibited from separator design. Design minimum operating temperatures of the influent oil-in-water mixture will be 45 degrees F and ambient air temperatures will range from 30 to 95 degrees F during operation. The design specific gravity of the heaviest oil at operating oil-water temperatures will be 0.93 and the total grease and oil concentration ranges from 0 to 2000 milligrams per liter (mg/L). The design oil globule diameter shall be 60 microns or smaller. The specific gravity of the water at design operating temperature will be 0.9998. The average specific gravity of the suspended solids is 2.5. The influent is further characterized as follows:

Oil-in-Water Mixture	Minimum		Maximum
Total suspended solids	50	to	500 mg/L
pH	6.5	to	8.0

Detergents shall not be used.

1.2.3 Performance Requirements

The grease and oil concentration in the effluent from the oil-water separator shall not exceed the following limitations:

Contaminants	Maximum
Total grease and oil, 30-day average	15 mg/L
Total grease and oil, daily maximum	30 mg/L

In addition, there shall be no ongoing or frequently recurring visible sheen in the effluent.

1.2.4 Maintenance and Operational Requirements

The oil/water separator shall be designed and installed in a manner which allows visual inspection of all internal components from outside the tank. The separator shall be accessible to the "owner" or "operator" for visual and physical inspections without requirement for mechanical or other physical devices to gain access, i.e., covers or grates shall be removable in whole or in segments which do not exceed 75 pounds in weight. All components shall be readily removable for inspection, repair and maintenance without requirement for reinforcing the tank or container which constitutes the oil/water separator. The unit shall be designed such that

it is structurally sound without liquid in the separator. Components such as parallel plate packs or configurations, and other components for which routine servicing is likely to be required shall be removable by hoisting from the separator in units or "packs" which are amenable to cleaning. The separator shall be designed such that standard components are available and can be installed without modification to the separator. This includes parallel plate packs, oil removal system components, weirs, and all other components which can reasonably be assumed to fail over the operational life of the separator.

1.2.5 Product Recovery

Design shall be such that product recovery can be conveniently accomplished from grade level without service personnel entering the separator. The Contractor shall provide an estimate as to man hours and equipment required for product recovery. Provisions for dewatering of the separator will allow dewatering from grade level by either gravity flow or pumping with owner supplied equipment. Dewatering provisions will assume at least weekly access, and the manufacturer/supplier will provide an estimate as to the man hours and equipment required for the dewatering operation.

Oil and other liquid products which separate from water and accumulate at the operating surface of the separator shall be recovered from the surface by methods which have proven successful for applications like those described herein. Static or stationary oil overflow systems will not be acceptable if variations in wastewater flow are anticipated to cause variations in operating level within the separator. This category of oil removal systems includes those which are of the standpipe, weir styles, and others which are set at a fixed level and incapable of continuous variation when the separator is in operation.

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-01 Data

Data; .

a. Separator;

An analysis which supports the separator design to meet the specified performance shall be submitted. The analysis shall indicate the minimum detention time at the design flow, the calculated overflow rate, the required square feet of projected plate area (square meters) to achieve the specified performance under laminar flow condition. Calculations shall take into account the rate of flow, influent concentrations, oil globule characteristics, fluid temperature, fluid specific gravities, and pH.

b. Accessory equipment;

Data which consists of calculations, and equipment descriptions for the oil-water separator system.

SD-04 Drawings

Drawings; G.

a. Separator;

Submit shop drawings for separator and accessory equipment including principal dimensions, location of fittings, weirs, baffles, foundations, oil storage, and oil removal equipment or methods.

Drawings for separator and accessory equipment shall demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, including principal dimensions, location of fittings, and unit foundation.

SD-06 Instructions

Instructions; G.

a. Separator System;

Proposed instructions describing the installation and operation of the system. Methods of product recovery and estimates as to man hours and equipment required for product recovery will be included.

SD-09 Reports

Reports; .

a. Shop hydrostatic test;

b. Field Inspection

c. Field hydrostatic test

d. Pre operational test

e. In-service test

Test reports in booklet form showing the results of factory tests performed and tests performed to adjust each component following the installation of the system and the field tests performed to prove compliance with the specified performance criteria.

SD-13 Certificates

Certificates; .

a. Separator Corrosion Protection;

Submit written verification on the fabricator's letterhead that surface preparation and coating application were performed in accordance with the manufacturer's printed recommendations for the coating system.

SD-19 Operation and Maintenance Manuals

Operation and Maintenance Manuals; .

a. Separator system;

b. Accessory equipment;

Six copies of operating and maintenance instructions shall be prepared by the manufacturer. These instructions shall outline the step-by-step procedures required for system startup, operation and shutdown, routine maintenance, possible breakdowns and repairs, and troubleshooting. These instructions shall include the manufacturer's name model number, service manual parts list, and brief description of the equipment and their basic operating features. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS," name and location of the facility, name of the Contractor, and contract number. The Contractor shall provide an estimate of the man hours and equipment required for routine maintenance and product recovery which is specific to the application anticipated. Appropriate cleaning methods for plates shall be described in detail.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage; unload and store with minimum handling. Store materials on-site in enclosures or under protective coverings. Protect materials not suitable for outdoor storage to prevent damage during periods of inclement weather, such as subfreezing temperatures, precipitation, and high winds. Store materials susceptible to deterioration by direct sunlight under cover and avoid damage due to high temperatures. Do not store materials directly on ground. If special precautions are required, prominently and legibly stencil instructions for such precautions on outside of equipment or its crating.

1.4.2 Handling

Handle separator in such a manner as to ensure delivery to final location in sound, undamaged condition. Take special care not to damage interior and exterior surfaces of separator or any of the critical components of the system which affect separator performance. Make satisfactory repairs to damaged materials at no cost to Government. Carry and do not drag materials.

