

# SUBMITTAL REGISTER

CONTRACT NO.  
N40085-15-D-003

TITLE AND LOCATION  
Hangar 111 Fire Protection & Structural Repairs

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					REMARKS			
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE		DATE OF ACTION	MAILED TO CONTR/	DATE RCD FRM APPR AUTH
		01 11 00	SD-01 Preconstruction Submittals																
			Phasing Plan	1.2.2	G														
		01 14 00	SD-01 Preconstruction Submittals																
			Roof work plan	1.6	G														
			Written Approval	1.6	G														
			Written Inspection Report	1.6	G														
			Paint Application Plan	1.7	G														
			List of Contact Personnel	1.3.1.1															
		01 20 00.00 20	SD-01 Preconstruction Submittals																
			Schedule of Prices	1.3															
		01 30 00	SD-01 Preconstruction Submittals																
			View Location Map	1.3	G														
			Progress and Completion	1.4	G														
			Pictures																
		01 32 17.00 20	SD-01 Preconstruction Submittals																
			Qualifications	1.5	G														
			Baseline Network Analysis	1.3	G														
			Schedule																
			SD-07 Certificates																
			Monthly Network Analysis	1.7.1	G														
			SD-11 Closeout Submittals																
			As-Built Schedule	1.7.2	G														
		01 33 00	SD-01 Preconstruction Submittals																
			Submittal Register	1.8	G														
		01 33 29	SD-01 Preconstruction Submittals																

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 33 29	Preliminary Sustainability Notebook	1.5.2.1	G												
			Preliminary High Performance and Sustainable Building Checklist	1.5.2.1													
			SD-11 Closeout Submittals														
			Final Sustainability Notebook	1.5.2.1	G												
			Final High Performance and Sustainable Building Checklist	1.5.2.1	G												
		01 35 26	SD-01 Preconstruction Submittals														
			Accident Prevention Plan (APP)	1.8	G												
			SD-06 Test Reports														
			Monthly Exposure Reports	1.4													
			Notifications and Reports	1.13													
			Accident Reports	1.13.2	G												
			LHE Inspection Reports	1.13.3													
			SD-07 Certificates														
			Contractor Safety Self-Evaluation Checklist	1.5													
			Crane Operators/Riggers	1.7.1.5													
			Standard Lift Plan	1.8.2.2	G												
			Critical Lift Plan	1.8.2.3	G												
			Naval Architecture Analysis	1.8.2.3	G												
			Activity Hazard Analysis (AHA)	1.9													
			Confined Space Entry Permit	1.10.1													
			Hot Work Permit	1.10.1													
			Certificate of Compliance	1.13.4													

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		01 35 26	License Certificates	1.15														
			Radiography Operation Planning Work Sheet	1.15.1	G													
		01 35 29.13	SD-02 Shop Drawings															
			Work Zones	3.9.1	G													
			Decontamination Facilities	3.10.1	G													
			SD-03 Product Data															
			Amendments to the APP/SSHP	1.4														
			Exposure Monitoring/Air Sampling Program	3.5														
			Site Control Log	3.9.2														
			SSHO's Daily Inspection Logs	1.8														
			SD-07 Certificates															
			Certificate Of Worker/Visitor Acknowledgement	1.7														
			SD-11 Closeout Submittals															
			Safety And Health Phase-Out Report	1.9														
		01 45 00.00 20	SD-01 Preconstruction Submittals															
			Construction Quality Control (QC) Plan	1.6.1	G													
			Indoor Air Quality (IAQ) Management Plan	1.17	G													
			Basis of Design and Design Intent	1.9.1														
			SD-05 Design Data															

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		01 45 00.00 20	Design Review	1.9.2													
			Contract Document Review	1.9.3													
			SD-07 Certificates														
			CA Resume	1.5.2.2													
		01 50 00	SD-01 Preconstruction Submittals														
			Construction Site Plan	1.3	G												
			Traffic Control Plan	3.4.1	G												
			SD-06 Test Reports														
			Backflow Preventer Tests	2.2.5													
			SD-07 Certificates														
			Backflow Tester	1.4.1													
			Backflow Preventers	1.4													
		01 57 19	SD-01 Preconstruction Submittals														
			Preconstruction Survey	1.6.1													
			Solid Waste Management Permit	1.10	G												
			Regulatory Notifications	1.6.2	G												
			Environmental Protection Plan	1.7	G												
			Dirt and Dust Control Plan	1.7.9.1	G												
			Employee Training Records	1.6.5	G												
			Environmental Manager	1.6.4	G												
			Qualifications														
			SD-06 Test Reports														
			Laboratory Analysis	3.7.1.1.2													
			Solid Waste Management Report	3.7.2.1	G												
			SD-07 Certificates														
			Employee Training Records	1.6.5	G												

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		01 57 19	ECATTS Certificate Of Completion	1.4.1.2	G													
			SD-11 Closeout Submittals															
			Waste Determination Documentation	3.7.1	G													
			Disposal Documentation for Hazardous and Regulated Waste	3.7.3.6	G													
			Assembled Employee Training Records	1.6.5	G													
			Solid Waste Management Permit	1.10	G													
			Solid Waste Management Report	3.7.2.1	G													
			Contractor Hazardous Material Inventory Log	3.8.1	G													
			Hazardous Waste/Debris Management	3.7.3.1	G													
			Regulatory Notifications	1.6.2	G													
			Sales Documentation	3.7.2.1	G													
			Contractor Certification	3.7.2.1														
		01 74 19	SD-01 Preconstruction Submittals															
			Waste Management Plan	1.6	G													
			SD-11 Closeout Submittals															
			Records	1.7														
		01 78 00	SD-03 Product Data															
			Warranty Management Plan	1.6.1														
			Warranty Tags	1.6.4														
			Final Cleaning	3.4														

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																		(g)
		01 78 00	Spare Parts Data	1.5														
			SD-08 Manufacturer's Instructions															
			Instructions	1.6.1														
			SD-10 Operation and Maintenance Data															
			Operation and Maintenance Manuals	3.3	G													
			SD-11 Closeout Submittals															
			As-Built Drawings	3.1	G													
			Record Drawings	3.2	G													
			Certification of EPA Designated Items	2.1	G													
			NAVFAC Sustainable & Energy Data Record Card	3.5	G													
		01 78 23	SD-10 Operation and Maintenance Data															
			O&M Database	1.4	G													
			Training Plan	3.1.1	G													
			Training Outline	3.1.3	G													
			Training Content	3.1.2	G													
			SD-11 Closeout Submittals															
			Training Video Recording	3.1.4	G													
			Validation of Training Completion	3.1.6	G													
		01 78 24.00 20	SD-11 Closeout Submittals															
			eOMSI, Progress Submittal	1.4.1	G													
			eOMSI, Prefinal Submittal	1.4.2	G													

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		01 78 24.00 20	eOMSI, Final Submittal	1.4.3	G													
		02 41 00	SD-01 Preconstruction Submittals															
			Demolition Plan	1.2.1	G													
			Existing Conditions	1.10														
			SD-07 Certificates															
			Notification	1.6	G													
		02 65 00	SD-01 Preconstruction Submittals															
			Work Plan	1.4.4	G													
			Site Safety and Health Plan	1.4.4.1	G													
			Excavation and Material Handling Plan	1.4.4.2	G													
			Field Sampling and Laboratory Testing Plan	1.4.4.3	G													
			Tank and Piping Removal And Disposal Plan	1.4.4.4	G													
			Spill and Discharge Control Plan	1.4.4.5	G													
			Qualifications	1.4.1	G													
			Laboratory Services	1.4.2	G													
			State Licensed Hazardous Waste Transporter	3.12.3														
			SD-06 Test Reports															
			Laboratory and Field Testing Reports	3.15														
			Backfill Material	2.1														
			Tank Contents Verification	3.2														
			Contaminated Water Disposal	3.5.2														

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		02 65 00	Soil Examination, Testing, and Analysis	3.10													
			Backfilling	3.11	G												
			SD-11 Closeout Submittals														
			Salvage Rights	3.12.4	G												
			Tank Closure Report	3.15													
		02 81 00	SD-03 Product Data														
			Onsite Hazardous Waste Management	3.1	G												
			Notices of Non-Compliance and Notices of Violation	3.2													
			Packaging Notifications	2.1.1													
			SD-06 Test Reports														
			Recordkeeping	3.5	G												
			Spill Response	3.6													
			Exception Report	3.5	G												
			SD-07 Certificates														
			Certification	1.4.3													
			Security Plan	3.2.4													
			Transportation and Disposal Coordinator	1.4.1	G												
			Training	1.4.2	G												
			EPA Offsite Policy	3.2.2													
			Certificates of Disposal	3.2.5													
			Shipping Documents and Packagings Certification	3.2.3	G												

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		02 81 00	Waste Minimization	3.4														
		02 83 13.00 20	SD-01 Preconstruction Submittals															
			Occupational and Environmental Assessment Data Report	1.5.2.3	G													
			Lead Compliance Plan	1.5.2.2	G													
			Competent Person	1.5.1.1	G													
			Training Certification	1.5.1.2	G													
			lead waste management plan	1.5.2.8	G													
			written evidence	3.5.2.1	G													
			Medical Examinations	1.5.2.4	G													
			SD-06 Test Reports															
			sampling results	1.5.2.3	G													
			Occupational and Environmental Assessment Data Report	1.5.2.3	G													
			SD-07 Certificates															
			Testing laboratory	1.5.1.3	G													
			Third party consultant qualifications	1.5.1.4	G													
			Clearance Certification	3.5.1.1	G													
			SD-11 Closeout Submittals															
			hazardous waste manifest	3.5.2.1	G													
			turn-in documents or weight tickets	3.5.2.1	G													
		03 30 00	SD-01 Preconstruction Submittals															
			Concrete Curing Plan	1.6.3.1														
			Quality Control Plan	1.6.5	G													

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		03 30 00	Quality Control Personnel Certifications	1.6.6	G												
			Quality Control Organizational Chart	1.6.6													
			Laboratory Accreditation	1.6.8	G												
			SD-02 Shop Drawings														
			Reinforcing Steel	1.6.2.1	G												
			SD-03 Product Data														
			Joint Sealants	2.4.8	G												
			Joint Filler	2.4.7	G												
			Materials for Forms	2.1													
			Cementitious Materials	2.4.1	G												
			Concrete Curing Materials	2.3.3													
			Reinforcement	2.5													
			Admixtures	2.4.5													
			Vapor Barrier	2.4.6	G												
			Waterstops	2.2.1	G												
			SD-05 Design Data														
			Mix Design	2.3.1	G												
			SD-06 Test Reports														
			Concrete Mix Design	1.6.1.1	G												
			Pozzolan	1.6.4.1	G												
			Ground Granulated Blast-Furnace Slag	1.6.4.2													
			Aggregates	2.4.3	G												
			Tolerance Report	3.10.2.1													

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		03 30 00	Compressive Strength Tests	3.14.2.3	G														
			Unit Weight of Structural Concrete	3.14.2.5															
			Alkali-silica Reactivity Report (ASR)	1.6.4.4	G														
			Air Content	3.14.2.4															
			Slump Tests	3.14.2.1															
			Water	2.4.2															
			SD-07 Certificates																
			Reinforcing Bars	2.5.1															
			Welder Qualifications	1.8															
			Material Safety Data Sheets	1.6.3.2															
			Field Testing Technician and Testing Agency	1.6.6.2															
			SD-08 Manufacturer's Instructions																
			Curing Compound	2.3.3															
		04 20 00	SD-02 Shop Drawings																
			Cut CMU	3.3.2.1	G														
			Detail Drawings	3.4.1.1	G														
			SD-03 Product Data																
			Hot Weather Procedures	1.5.1	G														
			Cold Weather Procedures	1.5.2	G														
			Cement	2.2.2.2.1	G														
			Cementitious Materials	2.4.1.1	G														
			SD-05 Design Data																
			Masonry Compressive Strength	2.1.2	G														

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		04 20 00	Fire-Rated Concrete Masonry Units	2.2.2.3														
			SD-06 Test Reports															
			Fire-Rated Concrete Masonry Units	2.2.2.3														
			Field Testing of Mortar	3.6.1.1														
			Field Testing of Grout	3.6.1.2														
			Prism Tests	3.6.1.3														
			SD-07 Certificates															
			Concrete Masonry Units (CMU)	2.2.2.2														
			Cementitious Materials	2.4.1.1														
			Admixtures for Masonry Mortar	2.4.1.3														
			Admixtures for Grout	2.4.2.2														
			Anchors, Ties, and Bar Positioners	2.6.2														
			Joint Reinforcement	2.6.3														
			SD-08 Manufacturer's Instructions															
			Admixtures for Masonry Mortar	2.4.1.3														
			Admixtures for Grout	2.4.2.2														
			SD-10 Operation and Maintenance Data															
			Take-Back Program	3.7														
		05 12 00	SD-02 Shop Drawings															
			Structural Steel Repair Drawing	1.3.1	G													
			Structural Steel Repair Drawing	1.3.1	G													

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		05 12 00	Fiber Reinforced Polymer (FRP) Repair Drawings including installation procedure	1.3.1.1	G														
			SD-03 Product Data																
			Carbon Fiber fabric	2.2.4.1	G														
			Glass fiber fabric	2.2.4.2	G														
			Epoxy adhesive	2.2.4.3	G														
			Fumed silica repair mortar	2.2.4.4	G														
			Welding electrodes and rods	2.3.1															
			SD-06 Test Reports																
			Weld Inspection Reports	3.5.2.3	G														
			Existing structural steel inspection reports	3.5.2.2	G														
			SD-07 Certificates																
			Steel	2.2															
			Existing structural steel inspector certification	1.3.2.4	G														
			FRP Installer Certification	1.3.2.3	G														
			Welding inspection procedures and qualifications	1.3.2.2	G														
			Welding procedures and qualifications	1.3.2.1															
			Welding electrodes and rods	2.3.1															
		05 50 13	SD-02 Shop Drawings																
			Floor gratings	2.3	G														
			angles and plates	2.4	G														

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		05 50 13	Draft curtain angle;	2.5	G													
			Hangar door insulated translucent panel support frame;	2.6	G													
			SD-03 Product Data															
			Floor gratings	2.3	G													
			SD-06 Test Reports															
			Floor Grating Proof Test;	3.7.1	G													
		07 21 13	SD-03 Product Data															
			Manufacturer's Standard Details	1.3	G													
			Block or Board Insulation	2.2	G													
			Vapor Retarder	2.3	G													
			Pressure Sensitive Tape	2.4	G													
			Protection Board or Coatings	1.4	G													
			Accessories	2.6	G													
			SD-07 Certificates															
			Block or Board Insulation	2.2	G													
			Vapor Retarder	2.3	G													
			Protection Board or Coating	2.5	G													
			Protection Board or Coating	3.4.2	G													
			Special Warranties	1.7	G													
			Special Warranties	1.7	G													
			SD-08 Manufacturer's Instructions															
			Block or Board Insulation	2.2														
			Adhesive	2.6.1														
			SD-11 Closeout Submittals															

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION CODE	DATE OF ACTION
		07 21 13	Volatile Organic Compound (VOC) Content	2.1.1	S													
			Recycled Content	2.1.2	S													
		07 21 16	SD-03 Product Data															
			Blanket Insulation	2.2														
			Vapor Retarder	2.4														
			Pressure Sensitive Tape	2.5														
			Accessories	2.6														
			SD-08 Manufacturer's Instructions															
			Insulation	3.3.1														
			SD-11 Closeout Submittals															
			Recycled Content for Insulation Materials	2.1.1	S													
			Reduce Volatile Organic Compounds (VOC)	2.1.2	S													
		07 22 00	SD-02 Shop Drawings															
			Insulation Board Layout	1.3	G													
			Verification of Existing Conditions	1.3	G													
			SD-03 Product Data															
			Insulation	2.1	G													
			Protection Board	1.4	G													
			Fasteners	2.4	G													
			Asphalt	2.3.3	G													
			SD-07 Certificates															
			Installer Qualifications	1.6	G													

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		07 22 00	Certificates Of Compliance For Felt Materials	1.6	G													
			SD-08 Manufacturer's Instructions															
			Fasteners	2.4	G													
			Insulation	2.1	G													
		07 42 13	SD-01 Preconstruction Submittals															
			Qualification of Manufacturer	1.5.3	G													
			Qualification of Installation Contractor	1.5.4	G													
			Qualification of Welders	1.5.4.1	G													
			Warranty	1.8	G													
			SD-02 Shop Drawings															
			Installation Drawings	1.5.1.1	G													
			SD-03 Product Data															
			Wall Panels	2.2.1	G													
			Factory Color Finish	2.2.2														
			Closure Materials	1.5.5														
			Pressure Sensitive Tape	2.5.4.4														
			Sealants and Caulking	2.5.4.1														
			Galvanizing Repair Paint	1.5.3.1														
			Enamel Repair Paint	1.5.3.1														
			Accessories	1.5.5														
			Accessories	2.5														
			SD-04 Samples															
			Wall Panels	2.2.1	G													
			Fasteners	1.5.3.1	G													

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION CODE	DATE OF ACTION
		07 42 13	Metal Closure Strips	2.5.3	G													
			SD-05 Design Data															
			Wind load design analysis	1.5.1.2	G													
			SD-06 Test Reports															
			Leakage Tests	3.7.2	G													
			Wind Load Tests	1.3.2	G													
			Coating	2.2.2.6	G													
			Chalking	2.2.2.6	G													
			Seismic Tests	1.3.2	G													
			SD-07 Certificates															
			Coil Stock	1.5.3.1	G													
			Fasteners	1.5.3.1	G													
			Galvanizing Repair Paint	1.5.3.1	G													
			Enamel Repair Paint	1.5.3.1	G													
			SD-08 Manufacturer's Instructions															
			Installation	3.3	G													
			SD-09 Manufacturer's Field Reports															
			Manufacturer's Field Reports	3.8.1	G													
			SD-11 Closeout Submittals															
			Warranty	1.8	G													
			Maintenance Instructions	1.5.6	G													
			20 year 'No Dollar Limit' warranty for labor and material	1.8.1														
		07 52 00	SD-02 Shop Drawings															
			Roof plan	1.4.4	G													

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		07 52 00	SD-03 Product Data																
			Modified Bitumen Sheets	2.1	G														
			Asphalt	2.3															
			Cold-Applied Membrane	2.4	G														
			Adhesive																
			Primer	2.6	G														
			Modified Bitumen Roof Cement	2.7	G														
			Fasteners And Plates	2.8	G														
			Warranty	1.8	G														
			SD-07 Certificates																
			Qualification of Manufacturer	1.4.1															
			Qualification of Applicator	1.4.2															
			Wind Uplift Resistance	1.4.3	G														
			SD-08 Manufacturer's Instructions																
			Modified Bitumen Membrane	3.3.4	G														
			Application																
			Flashing	3.3.5	G														
			Temperature Limitations for	3.2.2.1															
			Asphalt																
			Torches	3.2.1.3															
			Cold Adhesive Applied Modified	3.3.2.1	G														
			Bitumen Membrane																
			Primer	2.6															
			Coating Application	3.3.7.2	G														
			Cold Weather Installation	1.6	G														
			SD-11 Closeout Submittals																

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		07 52 00	Warranty	1.8															
			Information Card	3.8															
			Instructions To Government Personnel	3.7															
		07 81 00	SD-03 Product Data																
			Fireproofing Material	3.3	G														
			SD-04 Samples																
			Spray-Applied Fireproofing	2.1	G														
			SD-06 Test Reports																
			Fire Resistance Rating	1.2.2	G														
			Field Tests	3.6	G														
			Evaluation Reports	1.2.3	G														
			SD-07 Certificates																
			Installer Qualifications	1.4.1	G														
			Surface Preparation Report	3.1	G														
			Manufacturer's Inspection Report	3.5.2	G														
		07 84 00	SD-02 Shop Drawings																
			Firestopping System	2.1	G														
			SD-03 Product Data																
			Firestopping Materials	2.2	G														
			SD-06 Test Reports																
			Inspection	3.3	G														
			SD-07 Certificates																
			Inspector Qualifications	1.5.2															
			Firestopping Materials	2.2															
			Installer Qualifications	1.5.1	G														