PART 2 PRODUCTS

2.1 STEEL SEPARATOR

Use 3/16-inch minimum thick carbon steel conforming to ASTM A 36. More material having equivalent structural properties and corrosion resistance for tank, hoppers, stationary and adjustable weirs, nozzles, flow distributor and energy dissipator device, seals, and tank cover(s). Weld in accordance with AWS D1.1 to provide watertight tank that will not warp or deform under load. Use welders qualified in accordance with AWS Standard Qualification Procedure. Grind welds smooth and remove weld spatter. Fabricate free of kinks and sharp bends in a manner not to reduce the strength of steel to a value less than that intended by the design. Size and shape of bends shall be uniform. Bolts, stiffeners, washers, nuts, screws, pins, and fittings as required shall be 304 stainless steel. Clean and finish carbon steel surfaces as described in paragraph entitled "Separator Corrosion Protection".

2.1.1 Separator Corrosion Protection

The protection shall consist of a Protective Coating, U.L.-Listed Dielectric Bushings and Cathodic Protection. External tank surfaces and appurtenances shall be resistant to corrosion from the in situ soil, backfill material, groundwater, and surface runoff. Parallel plate material and orientation shall enhance oil coalescence and solids removal, and be corrosion and chemically resistant to the oil-in-water mixture and atmosphere as specified in paragraph entitled, "SYSTEM DESCRIPTION".

a. Protective Coating. After shop conducted hydrostatic tests have been successfully completed, provide a manufacturer's standard coating system to the interior and exterior surfaces of the separator. Prior to shop painting, abrasive blast clean the surfaces in accordance with SSPC SP 10 to a surface profile of 1 to 2 1/2 mils. Total dry film thickness of coating system shall not be less than 9 mils. Repair and replace areas of the coating system which are found to be damaged or defective upon delivery of equipment to the site or found to be defective due to work of the applicator.

b. Cathodic Protection. Provide cathodic protection with test stations as specified in Section 16640, "CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

2.2 SEPARATORS OTHER THAN STEEL

Separators constructed of reinforced fiberglass may be provided in lieu of carbon steel. Provide fiberglass tanks with lifting straps. Glass fiber reinforced plastic weirs may be accepted as a suitable weir and baffle material provided that necessary requirements for anchorage of these items include provisions for contraction and expansion. Surfaces shall be seamless, chemically resistant to oil-in-water mixture, and resistant to ultraviolet deterioration. Preserve wood components prior to applying resin laminates to prevent deterioration.

2.2.1 Protective Coating for Other than Steel Separator

After shop conducted hydrostatic tests and have been successfully completed, provide a coating system which will protect the separator from the oil-in-water mixture, in situ soil, and ground water.

2.3 TANK

Parts subject to wear or requiring adjustment, inspection, cleaning or repairs hall be accessible and capable of convenient removal when required. Provide tank to withstand hydraulic and soil loadings under static and dynamic conditions while empty and during operating conditions. Submit calculations certified by a structural engineer that below grade separator tanks are designed to withstand the burial depth indicated on the drawings or encountered in the field and are provided with holddown pad and other accessories necessary to withstand static and dynamic hydraulic and soil loadings while empty and during operating conditions. Provide adequate support for additional loadings from tank appurtenances including weirs, hoppers, internal supports, parallel plate oil coalescers, equipment transportation, and rapid lowering and braking of load during handling operations. Bolt the tank and accessories to weld-fabricated, structural steel skid base, or mount on manufacturer's standard base. Submit for approval, separator shop drawings which indicate the components of the separator including anchorage details.

2.3.1 Lifting Mechanism

Fit tank with lifting lugs, straps, or supports for handling and installation. Each lifting mechanism shall carry the total dry weight of the tank and attendant appurtenances. Prominently display lifting instructions on a plate located on the outside of the tank.

2.3.2 Connections

As a minimum, fit tank with the connections specified. Other connections are allowable, depending on the equipment supplied and as is standard with the manufacturer.

Connection	Inside Diameter (in.)(mm)	No. Required
Influent	4 (200)	1
Effluent	4 (200)	1
Vent	2 (50)	1

2.4 WEIRS

Attach stationary weirs and adjustable weir supports to tank side walls to provide a watertight seal between adjoining compartments and trough to prevent hydraulic short-circuiting. Use carbon steel for weir plates and baffles. Provide sharp crested weirs of size and section specified by manufacturer. Provide slotted holes in weir plates and baffles or supports to permit horizontal and vertical adjustment of weir or baffle. Use non deteriorating sealant or gaskets for mounting weir plates. Fill voids between tank wall and weir plate with sealant to make watertight.

2.5 TANK DRAINAGE

Provide low points for dewatering tank.

2.6 IDENTIFICATION PLATES

Provide identification and instruction plates necessary data stamped on the plate. Securely affix plates, in prominent location, to tank with nonferrous screws or bolts of not less than 1/8-inch in diameter.

2.7 INSTRUCTION PLATES

Instruction plates shall describe special or required procedures to operate and service equipment, and shall include warnings of hazardous procedures and notice of safety and health requirements. Plates shall be durable and legible throughout equipment life and shall be mounted near tank.

2.8 WARNING STAGE

On entrances to the tank place a permanent sign which states the following: "DO NOT ENTER TANK OR PERFORM HOT WORK ON OR IN TANK UNTIL THE ATMOSPHERE HAS BEEN TESTED AND CERTIFIED GAS FREE AND SAFE".

2.9 INLET COMPARTMENT

Provide inlet compartment of sufficient volume to effectively reduce influent settleable solids and dissipate energy. Provide an inlet compartment with a minimum below water volume of 15 cubic feet. Provide

nonclogging flow distributor and energy dissipator device. Locate adjustable, primary surface oil overflow weir and sample ports as recommended by the manufacturer. The inlet compartment shall be easily accessible with removable panels to allow maintenance personnel visual inspection of the inlet compartment without entering the separator.