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																		(g)
		07 92 00	SD-03 Product Data															
			Sealants	2.1														
			Primers	2.2														
			Bond breakers	2.3														
			Backstops	2.4														
			SD-07 Certificates															
			Sealant	3.3.6														
		08 11 13	SD-02 Shop Drawings															
			Doors	2.1	G													
			Doors	2.1	G													
			Frames	2.4	G													
			Frames	2.4	G													
			Accessories	2.2														
			Weatherstripping	2.5														
			SD-03 Product Data															
			Doors	2.1	G													
			Frames	2.4	G													
			Accessories	2.2														
			Weatherstripping	2.5														
		08 34 16.10	SD-02 Shop Drawings															
			Hangar doors	2.1	G													
			SD-05 Design Data															
			Hangar doors	2.1	G													
			SD-10 Operation and Maintenance Data															
			Hangar doors	2.1	G													

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																		(g)
		08 60 45	SD-02 Shop Drawings															
			Shop Drawings	3.2	G													
			SD-03 Product Data															
			Translucent Panels	2.1	G													
			Warranty	1.6														
			SD-06 Test Reports															
			Test Reports	2.1														
			SD-07 Certificates															
			Systems	2.4														
			Qualifications	1.4														
		08 71 00	SD-02 Shop Drawings															
			Hardware schedule	1.3	G													
			Keying system	2.2.6														
			SD-03 Product Data															
			Hardware items	2.2	G													
			SD-08 Manufacturer's Instructions															
			Installation	3.1														
			SD-10 Operation and Maintenance Data															
			Hardware Schedule	1.3	G													
			SD-11 Closeout Submittals															
			Key Bitting	1.4														
		08 81 00	SD-03 Product Data															
			Insulating Glass	1.6.1														
			Glazing Accessories	1.3														
			SD-04 Samples															

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		08 81 00	Glazing Compound	2.3.2															
			Tape	2.3.6															
			Sealant	2.3.3.1															
			SD-08 Manufacturer's Instructions																
			Setting and Sealing Materials	2.3															
			Glass Setting	3.2															
		09 67 23.16	SD-04 Samples																
			Joint Sealant	1.3.1.1	G														
			Joint Sealant	1.3.2.3	G														
			Epoxy Mortar Flooring System	1.3.1.2	G														
			Epoxy Mortar Flooring System	1.3.2.4	G														
			Epoxy Mortar Flooring System	1.3.3.2	G														
			White Aluminum Oxide Non-Skid Grit	2.3	G														
			SD-06 Test Reports																
			Joint Sealant	1.3.1.1	G														
			Joint Sealant	1.3.2.3	G														
			Epoxy Mortar Flooring System	1.3.1.2	G														
			Epoxy Mortar Flooring System	1.3.2.4	G														
			Epoxy Mortar Flooring System	1.3.3.2	G														
			Primer	1.3.1.3	G														
			Grout Coat	1.3.1.4	G														
			Urethane Topcoat	1.3.1.5	G														
			White Aluminum Oxide Non-Skid Grit	2.3	G														
			Patch Test Demonstration	1.7	G														

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		09 67 23.16	Daily Inspection Report	1.3.1.6	G														
			Adhesion Testing	3.12.3	G														
			SD-07 Certificates																
			Work Plan	1.3.2.1	G														
			Flooring System Applicator	1.3.2.2	G														
			Qualifications																
			Joint Sealant	1.3.1.1	G														
			Joint Sealant	1.3.2.3	G														
			Epoxy Mortar Flooring System	1.3.1.2	G														
			Epoxy Mortar Flooring System	1.3.2.4	G														
			Epoxy Mortar Flooring System	1.3.3.2	G														
			Warranty	1.3.2.5	G														
			SD-08 Manufacturer's Instructions																
			Joint Sealant	1.3.1.1	G														
			Joint Sealant	1.3.2.3	G														
			Epoxy Mortar Flooring System	1.3.1.2	G														
			Epoxy Mortar Flooring System	1.3.2.4	G														
			Epoxy Mortar Flooring System	1.3.3.2	G														
			Water-Based Alkaline Degreaser	1.3.3.3	G														
			SD-11 Closeout Submittals																
			Inspection Logbook	3.12.2.2	G														
		09 90 00	SD-02 Shop Drawings																
			Piping identification stencil	3.10															
			SD-03 Product Data																
			Environmental Data	1.8.2.1.1															

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		09 90 00	Materials	2.1															
			Coating	2.1	G														
			Coating	2.1	G														
			Manufacturer's Technical Data Sheets	2.1															
			Sealant	3.3.5															
			SD-04 Samples																
			Color	1.9.1	G														
			Textured Wall Coating System	1.4.2	G														
			Sample Textured Wall Coating System Mock-Up	1.4.3	G														
			SD-07 Certificates																
			Applicator's qualifications	1.3															
			Qualification Testing	1.4.1.2	G														
			SD-08 Manufacturer's Instructions																
			Application instructions	3.4.1															
			Mixing	3.7.2															
			Manufacturer's Material Safety Data Sheets	1.7.2															
		09 97 13.27	SD-05 Design Data																
			Containment System	1.4.4.1															
			SD-06 Test Reports																
			Joint Sealant Qualification Test Reports	1.4.5.1															
			Coatings Qualification Test Reports	1.4.5.2															

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		09 97 13.27	Metallic Abrasive Qualification Test Reports	1.4.5.3														
			Coating Sample Test Reports	3.2.3														
			Abrasive Sample Test Reports	3.2.4														
			Inspection Report Forms	3.9.2.2														
			Daily Inspection Reports	3.9.2.3														
			Recycled Metallic Abrasive Field Test Reports (Daily and Weekly)	1.4.5.4														
			SD-07 Certificates															
			Contract Errors, Omissions, and Other Discrepancies	1.4.1														
			Corrective Action Procedures	1.4.2.1														
			Coating Work Plan	1.4.3	G													
			Qualifications of Certified Industrial Hygienist (CIH)	1.4.6.1														
			Qualifications Of Individuals Performing Abrasive Blasting	1.4.6.5														
			Qualifications of Certified Protective Coatings Specialist (PCS)	1.4.6.2														
			Qualifications of Coating Inspection Company	1.4.6.3														
			Qualifications of QC Specialist Coating Inspector	1.4.6.4														
			Qualifications of Testing Laboratory for Coatings	1.4.6.6														

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		09 97 13.27	Qualifications of Testing Laboratory for Abrasive	1.4.6.7															
			Qualifications of Coating Contractors	1.4.6.8															
			Joint Sealant Materials	1.4.6.9															
			Coating Materials	1.4.6.10															
			Coating System Component Compatibility	1.4.6.11															
			Non-metallic Abrasive	1.4.6.12															
			Metallic Abrasive	1.4.6.13															
			SD-08 Manufacturer's Instructions																
			Joint Sealant Instructions	1.5.1															
			Coating System Instructions	1.5.2															
			SD-11 Closeout Submittals																
			Disposal of Used Abrasive	3.6.6															
			Inspection Logbook	3.9.2.4	G														
		21 13 13.00 20	SD-02 Shop Drawings																
			Shop Drawings	1.5.2	G														
			SD-03 Product Data																
			Pipe	2.2.1	G														
			Fittings	2.2.1	G														
			Riser check valves	2.2.6	G														
			Valves	2.2.4	G														
			Sprinklers	2.2.3	G														
			Pipe hangers and supports	2.2.5	G														
			Sprinkler Alarm Switches	2.3.1	G														

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		21 13 13.00 20	Fire department connections	2.2.7	G													
			Mechanical couplings	2.2.1	G													
			Expansion Tank	2.2.8	G													
			Hose Valve Manifold Test Header	2.5	G													
			SD-05 Design Data															
			Hydraulic Calculations	1.3	G													
			Expansion Tank Calculations	1.3.8	G													
			SD-06 Test Reports															
			request to schedule Preliminary Tests	3.6	G													
			Preliminary Test Report	3.6	G													
			request to schedule Final Acceptance Test	3.7	G													
			Final Acceptance Test Report	3.7	G													
			SD-07 Certificates															
			Inspection by Fire Protection Engineer	3.1	G													
			Fire Protection Engineer	1.5.1	G													
			Sprinkler System Installer	1.5.2	G													
			SD-10 Operation and Maintenance Data															
			Operating and Maintenance Instructions	3.8														
			Operating and Maintenance Instructions	3.8														
			SD-11 Closeout Submittals															

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION CODE	DATE OF ACTION
		21 13 13.00 20	As-built drawings	3.7														
			On-site training	3.8														
		21 13 20.00 20	SD-02 Shop Drawings															
			Fire extinguishing system	1.3.1.1	G													
			SD-03 Product Data															
			Pipe, fittings, and mechanical couplings	2.7.1	G													
			Flow Control valves	2.1.1	G													
			Valves	2.7.6	G													
			Grate nozzles	2.5	G													
			Pipe hangers and supports	2.7.4	G													
			Pressure switch	2.9	G													
			Fire department inlet connections	2.7.11	G													
			AFFF concentrate storage tanks	2.4.2	G													
			Proportioning equipment	2.4	G													
			AFFF concentrate	2.3	G													
			Strainers	2.7.3	G													
			Seismic Bracing	2.7.5	G													
			Surge Tank	2.6	G													
			Surrogate Concentrate	2.3.2	G													
			Hose Valve Manifold Test Header	2.7.12	G													
			SD-05 Design Data															
			Hydraulic calculations	1.3.1.2	G													
			Pressure discharge graphs or tables	1.3.1.2	G													
			Seismic Bracing	2.7.5	G													

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		21 13 20.00 20	SD-06 Test Reports															
			Request for Discharge Permit	3.5.2.2	G													
			Preliminary tests	3.5.1	G													
			Acceptance tests	3.5.2	G													
			SD-07 Certificates															
			Qualifications of installer	1.5.1	G													
			AFFF containment and disposal plan	1.3.1.3	G													
			SD-10 Operation and Maintenance Data															
			Flow control valves	2.1.1	G													
			Proportioning equipment	2.4	G													
			AFFF concentrate storage tanks	2.4.2	G													
			Grate nozzles	2.5	G													
			fire extinguishing system	1.3.1.1	G													
			SD-11 Closeout Submittals															
			As-built drawings for the fire extinguishing system	1.3.1.4	G													
		22 00 00	SD-06 Test Reports															
			Tests, Flushing and Disinfection	3.4														
			SD-07 Certificates															
			Materials and Equipment	1.3														
		23 00 00	SD-02 Shop Drawings															
			Detail Drawings	1.4.5	G													
			SD-03 Product Data															
			Duct Connectors	2.10.1.1														

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION CODE	DATE OF ACTION
		23 00 00	Low Leakage Air Dampers	2.14	G													
			Air Handling Units	2.12	G													
			Diagrams	1.2.1.2	G													
			SD-06 Test Reports															
			Performance Tests	3.10	G													
			SD-08 Manufacturer's Instructions															
			Manufacturer's Installation	3.3														
			Instructions															
			Operation and Maintenance	3.12.2														
			Training															
			SD-10 Operation and Maintenance															
			Data															
			Operation and Maintenance	3.12.1	G													
			Manuals															
			Air Handling Units	2.12	G													
			SD-11 Closeout Submittals															
			Energy Efficient Equipment	2.1.1	S													
			Reduce Volatile Organic	2.1.2	S													
			Compounds (VOC)															
			Indoor Air Quality During	3.1	S													
			Construction															
			Ozone Depleting Substances for	2.1.3	S													
			Refrigerants															
		23 05 15	SD-01 Preconstruction Submittals															
			Material, Equipment, and Fixture	1.2	G													
			Lists															

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		23 05 15	SD-02 Shop Drawings														
			Record Drawings	1.2	G												
			Connection Diagrams	1.2	G												
			Coordination Drawings	1.2	G												
			Fabrication Drawings	1.2	G												
			Installation Drawings	3.1	G												
			SD-03 Product Data														
			Pipe and Fittings	2.1	G												
			Piping Specialties	2.2	G												
			Valves	2.3	G												
			Miscellaneous Materials	2.4	G												
			Supporting Elements	2.5	G												
			Equipment Foundation Data	1.2	G												
			SD-04 Samples														
			Manufacturer's Standard Color Charts	1.2	G												
			SD-05 Design Data														
			Pipe and Fittings	2.1	G												
			Piping Specialties	2.2	G												
			Valves	2.3	G												
			SD-06 Test Reports														
			Hydrostatic Tests	3.1	G												
			Air Tests	3.1	G												
			Valve-Operating Tests	3.1	G												
			Non-Destructive Electric Tests	3.1	G												
			System Operation Tests	3.1	G												

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																		(g)
		23 05 15	SD-07 Certificates															
			Record of Satisfactory Field Operation	1.4.2	G													
			List of Qualified Permanent Service Organizations	1.4.3	G													
			Listing of Product Installations	1.2	G													
			Records of Existing Conditions	1.2	G													
			Temperature Ratings	3.1	G													
			SD-10 Operation and Maintenance Data															
			Operation and Maintenance Manuals	3.8	G													
		23 05 93	SD-01 Preconstruction Submittals															
			Records of Existing Conditions	1.3	G													
			Records of Existing Conditions	1.3.3	G													
			TAB Firm	1.5.4.1	G													
			TAB team assistants	1.2	G													
			TAB team engineer	1.2	G													
			TAB Specialist	1.5.4.2	G													
			TAB team field leader	1.2	G													
			SD-02 Shop Drawings															
			TAB Schematic Drawings and Report Forms	1.3.3	G													
			SD-03 Product Data															
			Equipment and Performance Data	1.3	G													

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		23 05 93	TAB Related HVAC Submittals	1.5.4.4	G														
			TAB Procedures	1.5.2	G														
			Calibration	1.5.2	G														
			Systems Readiness Check	1.3.3	G														
			TAB Execution	1.5.5	G														
			SD-06 Test Reports																
			TAB Work Execution Schedule	3.7	G														
			TAB Procedures Summary	3.7	G														
			Design review report	1.3.3	G														
			Design review report	1.7.2.1	G														
			Design review report	3.7	G														
			TAB report for Season 1	1.5.6.1	G														
			TAB report for Season 2	1.5.6.1	G														
			SD-07 Certificates																
			Independent TAB agency and personnel qualifications	1.5.1	G														
			Independent TAB agency and personnel qualifications	1.5.1	G														
			Advance Notice of TAB Field Work	3.7	G														
			Completed Pre-TAB Work Checklist	3.7															
			TAB Firm	1.5.4.1	G														
			TAB Submittal and Work Schedule	1.7.1	G														
			Design review report	1.3.3	G														

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		23 05 93	Design review report	1.7.2.1	G														
			Design review report	3.7	G														
			Pre-field TAB engineering report	1.7.2.2	G														
		23 07 00	SD-02 Shop Drawings																
			MICA Plates	3.2.2.4	G														
			Pipe Insulation Systems	2.4															
			Pipe Insulation Systems	3.2															
			Duct Insulation Systems	3.3															
			SD-03 Product Data																
			Pipe Insulation Systems	2.4	G														
			Pipe Insulation Systems	3.2	G														
			Duct Insulation Systems	3.3	G														
			SD-04 Samples																
			Display Samples	3.1.1	G														
			SD-08 Manufacturer's Instructions																
			Pipe Insulation Systems	2.4	G														
			Pipe Insulation Systems	3.2	G														
			Duct Insulation Systems	3.3	G														
			SD-11 Closeout Submittals																
			Reduce Volatile Organic Compounds (VOC)	2.1.1	S														
			Recycled Content	2.1.2	S														
		23 09 23.13 20	SD-02 Shop Drawings																
			Control System Drawings Title Sheet	1.4.1.1	G														
			List of I/O Points	1.4.1.2	G														

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		23 09 23.13 20	Control System Components List	1.4.1.3	G													
			Control System Schematics	1.4.1.4	G													
			HVAC Equipment Electrical	1.4.1.5	G													
			Ladder Diagrams															
			Component Wiring Diagrams	1.4.1.6	G													
			Terminal Strip Diagrams	1.4.1.7	G													
			BACnet Communication	1.4.1.8	G													
			Architecture Schematic															
			SD-03 Product Data															
			Direct Digital Controllers	2.1.2	G													
			BACnet Gateways	2.1.2.12	G													
			BACnet Discovery Tool	2.1.6	G													
			BACnet Operator Workstation	2.1.5	G													
			Software															
			BACnet Operator Workstation	2.1.4	G													
			Sensors and Input Hardware	2.2	G													
			Output Hardware	2.3	G													
			Surge and Transient Protection	2.4.2	G													
			Indicators	2.6	G													
			SD-05 Design Data															
			Performance Verification Testing	3.4.2	G													
			Plan															
			Pre-Performance Verification	3.4.4	G													
			Testing Checklist															
			SD-06 Test Reports															

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																		(g)
		23 09 23.13 20	Performance Verification Testing Report	3.4.11	G													
			SD-07 Certificates															
			Contractor's Qualifications	1.6.6	G													
			SD-09 Manufacturer's Field Reports															
			Pre-PVT Checklist	3.4.1	G													
			SD-10 Operation and Maintenance Data															
			BACnet Direct Digital Control Systems	1.4	G													
			Controls System Operators Manuals	3.3	G													
			SD-11 Closeout Submittals															
			Training Documentation	3.5.1	G													
		23 81 00.00 20	SD-02 Shop Drawings															
			Field-Assembled Refrigerant Piping	2.4.2														
			Control System Wiring Diagrams	1.3.2														
			SD-03 Product Data															
			Packaged Terminal Units	2.2														
			Refrigerant	1.4														
			Refrigerant Piping and Accessories	2.4														
			SD-06 Test Reports															
			Salt-Spray Tests	2.6.1														

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	
		23 81 00.00 20	Start-Up and Initial Operational Tests	3.8.3														
			SD-08 Manufacturer's Instructions															
			Packaged Terminal Units	2.2														
			Refrigerant Piping and Accessories	2.4														
			SD-10 Operation and Maintenance Data															
			Packaged Terminal Units	2.2														
			SD-11 Closeout Submittals															
			Posted Operating Instructions	1.3.4														
			Energy Efficient Equipment for Unitary Air Conditioning Equipment	2.1.1	S													
			Ozone Depleting Substances	2.1.2	S													
			Indoor Air Quality During Construction	3.1.1	S													
		23 82 00.00 20	SD-03 Product Data															
			Unit Heaters	2.2	G													
			SD-05 Design Data															
			Suspension and bracing of unit heaters	3.1.1	G													
			SD-10 Operation and Maintenance Data															
			Unit Heaters	2.2														
			SD-11 Closeout Submittals															

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		23 82 00.00 20	Energy Efficient Equipment for Heating and Cooling Units	2.1.1	S													
		26 20 00	SD-02 Shop Drawings															
			Panelboards	2.11	G													
			Transformers	2.13	G													
			Wireways	2.23	G													
			SD-03 Product Data															
			Receptacles	2.10	G													
			Circuit breakers	2.11.3	G													
			Switches	2.8	G													
			Transformers	2.13	G													
			Enclosed circuit breakers	2.12	G													
			Motor controllers	2.14	G													
			Manual motor starters	2.15	G													
			SD-06 Test Reports															
			600-volt wiring test	3.4.2	G													
			Grounding system test	3.4.5	G													
			Transformer tests	3.4.3	G													
			Ground-fault receptacle test	3.4.4	G													
			SD-07 Certificates															
			Fuses	2.9	G													
			SD-09 Manufacturer's Field Reports															
			Transformer factory tests	2.25.1														
			SD-10 Operation and Maintenance Data															

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		26 20 00	Electrical Systems	1.5.1	G														
		26 29 23	SD-02 Shop Drawings																
			Schematic diagrams	1.5.1	G														
			Interconnecting diagrams	1.5.2	G														
			Installation drawings	1.5.3	G														
			SD-03 Product Data																
			Variable frequency drives	2.1	G														
			Wires and cables	2.3															
			Equipment schedule	1.5.4															
			SD-06 Test Reports																
			VFD Test	3.2.1															
			Performance Verification Tests	3.2.2															
			Endurance Test	3.2.3															
			SD-08 Manufacturer's Instructions																
			Installation instructions	1.5.5															
			SD-09 Manufacturer's Field Reports																
			VFD Factory Test Plan	2.5.1	G														
			Factory test results	1.5.6															
			SD-10 Operation and Maintenance Data																
			Variable frequency drives	2.1															
		26 35 43	SD-03 Product Data																
			Aircraft power cable assembly	2.2	G														
			SD-06 Test Reports																
			Work Plan	1.4.1	G														