2.10 OIL SEPARATION COMPARTMENT

2.10.1 General

The maximum surface loading rate for the oil separation compartment shall be 1200 gallons per day per square foot . The separator will also provide a minimum detention time within the oil separation compartment of 15 minutes at design flow. Detention time will recomputed by calculating the volume of the separation zone within the separator and dividing this volume by the design flow rate.

2.11 PARALLEL PLATES

Equip oil coalescing compartment with easily removable and reinstallable, parallel plates, arranged to optimize separation of free oil from liquid carrier. When plate design permits cleaning in place, provide sufficient access to permit complete cleaning of the plates and removal of the sludge. Provide parallel plates at an angle from 40 to 60 degrees with respect to longitudinal axis of the plate corrugations and space not less than 3/4-inch and not more than 1-1/2-inch apart for removal of free oil and settleable solids. Configuration used shall not promote solids buildup on plates which would increase velocities to point of discharging an effluent of unacceptable quality. The design shall maintain laminar flow at maximum design flow rate throughout plate packs including entrance and exit so as to prevent re-entrainment of oil with water. Flow through plate packs shall be in a downflow mode parallel to plate corrugations or cross-flow perpendicular to plate corrugations, so that the oil collects and coalesces at high point of corrugations and rises to top of pack without clogging from oil or settleable solids. The coalescing device shall be easily removed and reinstalled from ground level, and appropriate cleaning methods will be described in detail in the Operation and Maintenance Manual. The surface area of the plates shall be calculated using the vertical projection of the plates onto a horizontal surface. The effective surface area shall be calculated by reducing the projected area by a factor of 25%. Utilization of the surface area of filtration devices or systems shall not be allowed in computing available surface area for oil/water separators. The minimum effective projected surface area shall be 1790 square feet .

2.12 SUPPORTS

Brace and support individual plates or plate packs to withstand loads associated with transportation and operation of units, including in-place cleaning. Equip each plate pack with lifting lugs or other attachments for handling and installation. Each lug shall carry total weight of plate pack.

2.13 BAFFLES

Provide oil retention baffle, and stationary underflow baffle. Position underflow baffle to prevent resuspension of solids that have accumulated in secondary solids hopper.

2.14 OIL STORAGE

Provide oil storage as an integral part of proposed oil-water separator system. The system may provide a separate, but integral compartment for the storage of oil or storage may be provided on top of the oil separation compartment. As a minimum, the separator oil storage compartment shall have a capacity of not less than 10 percent of the total tank volume.

2.15 OUTLET COMPARTMENT

The outlet compartment shall have a minimum volume of 15 cubic feet . The outlet compartment shall have an adjustable overflow effluent weir and an effluent connection.

2.16 ACCESSORIES AND ACCESSORY EQUIPMENT

Provide bolts, stiffeners, washers, nuts, screws, pins, gaskets, and fittings as required for adjustable weirs, tank covers and parallel plate packs.

2.17 ACCESS COVERS

The separator tank shall be provided with easily removable access panels adequate to allow maintenance personnel accomplish visual inspection, oil and sludge removal, and removal of the plate packs without entering the separator.

PART 3 EXECUTION

3.1 SHOP HYDROSTATIC TEST

Prior to applying coatings, perform hydrostatic test at atmospheric pressure by filling tank with water in the shop for a minimum of 4 hours. Testing shall be conducted after all seams have been cleaned and all welds have been inspected in accordance with ASTM E 165. Acceptance criteria, for the hydrostatic test, is no leakage after 4 hours using a thorough visual inspection for the leaks.

3.2 FIELD INSPECTION

Inspect each component of separator for compliance with requirements specified in PART 2 PRODUCTS. Redesign or modification of equipment to comply with specified requirements, or necessary redesign or modification following failure to meet specified requirements, shall receive particular attention for adequacy and suitability. This element of inspection shall encompass visual examinations and dimensional measurements. Noncompliance with specified requirements, or presence of one or more defects preventing or lessening maximum efficiency of separator operation, shall constitute cause for rejection.

3.3 INSTALLATION

Lift tank as required and place onto level foundation using lifting mechanism provided. Level tank and bolt to supports to prevent hydrostatic uplift and ensure unit stability. Use a lifting bar through lugs to insert plate packs into tank and place on supports. Caulk around packs and pack supports with sealing compound conforming to FS SS-S-210 to prevent hydraulic short-circuiting. Avoid abrupt contact between the packs and the tank walls and pack supports to avoid damage. Separator system installation shall be conducted in accordance with manufacturer's

recommendations.

3.4 FIELD QUALITY CONTROL

3.4.1 Field Hydrostatic Test

After separator has been leveled and secured to foundation and parallel plate packs are in place, level effluent overflow weir at elevation specified by manufacturer and hydrostatically test unit at atmospheric or operational pressure (for no leakage) for an additional 8 hours by filling with water. Perform the hydrostatic test prior to backfilling below ground or partially below ground installations.

3.4.2 Pre Operational Test

The manufacturer's service representative shall inspect, operate, and test unit before in-service testing by the Contractor.

Tests shall include but not be limited to the following:

a. Soundness (without cracked or otherwise damaged parts).

b. Completeness in all details, as specified.

c. Correctness of setting, alignment, and relative arrangement of each component.

d. Verification of proper operation for all system components.

Pre operational Inspection and Test Report:

Submit manufacturer's service representative's pre operational test report. Document inspections, operations, adjustments, and tests performed and indicate whether they were acceptable or not. For unacceptable items, describe corrective action taken or recommended. Include detailed descriptions of points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. Include the manufacturer's certificate that equipment conforms to specified requirements and is ready for permanent operation and that nothing in installation will render manufacturer's warranty null and void.