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		26 35 43	Performance Test Plan	1.4.2	G												
			SD-09 Manufacturer's Field Reports														
			Initial Inspection and Tests	3.2.3	G												
			Performance Tests	1.4.3	G												
			Performance Tests	3.2.4	G												
			Training Syllabus	3.3.1	G												
			SD-10 Operation and Maintenance Data														
			Frequency converter	2.1	G												
			Preliminary Operation and Maintenance Manuals	1.5.1.1	G												
		28 05 26.00 40	SD-03 Product Data														
			Grounding Systems	1.3	G												
			Ground Wires	2.1.1	G												
			Connectors and Fasteners	2.1.2	G												
			Bonding Materials	3.2.2	G												
			SD-06 Test Reports														
			Continuity Isolation Test	3.3.1	G												
			SD-08 Manufacturer's Instructions														
			Grounding Systems	1.3	G												
		28 31 76	SD-02 Shop Drawings														
			Nameplates	2.1.2	G												
			Instructions	2.13.10	G												
			Wiring Diagrams	3.2.1	G												
			System Layout	1.2.1	G												

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		28 31 76	System Operation	2.3	G													
			Notification Appliances	2.17	G													
			Amplifiers	2.14	G													
			SD-03 Product Data															
			Technical Data And Computer Software	1.6	G													
			Fire Alarm Control Unit and Mass Notification Control Unit (FMCP)	2.13	G													
			Terminal cabinets	3.2.2	G													
			Manual stations	2.16	G													
			Transmitters	2.20	G													
			Batteries	2.12.1	G													
			Batteries	2.24.2.1	G													
			Battery chargers	2.12.2	G													
			Battery chargers	2.24.2.2	G													
			Smoke sensors	2.10	G													
			Notification appliances	2.17	G													
			Addressable interface devices	2.7	G													
			Amplifiers	2.14	G													
			Tone generators	2.14	G													
			Digitalized voice generators	2.14	G													
			Radio transmitter and interface panels	2.20.1	G													
			Rotating Beacons	2.24.8.1	G													
			Notification appliance booster panels	2.21	G													

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION
		28 31 76	Waves Panel	2.19	G												
			Abort Stations	2.24.4	G												
			Manual Release Stations	2.24.3	G												
			HVAC Shutdown Buttons	2.24.5	G												
			Temperature Sensor	2.23	G												
			Water Sensor	2.22	G												
			Pressure Switch	2.24.8.2	G												
			LCD, LED Display Unit (VDU)	2.15	G												
			SD-05 Design Data														
			Battery power	2.12.1.2	G												
			Battery chargers	2.12.2	G												
			Battery chargers	2.24.2.2	G												
			SD-06 Test Reports														
			Field Quality Control	3.7													
			Testing Procedures	3.7.1	G												
			Smoke sensor testing	2.10.3	G												
			IR Detectors	3.1.3	G												
			IR Detector Coverage	3.1.3	G												
			Releasing Panel Test Report	3.1.2	G												
			SD-07 Certificates														
			Installer	1.7.1.4													
			Formal Inspection and Tests	3.7.2.2													
			Final Testing	3.7.2.3													
			SD-09 Manufacturer's Field Reports														
			System Operation	2.3	G												

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION CODE	DATE OF ACTION
		28 31 76	Fire Alarm/Mass Notification System	1.7.2.2														
			SD-10 Operation and Maintenance Data															
			Operation and Maintenance (O&M) Instructions	3.10	G													
			Instruction of Government Employees	3.8	G													
			SD-11 Closeout Submittals															
			As-Built Drawings	3.7.2.4														
		31 00 00	SD-01 Preconstruction Submittals															
			Shoring	3.5	G													
			Dewatering Work Plan	1.4.3	G													
			SD-03 Product Data															
			Utilization of Excavated Materials	3.9	G													
			Rock Excavation	1.4.1.2														
			Opening of any Excavation or Borrow Pit	3.4														
			Shoulder Construction	3.15														
			SD-06 Test Reports															
			Testing	3.18														
			Borrow Site Testing	2.1														
			SD-07 Certificates															
			Testing	3.18														
		31 05 19	SD-03 Product Data															
			Thread	2.1.2														

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																		(g)
		31 05 19	Manufacturing Quality Control Sampling and Testing	2.2														
			SD-04 Samples															
			Quality Assurance Samples and Tests	3.1														
			SD-07 Certificates															
			Geotextile	2.1.1														
		31 23 00.00 20	SD-01 Preconstruction Submittals															
			Dewatering work plan	1.7.2														
			Shoring And Sheeting Plan	1.7.1														
			SD-06 Test Reports															
			Borrow Site Testing	1.6	G													
			Fill and backfill	3.14.2.1														
			Select material	3.14.2.2														
			Porous fill	3.14.2.3														
			Density tests	3.14.2.4														
			Moisture Content Tests	3.14.2.5														
		31 32 11	SD-02 Shop Drawings															
			Layout	3.2.2														
			Obstructions Below Ground	3.2.4														
			Seed Establishment Period	2.5.12.1														
			Maintenance Record	3.6														
			SD-03 Product Data															
			Geosynthetic Binders	2.2.2														
			Synthetic Grid Systems	2.6.1														

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION CODE	DATE OF ACTION
		31 32 11	Articulating Cellular Concrete Block Systems	2.8														
			Equipment	1.1														
			Finished Grade	3.1.1														
			Erosion Control Blankets	2.5														
			SD-04 Samples															
			Geosynthetic binders	2.2.2														
			Mulch	2.3														
			Hydraulic mulch	2.3.10														
			Geotextile fabrics	2.4														
			Erosion control blankets	2.5														
			Synthetic grid systems	2.6.1														
			Articulating Cellular Concrete Block Systems	2.8														
			SD-06 Test Reports															
			Geosynthetic Binders	2.2.2														
			Hydraulic Mulch	2.3.10														
			Geotextile Fabrics	2.4														
			Erosion Control Blankets	2.5														
			Synthetic Grid Systems	2.6.1														
			Articulating Cellular Concrete Block Systems	2.8														
			Compressive Strength Testing	2.8														
			Sand	2.7														
			Gravel	2.7														
			SD-07 Certificates															

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION CODE	DATE OF ACTION
		31 32 11	Fill Material	3.3.12.1														
			Mulch	2.3														
			Hydraulic Mulch	2.3.10														
			Geotextile Fabrics	2.4														
			Geosynthetic Binders	2.2.2														
			Synthetic Soil Binders	2.2.1														
			Installer's Qualification	1.5.1														
			Recycled Plastic	2.1														
			Seed	2.5.12														
			Asphalt Adhesive	2.3.8														
			Tackifier	2.3.11														
			Wood By-Products	2.3.6														
			Wood Cellulose Fiber	2.3.3														
			SD-10 Operation and Maintenance Data															
			Maintenance Instructions	3.6.2														
		32 11 16	SD-03 Product Data															
			Equipment	1.3														
			SD-06 Test Reports															
			Sampling and Testing	1.5														
			Field Density Tests	1.5.2.4														
		32 11 24	SD-06 Test Reports															
			Gradation	3.8.2.1														
			Gradation	3.8.2.1														
			Density	3.8.2.3														
			Density	3.8.2.3														

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION CODE	DATE OF ACTION
		32 11 24	Smoothness	3.8.2.2														
			Thickness	3.8.2.5														
		32 12 16	SD-03 Product Data															
			Mix Design	2.4	G													
			Quality Control	3.10	G													
			Material Acceptance	3.11	G													
			SD-04 Samples															
			Asphalt Cement Binder	2.3														
			Aggregates	2.2														
			SD-06 Test Reports															
			Aggregates	2.2	G													
			QC Monitoring	3.10.3.10														
			SD-07 Certificates															
			Asphalt Cement Binder	2.3	G													
			Testing Laboratory	3.6														
		32 16 13	SD-03 Product Data															
			Concrete	2.1														
			SD-06 Test Reports															
			Field Quality Control	3.8														
		32 17 23.00 20	SD-03 Product Data															
			Reflective media for roads and streets	2.1.2														
			Paints for roads and streets	2.1.1														
			High Build Acrylic Coating (HBAC)	2.1.6	G													
			Thermoplastic compound	2.1.3														

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																		(g)
		32 17 23.00 20	Thermoplastic compound	3.2.2.3														
			Raised Pavement Markers	2.1.5														
			Equipment	1.5	G													
			SD-06 Test Reports															
			Reflective media for roads and streets	2.1.2														
			Paints for roads and streets	2.1.1														
			High Build Acrylic Coating (HBAC)	2.1.6	G													
			Thermoplastic compound	2.1.3														
			Thermoplastic compound	3.2.2.3														
			Raised Pavement Markers	2.1.5														
			SD-07 Certificates															
			Reflective media for roads and streets	2.1.2														
			Paints for roads and streets	2.1.1														
			Volatile Organic Compound	3.5.2														
			Thermoplastic compound	2.1.3														
			Thermoplastic compound	3.2.2.3														
			Construction equipment list	1.5														
			SD-08 Manufacturer's Instructions															
			Paints for roads and streets	2.1.1														
			Thermoplastic compound	2.1.3														
			Thermoplastic compound	3.2.2.3														
		32 31 13	SD-02 Shop Drawings															
			Fence Assembly	1.3														

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			ACTION CODE	DATE OF ACTION
		32 31 13	Location of Gate, Corner, End, and Pull Posts	3.15.1														
			Gate Assembly	1.3														
			Erection/Installation Drawings	1.3														
			SD-03 Product Data															
			Fence Assembly	1.3														
			Gate Assembly	1.3														
			Recycled Material Content	2.1														
			Zinc Coating	2.2														
			PVC Coating	1.5.1														
			Fabric	2.3														
			Stretcher Bars	2.11														
			Concrete	2.16														
			SD-04 Samples															
			Fabric	2.3														
			Line Posts	2.5														
			Sleeves	2.7														
			Top Rail	2.8														
			Tension Wire	2.10														
			Stretcher Bars	2.11														
			Wire Ties	2.15														
			SD-07 Certificates															
			Certificates of Compliance	1.5.2														
			SD-08 Manufacturer's Instructions															
			Fence Assembly	1.3														
			Gate Assembly	1.3														

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
																		(g)
		32 31 13	Hardware Assembly	1.3														
			Accessories	1.3														
		32 92 19	SD-03 Product Data															
			Wood cellulose fiber mulch	2.5.3														
			Fertilizer	2.4														
			SD-06 Test Reports															
			Topsoil composition tests	2.2.3														
			SD-07 Certificates															
			seed	2.1														
			SD-08 Manufacturer's Instructions															
			Erosion Control Materials	2.7														
		32 92 23	SD-03 Product Data															
			Fertilizer	2.4														
			SD-06 Test Reports															
			Topsoil composition tests	2.2.3														
			SD-07 Certificates															
			sods	2.1														
		33 11 00	SD-02 Shop Drawings															
			Fire Department Control Pit	2.3														
			SD-03 Product Data															
			Piping Materials	2.1.1														
			Water distribution main	2.1														
			Water service line	2.2														
			Indicator posts	2.1.2.6														
			Corporation stops	2.2.2.1														
			Valve boxes	2.1.2.7														

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		33 11 00	Valve boxes	2.2.2.12														
			SD-06 Test Reports															
			Disinfection	2.2.2.17	G													
			SD-07 Certificates															
			Water distribution main	2.1														
			Water service line	2.2														
			lining	2.1.1.1														
			lining	2.1.1.1														
			lining	2.1.1.2														
			lining	2.1.1.2														
			Displacement Type Meters	2.2.2.14														
			Compound Type Meters	2.2.2.15														
			SD-08 Manufacturer's Instructions															
			Delivery, storage, and handling	1.4														
			Installation	3.1.1														
		33 30 00	SD-01 Preconstruction Submittals															
			Existing Conditions	1.6														
			SD-02 Shop Drawings															
			Drawings	1.4.2														
			Precast concrete manhole	2.3.1														
			Metal items	2.3.4														
			Frames, covers, and gratings	2.3.4.1														
			Afff Tank	2.5														
			Environmental Panel	2.7														
			Manual Oil Interceptor	2.8														
			Sump Pump	2.9														

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		33 30 00	SD-03 Product Data															
			Pipeline materials	2.1														
			SD-06 Test Reports															
			Reports	2.4														
			SD-07 Certificates															
			Portland Cement	2.2.2														
		33 40 00	SD-03 Product Data															
			Placing Pipe	3.3														
			SD-04 Samples															
			Pipe for Culverts and Storm Drains	2.1														
			SD-07 Certificates															
			Resin Certification	2.1.1														
			Pipeline Testing	3.7														
			Hydrostatic Test on Watertight Joints	2.6														
			Determination of Density	3.6.5														
			Frame and Cover for Gratings	2.3.7														
		33 60 01	SD-02 Shop Drawings															
			Detail Drawings	1.3.1	G													
			SD-03 Product Data															
			Piping and Fittings	2.4														
			Valves	2.5														
			Insulation	2.8.2														
			Expansion Joints	2.10														
			SD-04 Samples															

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		33 60 01	Insulated Sections	1.3.2	G													
			SD-10 Operation and Maintenance Data															
			Valve Manholes and Accessories Data Package 2	3.7 3.7.1	G G													
		34 73 13	SD-02 Shop Drawings															
			As-Built Drawings	1.3	G													
			SD-06 Test Reports															
			Tests	3.4														
			SD-07 Certificates															
			Static Ground Receptacle	2.2														
			Grounding Rods	2.3														
			Grounding Connectors	2.5														
			Copper Conductors	2.4														

## SECTION 01 14 00

## WORK RESTRICTIONS

**11/11**

## PART 1 GENERAL

## 1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

## SD-01 Preconstruction Submittals

Roof work plan; G

Written Approval; G

Written Inspection Report; G

Paint Application Plan; G

List of Contact Personnel

## 1.2 SPECIAL SCHEDULING REQUIREMENTS

- a. The hangar will remain in operation during the entire construction period. The Contractor must conduct his operations so as to cause the least possible interference with normal operations of the activity.
- b. Permission to interrupt any Activity roads, railroads, and/or utility service must be requested in writing a minimum of 15 calendar days prior to the desired date of interruption.
- c. The work under this contract requires special attention to the scheduling and conduct of the work in connection with existing operations. Identify on the construction schedule each factor which constitutes a potential interruption to operations.
- d. Airfield Access: Training and badging requirements for personnel and registration for vehicles to be granted access to apron areas will be provided by the Government.
- e. Throughout the duration of this contract, there will be Navy activities adjacent to this site that will require the contractor to stop work and vacate his personnel and equipment from the site. These activities include, but are not limited to change of command ceremonies, fueling and movement of ammunition. Duration of stoppages will normally be approximately 4 hours each. Duration of periods between stoppages will vary. For bidding purposes, expect one work stoppage per month.
- f. NAVFAC will require 48 hours to review the roof stay member reports.

Include this 48 hour requirement into the schedule when opening the roof, inspecting the stay and repairing the stay member/roof.

- g. Events being held on base including the air show will prohibit the contractor from working on those dates. Duration of stop work for the air show will include 3 days. For bidding purposes, expect 3 days of work stoppage.

### 1.3 CONTRACTOR ACCESS AND USE OF PREMISES

#### 1.3.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. Wear hard hats in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. Mark Contractor equipment for identification.

##### 1.3.1.1 Subcontractors and Personnel Contacts

Provide a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

##### 1.3.1.2 Identification Badges and Installation Access

Application for and use of badges will be as directed. Obtain access to the installation by participating in the Navy Commercial Access Control System (NCACS), or by obtaining passes each day from the Base Pass and Identification Office. Costs for obtaining passes through the NCACS are the responsibility of the Contractor. One-day passes, issued through the Base Pass and Identification Office, will be furnished without charge. Furnish a completed EMPLOYMENT ELIGIBILITY VERIFICATION (DHS FORM I-9) form for all personnel requesting badges. This form is available at <http://www.uscis.gov/portal/site/uscis> by searching or selecting Employment Verification (Form I-9). Immediately report instances of lost or stolen badges to the Contracting Officer.

- a. NCACS Program: NCACS is a voluntary program in which Contractor personnel who enroll, and are approved, are subsequently granted access to the installation for a period up to one year, or the length of the contract, whichever is less, and are not required to obtain a new pass from the Base Pass and Identification Office for each visit. The Government performs background screening and credentialing. Throughout the year the Contractor employee must continue to meet background screening standards. Periodic background screenings are conducted to verify continued NCACS participation and installation access privileges. Under the NCACS program, no commercial vehicle inspection is required, other than for Random Anti-Terrorism Measures (RAM) or in the case of an elevation of Force Protection Conditions (FPCON). Information on costs and requirements to participate and enroll in NCACS is available at <http://www.rapidgate.com> or by calling 1-877-727-4342. Contractors should be aware that the costs incurred to obtain NCACS credentials, or costs related to any means of access to a Navy Installation, are not reimbursable. Any time invested, or price(s) paid, for obtaining NCACS credentials will not be compensated in any way or approved as a direct cost of any contract with the

Department of the Navy.

- b. One-Day Passes: Participation in the NCACS is not mandatory, and if the Contractor chooses to not participate, the Contractor's personnel will have to obtain daily passes, be subject to daily mandatory vehicle inspection, and will have limited access to the installation. The Government will not be responsible for any cost or lost time associated with obtaining daily passes or added vehicle inspections incurred by non-participants in the NCACS.

#### 1.3.1.3 No Smoking Policy

Smoking is prohibited within and outside of all buildings on installation, except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

#### 1.3.2 Working Hours

Regular working hours must consist of an 8 1/2 hour period established by the Contractor Officer, between 7 a.m. and 3:30 p.m., Monday through Friday, excluding Government holidays.

#### 1.3.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work must be lighted in a manner approved by the Contracting Officer. Make utility cutovers after normal working hours or on Saturdays, Sundays, and Government holidays unless directed otherwise.

#### 1.3.4 Occupied Building And Airfields

The Contractor shall be working in an existing building which is occupied.

The existing buildings and their contents must be kept secure at all times. Provide temporary closures as required to maintain security as directed by the Contracting Officer.

Provide dust covers or protective enclosures to protect existing work that remains and Government material located in the hangar during the construction period.

Relocate movable furniture to another approved location within Hangar 111 as required to perform the work, protect the furniture, and replace the furniture in original locations upon completion of the work. Leave attached equipment in place, and protect them against damage, or temporarily disconnect, relocate, protect, and reinstall them at the completion of the work.

Do not enter airfield areas without prior clearance from the Government.

The Government will remove and relocate other Government property such as aircraft and associated equipment, tools, etc. in the areas of the building scheduled to receive work.

#### 1.3.5 Utility Cutovers and Interruptions

- a. Apply for outage at least 15 days in advance.
- b. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in the paragraph "Work Outside Regular Hours."
- c. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.
- d. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, and fire suppression system are considered utility cutovers pursuant to the paragraph entitled "Work Outside Regular Hours." Such interruptions are further limited to 4 hours. This time limit includes time for deactivation and reactivation.
- e. Operation of Station Utilities: The Contractor must not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor must notify the Contracting Officer giving reasonable advance notice when such operation is required.

#### 1.4 SECURITY REQUIREMENTS

There is a special access pass to enter the flight line. Coordinate with Jeffrey Weddle (jeffrey.a.weddle@navy.mil) for access to Flight Line. Brian M. Neal (brian.m.neal@navy.mil) from the Base Security should be contacted for authorization to take pictures. Vehicle access to the flight line requires a separate pass that must be renewed every 30 days.

#### 1.5 Foreign Object Debris

Contractor shall maintain a sweeper-vac on site, and clean the truck route from the hangar bay to the security post (where access is obtained to the flight line) to remove foreign object debris. FOD. Talk to Gramps at 433-2318 for more info.

#### 1.6 Roof Construction Activities

During construction, the existing roof system must be protected from damage. Any damage to the existing roof must be repaired at no additional cost and repairs shall be inspected and approved by the warranting manufacturer.

The contractor shall provide a walking platform, width as required for use by the contractor, from points of roof access to and around roof areas to be disturbed during construction. One recommended walking platform assembly includes polyethylene sheeting, 1" EPS insulation and ½" plywood over the exposed roof membrane. This assembly must not be permanently

attached to the existing roof but must be weighed down, i.e. bags of roof ballast.

Windborne debris created during the roof construction activities is prohibited. This includes but is not limited to the overspray from painting activities as well as the structural steel member cleaning process. Methods for cleaning the steel members as well as repainting the steel members shall take this into consideration.