-- End of Section --

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DIVISION 11 - EQUIPMENT

SECTION 11312N

PACKAGE GRINDER PUMP LIFT STATION

SECTION 11312N

PACKAGE GRINDER PUMP LIFT STATION

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.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M198	(1998) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983) Pipe Threads, General Purpose (Inch)
ASME/ANSI B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16.3	(1998) Malleable Iron Threaded Fittings Classes 150 and 300
ANSI B16.11	(1996) Forged Steel Fittings, Socket Welded and Threaded
ANSI B31.3	(1999) Process Piping
ANSI/AWWA C151/A21.51	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A53/A53M	(1999; Rev. B) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A123/A123M	(2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A126	(1995) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A536	(1984; R 1999) Ductile Iron Castings
ASTM A615/A615M	(2000) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C443/C443M	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C478/C478M	(1999; Rev. A) Precast Reinforced Concrete Manhole Sections
ASTM D1784	(1999) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D1785	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	(2000)1980 Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
ASTM D2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(1998) Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. (75 mm Through 1200 mm), for Water
AWWA C111/A21.11	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	(1999) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C500	(1993) Metal-Seated Gate Valves for Water and Systems
AWWA C509	(1994) Resilient-Seated Gate Valves for Water and Sewerage Systems
AWWA C600	(1999) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA M23	(1980) PVC Pipe - Design and Installation

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (1998) Motors and Generators

1.2 DESCRIPTION OF WORK

The work includes providing submersible sewage grinder pump station and related work. Provide system complete and ready for operations. Grinder pump station system including equipment, materials, installation, and workmanship shall be as specified herein.

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-03 Product Data

Pipe and fittings; G

Check valves; G

Gate valves; G

Submersible sewage grinder pumps; G

Pump motor; G

Flexible flanged coupling; G

SD-10 Operation and Maintenance Data

Submersible Sewage Grinder Pumps Data Package 3; G

Include pumps, alarms, and motors. Include all information on all equipment, alarm panel and controls, pumps and pump performance curves, and station layout in data for submersible sewage grinder pump station.

1.4 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials in enclosures or under protective covering. Store rubber gaskets not to be installed immediately under cover, out of direct sunlight. Do not store materials directly on the ground. Keep interior of pipes and fittings free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, and other accessories in such manner as to ensure delivery to the trench in sound, undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry pipe to the trench; do not drag it.

1.5 EXCAVATION, TRENCHING, AND BACKFILLING

Provide in accordance with Section 02316A"Excavation, Trenching, Filling, and Backfill for Utility Systems," except as specified herein.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

Provide pressure piping, air release valves, and related accessories for force main piping outside the sewage wet well and valve vault in accordance with Section 02350a "Sanitary Sewers".

2.1.1 Ductile-Iron Pipe

ANSI/AWWA C151/A21.51, thickness Class 52.

2.1.1.1 Flanged Pipe

AWWA C115/A21.15, ductile iron.

2.1.1.2 Fittings

AWWA C110/A21.10, flanged. Provide flanged joint fittings within wet well and valve vault as indicated. Provide mechanical joint fittings outside valve vault enclosure as indicated. Use fittings with pressure rating at least equivalent to that of the pipe.

2.1.1.3 Joints

AWWA C115/A21.15 for flanged joints. Use bolts, nuts, and gaskets for flanged connections recommended in the Appendix to AWWA C115/A21.15. Flange for setscrewed flanges shall be of ductile iron, ASTM A536, Grade 65-45-12, conforming to the applicable requirements of ASME/ANSI B16.1, Class 250. Setscrews for setscrewed flanges shall be 190,000 psi tensile strength, heat treated, and zinc-coated steel. Gasket for setscrewed flanges shall conform to the applicable requirements for mechanical-joint gaskets specified in AWWA C111/A21.11. Use setscrewed gasket designed to provide for confinement and compression of gasket when joint to adjoining flange is made.

2.1.2 PVC Plastic Pressure Pipe and Associated Fittings

2.1.2.1 Pipe and Fittings Less Than 4 inch Diameter

Use pipe, couplings and fittings manufactured of materials conforming to ASTM D1784, Class 12454-B.

(1) Screw-Joint: Use pipe conforming to dimensional requirements of ASTM D1785 Schedule 80, with joints meeting requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified. Use threaded pipe fittings conforming to requirements of ASTM D2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings. Test pipe couplings when used, as required by ASTM D2464.

(2) Push-On Joint: ASTM D3139, with ASTM F477 gaskets. Fittings for push-on joints: AWWA C110/A21.10 or AWWA C111/A21.11. Iron fittings and specials: cement-mortar lined (standard thickness) in accordance with AWWA C104/A21.4.

(3) Solvent Cement Joint: Use pipe conforming to dimensional requirements of ASTM D1785 or ASTM D2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic

test pressure. USe fittings for solvent cement jointing conforming to ASTM D2466 or ASTM D2467.

2.1.3 Insulating Joints

Provide between pipes of dissimilar metals a rubber gasket or other approved type of insulating joint or dielectric coupling to effectively prevent metal-to-metal contact between adjacent sections of piping.

2.1.4 Accessories

Provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required.

2.1.5 Flexible Flanged Coupling

Provide flexible flanged coupling applicable for sewage as indicated. Use flexible flanged coupling designed for a working pressure of 350 psi.

2.2 VALVES AND OTHER PIPING ACCESSORIES

2.2.1 Gate Valves in Valve Vault

AWWA C500 and AWWA C509. Valves conforming to AWWA C500 shall be outside-screw-and-yoke rising-stem type with double disc gates and flanged ends. Valves conforming to AWWA C509 shall be outside-screw-and-yoke rising-stem type with flanged ends. Provide valves with handwheels that open by counterclockwise rotation of the valve stem. Bolt and construct stuffing boxes to permit easy removal of parts for repair. Use valves from one manufacturer.

2.2.2 Check Valves 4 in and Larger Diameter

Nonclogging swing check valve rated for not less than 175 psig working pressure capable of passing 3-inch diameter solids. Cast iron conforming to ASTM A126. Buna-N disc and integral seat. Flanged ends conforming to AWWA C110/A21.10.

2.2.3 Identification Tags and Plates

Provide valves with tags or plates numbered and stamped for their usage. Use plates and tags of brass or nonferrous material and mounted or attached to the valve.

2.2.4 Pipe Support

Use pipe support schedule 40 galvanized steel piping conforming to ASTM A53/A53M. Provide either ANSI B16.3 or ANSI B16.11 galvanized threaded fittings.

2.2.5 Miscellaneous Metals

Use stainless steel bolts, nuts, washers, anchors, and supports for installation of equipment.

2.2.6 Quick Disconnect System with Hydraulic Sealing Flange

Use quick disconnect system consisting of a steel base plate for supporting the pumps, a hydraulic sealing flange, pump guide rails and the discharge

pipe supports. Use two guide rails of galvanized steel in accordance with ASTM A123/A123M. Provide a steel lifting chain for raising and lowering the pump in the basin. Build guides onto pump housing to fit the guide post to assure perfect alignment between pump and guide rails.

2.2.7 Wet Well Vent

Galvanized ASTM A53/A53M pipe with insect screening.

2.3 SUBMERSIBLE SEWAGE GRINDER PUMPS

Provide submersible sewage pumps with grinder units as shown on the drawings. Provide submersible, centrifugal sewage pumps of the non-clogging type with passageways designed to pass 3 inch diameter spheres without cloggingand grinder units capable of grinding all materials found in normal domestic sewage, including plastics, rubber, sanitary napkins, disposable diapers, and wooden articles into a finely ground slurry with particle dimensions no greater than 1/4 inch. Pump capacity and motor characteristics as specified. Design pump to operate in a submerged or partially submerged condition. Provide an integral sliding guide bracket and two guide bars capable of supporting the entire weight of the pumping unit.

2.3.1 Casing

Provide hard, close-grained cast iron casing which is free from blow holes, porosity, hard spots, shrinkage defects, cracks, and other injurious defects. Design casings to permit replacement of wearing parts. Design passageways to permit smooth flow of sewage and to be free of sharp turns and projections.

2.3.2 Impeller

Provide non-clogging type cast-iron, or bronz impeller. Make impeller with smooth surfaces, free flowing with the necessary clearance to permit objects in the sewage to pass. Fit and key, spline, or thread impeller on shaft, and lock in such manner that lateral movement will be prevented and reverse rotation will not cause loosening.

2.3.3 Shaft and Shaft Seals

Provide shaft of stainless steel. Provide mechanical seal of double carbon and ceramic construction with mating surfaces lapped to a flatness tolerance of one light band. Hold rotating ceramics in mating position with stationary carbons by a stainless steel spring. Oil lubricate bearings.

2.3.4 Bearings

Provide heavy duty ball thrust bearing or roller type bearing of adequate size to withstand imposed loads. Oil lubricate bearings.

2.3.5 Pump and Motor

Use pump and motor assembled on a single stainless steel shaft in a heavy duty cast-iron shell. Use free standing pump support legs of cast-iron providing enough clearance for the solids to get into the grinder.

2.4 PUMP MOTOR

Provide submersible sewage pumps in wet well NEMA MG 1, 3450 RPM, 208 volt, 3 phase, and 60 Hz cycle and for submersible pumps. Motor horsepower shall be not less than pump horsepower at any point on the pump performance curve. Fit motors with lifting "eyes" capable of supporting entire weight of pump and motor.

2.5 PUMP CONTROL SYSTEM

Provide a sealed mercury float switch control system as indicated. Automatically alternate operation from one pump to the other and start second pump in the event first pump cannot handle incoming flow. Provide manual "on-off" switch for each pump. Provide independent adjustable high and low water level switches. Provide floats, supports, and alarm. Metal parts, if used, shall be of bronze or equivalent corrosion resistant material.

2.5.1 Float Assembly Description

Use a direct acting float switch consisting of a normally-open mercury switch enclosed in a float. Use pipe mounted float assembly. Use float molded of rigid high-density polyurethane foam, color-coded and coated with a durable, water and corrosion-resistant jacket of clear urethane. Provide connecting cable and support pole in accordance with manufacturers recommendations. Provide a cast aluminum NEMA Type 4 junction box to connect float assembly. Use box with a gasketed cover with tapped float fitting and conduit entrance pipe threaded opening. Mount floats at fixed elevations as shown. Use floats designed to tilt and operate their switches causing sequential turn-on turn-off of the pump, when the liquid level being sensed rises or falls past the float.

2.5.2 Alternator

Provide an alternator control switch to operate in connection with each float. Use alternator control switch to alternate the operation of the pumps and operate both pumps if the water level rises above the second high water level. Incorporate time delay function and devices in the alternator controls such that both sewage pumps cannot be started simultaneously for an adjustable period of 10 to 120 seconds after shutdown. Use delay function designed to operate in any condition of start-up in either normal or emergency operational mode.

2.5.3 Sewage Pump Alarm and Control Panel

Enclose alarm panel in NEMA IV enclosure and with a flashing red light with long life bulb in guarded enclosure and 6 inch diameter horn. Horn shall emit 120 DB at 10 feet. Power alarm horn and light from 12V DC power supply with battery backup. Provide a rechargeable battery rated to power both the horn and light for a minimum of two hours upon loss of main power. Provide circuitry to automatically recharge the battery after main power is restored. Full charge of battery shall take no more than 20 hours. Use panel swith power on light, push to test button for horn and light and push to silence button for horn and light with automatic reset for next alarm. Use alarm designed to activate under the following conditions:

a. High liquid level as sensed by float switch

b. Loss of main power

c. No flow light as sensed by limit switch on the check valve

2.5.4 Electrical Requirements

Furnish motors with their respective pieces of equipment. Motors, controllers, contactors, and disconnects shall be as specified in Section 16415A "Electrical Work, Interior." Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field installed equipment.