Construction activities that are required above the standing reach from the roof shall be completed with a vertical conveyance system. The type of vertical conveyance system can include, but is not limited to, ladders and scaffolding.

A roof work plan shall be submitted which addresses:

The roof protection method, including that to protect the roof with the vertical conveyance system.

Indicate the means of access to the roof. Indicate emergency plan for access.

The steel member cleaning process and repainting process to prevent windborne debris.

The proposed vertical conveyance system  
Roof construction activities shall not commence until written authorization from the contracting officer is provided.

Provide submittal to contracting officer which indicates written approval from the roof manufacturer for the following:

Manufacturer shall provide written approval for means and method of repairing the roof that will not void warranty.

Manufacturer shall provide approval for installing contractor.

Provide a written inspection report from the manufacturer of the roof at completion which states that the existing roofing system has been inspected and is acceptable for continuing warranty coverage without exception.

1.7 Paint Application Plan

Submit a plan describing how paint will be removed and applied on this specific project. Paint removal shall indicate method of removal, debris collection, environmental impact and method for preparation of steel for new coatings.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

## SECTION 08 60 45

## TRANSLUCENT PANELS

02/12

## PART 1 GENERAL

## 1.1 SUMMARY

Provide commercially available translucent wall panel system which satisfy all requirements contained in this section and have been verified by load testing and independent design analyses (if required) to meet specified design requirements. See section 08 34 16.10 STEEL SLIDING HANGAR DOORS. Provide environmentally preferable products and work practices, applicable to systems, considering raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and/or disposal of the products or services used in the systems. The wall system shall be UV-stabilized, shatterproof and energy efficient. The plastics used in the manufacture of the wall panels shall be light transmitting plastics for daylighting applications.

## 1.2 REFERENCES

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

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 2604 (2010) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

## ASTM INTERNATIONAL (ASTM)

ASTM C297/C297M (2004; R 2010) Flatwise Tensile Strength of Sandwich Constructions

ASTM D1002 (2010) Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)

ASTM D1037 (2012) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

ASTM D2244 (2015a) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

ASTM D3841 (1997; E 2008; R 2008) Standard Specification for Glass Fiber-Reinforced Polyester Plastic Panels

ASTM E283 (2004; R 2012) Determining the Rate of Air Leakage Through Exterior Windows, Curtain

## Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM E331

(2000; R 2009) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

## 1.3 SUBMITTALS

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

## SD-02 Shop Drawings

Shop Drawings; G

## SD-03 Product Data

Translucent Panels; G  
Warranty

## SD-06 Test Reports

Test Reports

## SD-07 Certificates

Systems  
Qualifications

## 1.4 QUALITY ASSURANCE

- a. Provide documentation of Qualifications for the following: The manufacturer is a company specializing in the manufacture of the specified products with a minimum of 10 years documented experience. The installer has documented experience of 5 years minimum performing the work specified.
- b. Before fabrication, provide a full service mock-up of each type of wall system for review of wall panel construction and quality of hardware operation.

## 1.5 DELIVERY, STORAGE, AND HANDLING

Provide factory assembled system modules to the greatest extent possible. Ship panels to the jobsite in rugged shipping units, ready for erection. Store panels on the long edge, several inches above the ground, blocked and under cover to prevent warping. Deliver panels in manufacturer's original containers, dry, undamaged, with seals and labels intact. Deliver, store and protect all products in accordance with manufacturer's recommendations.

## 1.6 WARRANTY

Provide the manufacturer's complete warranty for materials, workmanship, and installation. The warranty is for 5 years from the time of project

completion and with no proration. The warranty must guarantee, but not be limited to, the following:

- a. In accordance with ASTM D2244, panels do not darken more than 3.0 Delta E units after 5 years of outdoor weathering in South Florida at 45 degrees facing south. Document compliance with this requirement in submitted Test Reports.
- b. There is no delamination of the panel affecting appearance, performance, weatherability or structural integrity of the panels or the completed system.
- c. There is no fiberbloom on the panel face.
- d. Provide a single source warranty for the glazing panels and the framing system. Third party warranty for the glazing panels will not be accepted.

## PART 2 PRODUCTS

### 2.1 TRANSLUCENT PANELS

Fabricate skylight panels of glass-fiber reinforced polyester panels conforming to the specified requirements and other appropriate lab test specified criteria, weighing not less than 8 ounces/square foot. Submit certified Test Reports from independent testing laboratory for each type and class of panel system. Reports must verify that the material meets specified performance requirements. Previously completed test reports will be acceptable if they are current and indicative of products used on this project. Size and color of skylight panels as indicated.

### 2.2 GLASS-FIBER PANELS

Provide glass-fiber reinforced polyester panels conforming to ASTM D3841.

#### 2.2.1 Weatherability

Provide the exposed faces of fiberglass sandwich type panels with a permanent glass veil erosion barrier embedded integrally to provide maximum long term resistance to reinforcing fiber exposure. The exterior face sheet must be uniform in strength and resistant to penetration by pencil point.

#### 2.2.2 Non Combustible Grid Core

Use 6063-T6 aluminum I-beams with provisions for mechanical interlocking of muntin-mullion and perimeter to prevent high and low intersections which do not allow full bonding surface to contact with face material. I-beam width no less than 7/16 inch. Machine I-beam grid to tolerances of not greater than plus or minus 0.002 inch for flat panels. Panels must withstand 1200 degrees F fire for a minimum of one hour without collapse or exterior flaming.

#### 2.2.3 Adhesive

Use heat and pressure resin-type laminate adhesive engineered for structural sandwich panel use; which passes testing requirements specified by the International Conference of Building Officials' "Acceptance Criteria for Sandwich Panel Adhesive". Provide with the following minimum

strength:

- a. Tensile Strength of 750 psi in accordance with ASTM C297/C297M after two exposures to six cycles each of the aging conditions prescribed in ASTM D1037.
- b. Shear Strength, after exposure to five separate aging conditions in accordance with ASTM D1002:
  - (1) 540 psi at 50 percent relative humidity and 73 degrees F.
  - (2) 800 psi under accelerated aging in accordance with ASTM D1037 at room temperature.
  - (3) 250 psi under accelerated aging in accordance with ASTM D1037 at 182 degrees F.
  - (4) 100 psi at 182 degrees F.

#### 2.2.4 Panel Construction

Provide panels consisting of fiberglass faces laminated to an aluminum I-beam grid core.

### 2.3 COMMON PANEL REQUIREMENTS

#### 2.3.1 Appearance

Provide face sheets uniform in color to prevent splotchy appearance and completely free of ridges and wrinkles which prevent proper surface contact. Clusters of air bubbles/pinholes which collect moisture and dirt are not acceptable.

#### 2.3.2 Panel Fabrication

Panel construction must meet the following requirements:

- a. Light transmission 13 percent; color as indicated.
- b. Assembled panel thickness inches.
- c. Grid size as indicated.

#### 2.3.3 Thermal Performance

Provide panels certified by the National Fenestration Rating Council with a whole-unit Solar Heat Gain Coefficient (SHGC) maximum of 0.27 and a U-factor maximum of 0.62 Btu/hr-ft<sup>2</sup>-F.

### 2.4 TRANSLUCENT PANEL SYSTEMS

Submit manufacturer's certificate that the systems meet or exceed specified requirements. Provide translucent panel systems meeting the following requirements:

- a. Integral perimeter framing system assembly by the manufacturer.
- b. Exterior panel faces crystal in color. Interior panel faces white in color.

- c. Air infiltration at 1.57 psf less than  $0.04 \text{ cfm/ft}^2$  and at 6.24 psf less than  $0.07 \text{ cfm/ft}^2$  in accordance with ASTM E283.
- d. Water penetration at test pressure of 5 psf equals zero in accordance with ASTM E331.
- e. Manufacturer is responsible for maximum system deflection, in accordance with the applicable building code, and without damage to system performance. Calculate deflection in accordance with engineering principles.
- f. Incorporate weepage elements within the perimeter framework of the glazing system for drainage of any condensation or water penetration.
- g. System must accommodate movement within the system; movement between the system and perimeter framing components; dynamic loading and release of loads; and deflection of supporting members. Achieve this without damage to system or components, deterioration of weather seals and fenestration properties specified.
- h. The exterior panel face must repel an impact of 70 foot-pounds without fracture or tear when impacted by a 3.25 inch diameter, 5 pound free falling ball dropped from a vertical distance of 14 feet.
- i. Exposed aluminum color must be selected from the manufacturer's standard range. Provide corrosion resistant fluoropolymer, two coat high-performance organic finish in accordance with AAMA 2604.
- j. Provide a system requiring no scheduled recoating to maintain its performance or for UV resistance.
- k. Design criteria:
  - (1) Wind Load 44 psf.
  - 1. Use 6063-T6 and 6063-T5 extruded aluminum; all fasteners of stainless steel or cadmium plated steel.

## 2.5 FLEXIBLE SEALING TAPE

Provide manufacturer's standard pre-applied sealing tape to closure system at the factory under controlled conditions.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Field verify all submitted opening sizes, dimensions and tolerances; preparation of openings includes isolating dissimilar materials from aluminum system to avoid damage by electrolysis. The installer must examine area of installation to verify readiness of site conditions and to notify the Contractor about any defects requiring correction. Verify when structural support is ready to receive all specified work and to convene a pre-installation conference, if approved by the Contracting Officer, including the Contractor, system installer and all parties directly affecting and affected by the specified work. Do not install any materials that show visual evidence of biological growth due to the

presence of moisture. Do not commence work until conditions are satisfactory.

### 3.2 ERECTION

Erect translucent wall panel system in accordance with the approved shop drawings supplied by the manufacturer. Submit drawings showing fabrication details, materials, dimensions, installation methods, anchors, and relationship to adjacent construction. Fasten and seal in accordance with the manufacturer's shop drawings. Remove all panel, after other trades have completed work on adjacent materials. Carefully inspect and adjust panel installation as necessary to ensure proper installation and weather-tight conditions. provide all staging, lifts and hoists required for the complete installation and field measuring. Install system clean of dirt, debris or staining and thoroughly examined for removal of all protective material prior to final inspection of the designated work area.

-- End of Section --

## SECTION 33 30 00

SANITARY SEWERS  
04/08

## PART 1 GENERAL

## 1.1 SUMMARY

## 1.1.1 Sanitary Sewer Gravity Pipeline

Provide mains and laterals of polyvinyl chloride (PVC) plastic pipe, or galvanized steel pipe. Provide building connections of polyvinyl chloride (PVC) plastic pipe, or galvanized steel pipe.