2.5.5 Electric Motor

Use hermetically sealed electric motor. The power cable shall be sealed inside the motor end bell. The cable shall be neoprene covered with a flexible metal cover over it for its full length.

2.6 UNDERGROUND EQUIPMENT ENCLOSURE

2.6.1 Access Hatch Cover

Provide aluminum access hatch cover as indicated. The access hatch shall include lifting mechanism, automatic hold open arm, slam lock with handle, and flush lift handle with red vinyl grip. Use automatic hold open arm that locks in the 90 degree position. Use cover that is 1/4 inch diamond plate with 1/4 inch channel frame and continuous anchor flange. USe access hatch cover capable of withstanding a live load of 300 lbs./sq. ft. Provide stainless steel cylinder lock with two keys per lock. Key all the locks the same.

2.6.2 Wet Well and Valve Vault

Provide concrete wet well and Valve Vault with inside diameter as indicated. Precast structures may be provided in lieu of cast-in-place structures.

2.6.2.1 Cast-In-Place Concrete Structures

Provide wet well and valve vault with a compressive strength of 3000 psi at 28 days as specified in Section 03300 "Cast-In-Place Structural Concrete."

2.6.2.2 Precast Concrete Structures

ASTM C478/C478M, except as specified herein. Provide precast concrete structures with a compressive strength of 4000 psi at 28 days and an air entrainment of 6 percent, plus, or minus 2 percent and a minimum wall thickness of 5 inches. ASTM A615/A615M reinforcing bars. ASTM C443/C443M or AASHTO M198, Type B gaskets for joint connections. Use monolithic base and first riser.

2.6.3 Wet Well Base Material

Provide crushed stone as indicated and specified in Section02316A "Excavation, Trenching, Filling, and Backfill for Utility Systems." Provide polyethylene vapor barrier as indicated and specified in Section 02531a "Sanitary Sewers."

PART 3 EXECUTION

3.1 INSTALLATION

Provide pump station in accordance with drawings and requirements of the respective equipment manufacturers. Dampen and isolate equipment vibration.

3.1.1 Installation of Ductile-Iron Pressure Lines

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled, "General Requirements for Installation of Pipelines" of Section 02531a "Sanitary Sewers," and with the requirements of AWWA C600 for pipe installation, joint assembly, and valve-and-fitting installation.

a. Make flanged joint with gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight, taking care to avoid undue strain on flanges, fittings, and other accessories. Align bolt holes for each flanged joint. Use size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange.

3.1.2 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 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) Make threaded joints by wrapping the male threads with joint tape or by applying an approved thread lubricant, than threading the joining members together. Tighten joints with strap wrenches that will not damage the pipe and fittings. Do not tighten joint more than 2 threads past hand-tight.

(2) Push-On Joints: Bevel ends of pipe for push-on joints to facilitate assembly. Mark pipe to indicate when the pipe is fully seated. Lubricate gasket to prevent displacement. Exercise care 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.

3.1.3 Valves

Installation of Valves: Install gate valves conforming to AWWA C500 in accordance with AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves conforming to AWWA C509 in accordance with AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509. Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation , except as otherwise indicated. Make and assemble joints to gate valves and check valves as specified for making and assembling the same type joints between pipe and fittings.

3.1.4 Steel Piping

Install steel piping in accordance with ANSI B31.3. Use PTFE pipe thread paste or PTFE powder and oil for jointing compound for pipe threads.

3.1.5 Force Main

Provide in accordance with Section 02531a "Sanitary Sewers."

3.1.6 Equipment Installation

Install equipment in accordance with these specifications and the manufacturer's installation instructions. Grout equipment mounted on concrete foundations before installing piping. Install piping to avoid imposing stress on any equipment. Match flanges accurately before securing bolts.

3.2 FIELD TESTS AND INSPECTIONS

Perform all field tests, and provide all labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in Division 01. Produce evidence, when required, that any item of work has been constructed in accordance with contract requirements. Allow concrete to cure a minimum of 5 days before testing any section of piping where concrete thrust blocks have been provided.

3.2.1 Testing Procedure

Test piping in accordance with the Section 02530N "Sanitary Sewerage". Test in operation all equipment to demonstrate compliance with the contract requirements.

3.2.2 Sewage Grinder Pump Lift Station

Test pumps and controls, in operation, under design conditions to insure proper operation of all equipment. Provide all appliances, materials, water, and equipment for testing, and bear all expenses in connection with the testing. Conduct testing after all equipment is properly installed, electrical services and piping are installed, liquid is flowing, and the pump station is ready for operation. Correct all defects discovered to the satisfaction of the Contracting Officer, and all tests repeated, at the expense of the Contractor, until the equipment is in proper working order.

-- End of Section --

b. A registered professional engineer (P.E.) in fire protection engineering.

c. A registered PE in a related engineering discipline and member grade status in the National Society of Fire Protection Engineers.

d. An engineer with a minimum of 10 years' experience in fire protection engineering and member grade status in the National Society of Fire Protection Engineers.

1.4 SYSTEM DESIGN

1.4.1 Operation

The fire alarm and detection system shall be a complete, supervised fire alarm reporting system. The system shall be activated into the alarm mode by actuation of any alarm initiating device or from a Fire 2 signal from the Air Sampling System detector. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected , to signaling line circuits (SLC), Style 6, in accordance with NFPA 72. Alarm notification appliances shall be connected to notification appliance circuits (NAC), Style Z in accordance with NFPA 72. A looped conduit system shall be provided so that if the conduit and all conductors within are severed at any point, all IDC, NAC and SLC will remain functional. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Textual, audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc. Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits and shall provide the following features:

a. Sufficient memory to perform as specified and as shown for addressable system.

b. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors

c. Capability of each addressable device being individually disabled or enabled from the panel.

d. Each SLC shall be sized to provide 40 percent addressable expansion without hardware modifications to the panel.

The Air Sampling System ***(Vesda Air Sampling by Tyco or equal)*** shall consist of a highly sensitive laser-based smoke detector, aspirator, and filter. It shall be modular with an LED display and sounder integral to the detector. The system shall be capable of being locally configured via an integral programmer. The system shall allow programming of the following:

four smoke threshold alarm levels, Alert, Action, Fire 1 and Fire 2. These levels shall be programmable and able to be set at sensitivity ranges of 0.005 to 0.0015-6% obscuration/foot, to meet UL approved range of

protective grilles. Single stroke, electrically operated, supervised, solenoid bells shall be used for coded applications.

2.6.2 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box recessed single projector, or grille and utilize an electronically controlled piezoelectric driver and be the type suitable for use in an electrically supervised circuit. The sound shall be generated by an electronically controlled piezoelectric driver. Horns shall produce a sound rating of at least 85 dBA at 10 feet. Choice of typical sound outputs shall include Slow whoop, Hi-Lo, Siren, Horn, Temporal Coded Horn. Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles.

2.6.3 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and the contract drawings. Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second and a minimum of 75 candela. Strobe shall be surface mounted.

2.6.4 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. Units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the Contracting Officer.

2.7 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.7.1 Conduit

Conduit and fittings shall comply with NFPA 70, UL 6, UL 1242, and UL 797.

2.7.2 Wiring

Wiring shall conform to NFPA 70. Wiring for 120 Vac power shall be No. 12 AWG minimum. The SLC wiring shall be the type of cable in accordance with the manufacturers requirements. Wiring for fire alarm dc circuits ***for notification appliance circuits and valve actuators in sewer line associated w/ AFFF system operation*** shall be No. 14 AWG minimum, unless otherwise specified by the manufacturer. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except that rigid plastic conduit may be used under slab-on-grade. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. T-tapping using screw terminal blocks is allowed for style 5 addressable systems.

2.7.3 Special Tools and Spare Parts

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished

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 least5,000 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.

2.8 TRANSFORMERS, SUBSTATIONS, AND SWITCHGEAR

Transformers, substations, and switchgear shall be of the outdoor type having the ratings and arrangements indicated. Medium-voltage ratings of cable terminations shall be 15 kV between phases for 133 percent insulation level.

2.8.1 Pad-Mounted Transformers

Pad-mounted transformers shall comply with ANSI C57.12.26 and shall be of the loop feed ***radial switch***type. ***The second set of high voltage bushings shall be used for surge arresters.*** Pad-mounted transformer stations shall be assembled and coordinated by one manufacturer and each transformer station shall be shipped as a complete unit so that field installation requirements are limited to mounting each unit on a concrete pad and connecting it to primary and secondary lines. Stainless steel pins and hinges shall be provided. Barriers shall be provided between high- and low-voltage compartments. High-voltage compartment doors shall be interlocked with low-voltage compartment doors to prevent access to any high-voltage section unless its associated low-voltage section door has first been opened. Compartments shall be sized to meet the specific dimensional requirements of ANSI C57.12.26. ***Windings shall be made of copper.***Pentahead locking bolts shall be provided with provisions for a padlock.

2.8.1.1 High-Voltage Compartments

The high-voltage compartment shall be dead-front construction. Primary switching and protective devices shall include loadbreak switching, oil-immersed, bayonet-type, overload fuse in series with a partial range current-limiting fuse, medium-voltage separable loadbreak connectors, universal bushing wells and inserts or integral one piece bushings and surge arresters. Fuses shall comply with the requirements of paragraph METERING AND PROTECTIVE DEVICES. The switch shall be mounted inside transformer tank with switch operating handle located in high-voltage compartment and equipped with metal loop for hook stick operation. Fuses shall be interlocked with switches so that fuses can be removed only when the associated switch is in the "OPEN" position. Adjacent to medium-voltage cable connections, a nameplate or equivalent stencilled inscription shall be provided inscribed "DO NOT OPEN CABLE CONNECTORS UNLESS SWITCH IS OPEN." Surge arresters shall be fully insulated and configured to terminate on a second set of high voltage bushings.

2.8.1.2 Load-Break Switch

Radial-feed oil-immersed type rated at 15 kV, 95kV BIL, with a continuous

current rating and load-break rating of 200 ampere, and a make-and-latch rating of 10,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment.

~~Operation of switches shall be as follows:~~

~~ARRANGEMENT #~~	~~DESCRIPTION OF SWITCH ARRANGEMENT~~	~~SWITCH POSITION LINE A SW OPEN~~	~~CLOSE~~	~~LINE B SW OPEN~~	~~CLOSE~~	~~XFMR SW OPEN~~	~~CLOSE~~
~~1~~	~~Line A connected to Line B and both lines connected to transformer~~	~~X~~		~~X~~		~~X~~	
~~2~~	~~Transformer connected to Line A only~~	~~X~~		~~X~~		~~X~~	
~~3~~	~~Transformer connected to Line B only~~	~~X~~		~~X~~		~~X~~	
~~4~~	~~Transformer open and loop closed~~	~~X~~		~~X~~		~~X~~	
~~5~~	~~Transformer open and loop open~~	~~X~~		~~X~~		~~X~~	

2.8.1.3 Transformer Tank Sections

Transformers shall comply with IEEE C57.12.00, ANSI C57.12.21, and ANSI C57.12.26 and shall be of the less-flammable, liquid-insulated type with or liquid. Transformers shall be suitable for outdoor use and shall have 2 separate windings per phase. Standard NEMA primary taps shall be provided. Where primary taps are not specified, 4, 2-1/2 percent rated kVA high-voltage taps shall be provided below rated, primary voltage. Operating handles for primary tap changers for de-energized operation shall be located within high-voltage compartments, externally to transformer tanks. Adjacent to the tap changer operating handle, a nameplate or equivalent stenciled inscription shall be provided and inscribed "DO NOT OPERATE UNDER LOAD." Transformer ratings at 60 Hz shall be as follows:

Three-phase capacity.....~~112.5~~***150*** kVA.

Impedance.....~~5.75~~***2.00***%.

Temperature Rise.....65 degrees C.

High-voltage winding.....13.8 kV .

High-voltage winding connections.....Delta.

Low-voltage winding.....120/208 volts.

Low-voltage winding connections..... ..... wye

2.9.1.4 C-Rated, Current-Limiting Power Fuses

C-rated, current-limiting power fuses shall open in 1000 seconds at currents between 170 and 240 percent of the C rating.

2.9.2 Instrument Transformers

2.9.2.1 General

Instrument transformers shall comply with ANSI C12.11 and IEEE C57.13. Instrument transformers shall be configured for mounting in/on the device to which they are applied. Polarity marks on instrument transformers shall be visually evident and shown on drawings.

2.9.2.2 Current Transformers

Unless otherwise indicated, bar, wound, or window-type transformers are acceptable; and except for window-type units installed over insulated buses, transformers shall have a BIL rating consistent with the rated BIL of the associated switchgear or electric power apparatus bushings, buses or conductors. Current transformers shall have the indicated ratios. The continuous thermal-current rating factor shall not be less than 2.0 . Other thermal and mechanical ratings of current transformers and their primary leads shall be coordinated with the design of the circuit breaker and shall be not less than the momentary rating of the associated circuit breaker. Circuit protectors shall be provided across secondary leads of the current transformers to prevent the accident open-circuiting of the transformers while energized. Each terminal of each current transformer shall be connected to a short-circuiting terminal block in the circuit interrupting mechanism cabinet, power transformer terminal cabinet, and in the associated instrument and relay cabinets.

2.9.2.3 Current Transformers for Power Transformers

Single-ratio bushing type current transformers shall be provided internally around power transformer bushings as shown. Single-ratio units shall have a minimum relaying accuracy class of 0.6B-0.5 .

2.9.2.4 Current Transformers for Kwh and Demand Metering (Low-Voltage)

RATIO	RF at 30 degrees C
200/5	4.0
300/5	3.0
400/5	4.0
600/5	3.0
800/5	2.0
1200/5	1.5
1500/5	1.5
2000/5	1.5
3000/5	1.33

Primary Amp Rating (of CT)	Accuracy Class
200	0.3 thru B-0.1
300-400	0.3 thru B-0.2
600-1200	0.3 thru B-0.5
1500	0.3 thru B-0.9
2000-3000	0.3 thru B-1.8

Current transformers shall conform to IEEE C57.13. Provide current transformers with a metering accuracy Class of 0.3 through B-0.2, with a minimum RF of 4.0 at 30 degrees C, with 600-volt insulations, and 10 kV BIL. Provide butyl-molded, window-type current transformers mounted on the transformer low-voltage bushings. Route current transformer leads in a location as remote as possible from the power transformer secondary cables to permit current measurements to be taken with hook-on-ammeters.

2.9.3 Watthour Meters

For the AIB Annex,***Maintenanace facility #2, Mainteanance Operations Building and the Flight Operations Building*** refer to specification section 16415A. Watthour meter ***shall be for Sewage Lift Station only.*** ~~s~~ ***and*** shall conform to ANSI C12.10, except numbered terminal wiring sequence and case size may be the manufacturer's standard. Watthour meters shall be of the socket mounted outdoor type having a 30 minute, cumulative form, demand register meeting ANSI C12.4 and provided with not less than 2-1/2 stators. .

2.10 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1, IEEE C62.1, IEEE C62.2, and

2.6 TRANSIENT VOLTAGE SURGE PROTECTION (TVSS)

Transient voltage surge suppressors shall be provided ***on main distribution panels of all four buildings*** ~~as indicated~~. Surge suppressors shall meet the requirements of IEEE C62.11, C62.41 and C62.45 and be UL listed and labeled as having been tested in accordance with UL 1449. Surge suppressor ratings for buildings at the Rugge-Hamilton site shall be 120/208 volts rms, operating voltage; 60 Hz; 3-phase; 4 wire with ground; transient suppression voltage (peak let-through voltage) of 400 volts. Surge suppressor ratings for the AIB ANNEX building shall be 277/480 volt rms, operating voltage; 60 Hz; 3-phase; 4-wire with ground; suppression voltage (peak let-through voltage) of 800 volts. Each 277/480V and 120/208V TVSS device, at the service entrance, shall have a surge current capacity added between L-G and L-N protection modes of 120,000 amperes/phase for Category C2. And, a response time no greater than 5 nanoseconds. Fuses shall not be used as surge suppression.

2.7.1 MOLDED-CASE CIRCUIT BREAKERS

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489and UL 877 for circuit breakers and circuit breaker enclosures located in hazardous (classified) locations. Circuit breakers may be installed in panelboards, switchboards, enclosures, motor control centers, or combination motor controllers.

2.7.1.1 Construction

Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper conductors only 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.

2.7.1.2 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.

2.7.1.3 Cascade System Ratings

Circuit breakers used in series combinations shall be in accordance with UL 489. Equipment, such as switchboards and panelboards, which house