## 1.1.2 Sanitary Sewer Pressure Lines

Provide pressure lines of polyvinyl chloride (PVC) plastic pressure pipe.

## 1.2 REFERENCES

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

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2013) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2012) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C153/A21.53	(2011) Ductile-Iron Compact Fittings for Water Service
AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C605	(2013) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA C900	(2007; Errata 2008) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
AWWA M23	(2002; 2nd Ed) Manual: PVC Pipe - Design and Installation

## ASME INTERNATIONAL (ASME)

ASME B1.20.1 (2013) Pipe Threads, General Purpose (Inch)

ASME B16.3 (2011) Malleable Iron Threaded Fittings,  
Classes 150 and 300

## ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2013) Standard Specification for Zinc  
(Hot-Dip Galvanized) Coatings on Iron and  
Steel Products

ASTM A48/A48M (2003; R 2012) Standard Specification for  
Gray Iron Castings

ASTM A53/A53M (2012) Standard Specification for Pipe,  
Steel, Black and Hot-Dipped, Zinc-Coated,  
Welded and Seamless

ASTM A536 (1984; R 2014) Standard Specification for  
Ductile Iron Castings

ASTM C150/C150M (2012) Standard Specification for Portland  
Cement

ASTM C260/C260M (2010a) Standard Specification for  
Air-Entraining Admixtures for Concrete

ASTM C270 (2014a) Standard Specification for Mortar  
for Unit Masonry

ASTM C443 (2011) Standard Specification for Joints  
for Concrete Pipe and Manholes, Using  
Rubber Gaskets

ASTM C478 (2015) Standard Specification for Precast  
Reinforced Concrete Manhole Sections

ASTM C478M (2015) Standard Specification for Precast  
Reinforced Concrete Manhole Sections  
(Metric)

ASTM C828 (2011) Low-Pressure Air Test of Vitrified  
Clay Pipe Lines

ASTM C923 (2008; R 2013) Standard Specification for  
Resilient Connectors Between Reinforced  
Concrete Manhole Structures, Pipes and  
Laterals

ASTM C924 (2002; R 2009) Testing Concrete Pipe Sewer  
Lines by Low-Pressure Air Test Method

ASTM C94/C94M (2015) Standard Specification for  
Ready-Mixed Concrete

ASTM C969	(2002; R 2009) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C972	(2000; R 2011) Compression-Recovery of Tape Sealant
ASTM C990	(2009; R 2014) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM D1784	(2011) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D1785	(2012) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2321	(2014; E 2014) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2412	(2011) Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D2464	(2013) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	(2013) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2680	(2001; R 2014) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D2751	(2005) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D3034	(2014a) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe

and Fittings

- ASTM D3139 (1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
- ASTM D3212 (2007; R 2013) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- ASTM D3753 (2012; E 2013) Glass-Fiber-Reinforced Polyester Manholes and Wetwells
- ASTM D412 (2006a; R 2013) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
- ASTM D624 (2000; R 2012) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
- ASTM F1417 (2011a) Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air
- ASTM F477 (2014) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- ASTM F949 (2010) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

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

- 29 CFR 1910.27 Fixed Ladders

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

- UBPPA UNI-B-6 (1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

1.3 SUBMITTALS

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

SD-01 Preconstruction Submittals

Existing Conditions

SD-02 Shop Drawings

- Drawings
- Precast concrete manhole
- Metal items
- Frames, covers, and gratings

Afff Tank  
Environmental Panel  
Manual Oil Interceptor  
Sump Pump

SD-03 Product Data

Pipeline materials

SD-06 Test Reports

Reports

SD-07 Certificates

Portland Cement

#### 1.4 QUALITY ASSURANCE

##### 1.4.1 Installer Qualifications

Install specified materials by a licensed underground utility Contractor licensed for such work in the state where the work is to be performed. Installing Contractor's License shall be current and be state certified or state registered.

##### 1.4.2 Drawings

- a. Submit Installation Drawings showing complete detail, both plan and side view details with proper layout and elevations.
- b. Submit As-Built Drawings for the complete sanitary sewer system showing complete detail with all dimensions, both above and below grade, including invert elevation.
- c. Sign and seal As-Built Drawings by a Professional Surveyor and Mapper. Include the following statement: "All potable water lines crossed by sanitary hazard mains are in accordance with the permitted utility separation requirements."

#### 1.5 DELIVERY, STORAGE, AND HANDLING

##### 1.5.1 Delivery and Storage

###### 1.5.1.1 Piping

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

###### 1.5.1.2 Metal Items

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

### 1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

### 1.5.2 Handling

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

## 1.6 PROJECT/SITE CONDITIONS

Submit drawings of existing conditions, after a thorough inspection of the area in the presence of the Contracting Officer. Details shall include the environmental conditions of the site and adjacent areas. Submit copies of the records for verification before starting work.

## PART 2 PRODUCTS

### 2.1 PIPELINE MATERIALS

Pipe shall conform to the respective specifications and other requirements specified below. Submit manufacturer's standard drawings or catalog cuts.

#### 2.1.1 PVC Plastic Gravity Sewer Piping

##### 2.1.1.1 PVC Plastic Gravity Pipe and Fittings

ASTM D3034, SDR 35, or ASTM F949 with ends suitable for elastomeric gasket joints.

##### 2.1.1.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to ASTM D3212. Gaskets shall conform to ASTM F477.

#### 2.1.2 PVC Plastic Pressure Pipe and Associated Fittings

##### 2.1.2.1 PVC Plastic Pressure Pipe and Fittings

###### 2.1.2.1.1 Pipe and Fittings Less Than 4 inch Diameter

Pipe, couplings and fittings shall be manufactured of materials conforming to ASTM D1784, Class 12454B.

###### 2.1.2.1.1.1 Screw-Joint

Pipe shall conform 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. Fittings for threaded pipe shall conform to requirements of ASTM D2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings. Pipe couplings when used, shall be tested as required by ASTM D2464.

###### 2.1.2.1.1.2 Push-On Joint

ASTM D3139, with ASTM F477 gaskets. Fittings for push-on joints shall be iron conforming to AWWA C110/A21.10 or AWWA C111/A21.11. Iron fittings and specials shall be cement-mortar lined (standard thickness) in

accordance with AWWA C104/A21.4.

#### 2.1.2.1.1.3 Solvent Cement Joint

Pipe shall conform 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. Fittings for solvent cement jointing shall conform to ASTM D2466 or ASTM D2467.

#### 2.1.2.1.2 Pipe and Fittings 4 inch Diameter to 12 inch

Pipe shall conform to AWWA C900 and shall be plain end or gasket bell end, Pressure Class 150 (DR 18), with cast-iron-pipe-equivalent OD. Fittings shall be gray-iron or ductile-iron conforming to AWWA C110/A21.10 or AWWA C153/A21.53 and shall have cement-mortar lining conforming to AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified, as approved, for push-on joint suitable for use with the PVC plastic pressure pipe specified in this paragraph.

#### 2.1.2.2 PVC Plastic Pressure Joints and Jointing Material

Joints for pipe, 4 inch to 12 inch diameter, shall be push-on joints as specified in ASTM D3139. Joints between pipe and fittings shall be push-on joints as specified in ASTM D3139 or shall be compression-type joints/mechanical-joints as respectively specified in ASTM D3139 and AWWA C111/A21.11. Each joint connection shall be provided with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe shall conform to ASTM F477. Gaskets for push-on joints and compression-type joints/mechanical-joints for joint connections between pipe and fittings shall be as specified in AWWA C111/A21.11, respectively, for push-on joints and mechanical-joints.

#### 2.1.2.3 Steel Pipe

Steel Pipe Less Than 6 inches Diameter: ASTM A53/A53M, standard weight, threaded end, galvanized.

##### 2.1.2.3.1 Steel Pipe Fittings

Fittings Less Than 6 inches Diameter: ASME B16.3, galvanized.

##### 2.1.2.3.2 Steel Pipe Coatings and Linings

Materials shall comply with the following requirements: Steel, exterior, buried: AWWA C203.

## 2.2 CONCRETE MATERIALS

### 2.2.1 Cement Mortar

Cement mortar shall conform to ASTM C270, Type M with Type II cement.

### 2.2.2 Portland Cement

Submit certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes. Portland cement shall conform to ASTM C150/C150M, Type II for concrete used in

concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking. Air-entraining admixture conforming to ASTM C260/C260M shall be used with Type V cement.

2.2.3 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C94/C94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Precast Concrete Manholes & Glass-Fiber-Reinforced Polyester Manholes

Precast concrete manhole risers, base sections, and tops shall conform to ASTM C478; base and first riser shall be monolithic. Glass-Fiber-Reinforced Polyester Manholes shall conform to ASTM D3753.

2.3.2 Gaskets and Connectors

Gaskets for joints between manhole sections shall conform to ASTM C443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C923 or ASTM C990.

2.3.3 External Preformed Rubber Joint Seals

An external preformed rubber joint seal shall be an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" shall be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal shall be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Propylene Diene Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit shall consist of a top and bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be a non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections shall cover up to two more adjusting rings. Properties and values are listed in the following table:

Properties, Test Methods and Minimum Values for Rubber used in Preformed Joint Seals				
Physical Properties	Test Methods	EPDM	Neoprene	Butyl Mastic
Tensile, psi	ASTM D412	1840	2195	--
Elongation, percent	ASTM D412	553	295	350
Tear Resistance, ppi	ASTM D624 (Die B)	280	160	--

Properties, Test Methods and Minimum Values for Rubber used in Preformed Joint Seals				
Physical Properties	Test Methods	EPDM	Neoprene	Butyl Mastic
Rebound, percent, 5 minutes	ASTM C972 (mod.)	--	--	11
Rebound, percent, 2 hours	ASTM C972	--	--	12

2.3.4 Metal Items

2.3.4.1 Frames, Covers, and Gratings for Manholes

Submit certification on the ability of frame and cover to carry the imposed live load. Frame and cover must be cast gray iron, ASTM A48/A48M, Class 35B, cast ductile iron, ASTM A536, Grade 65-45-12, or reinforced concrete, ASTM C478 ASTM C478M. Frames and covers must be circular with vent holes. Size must be as indicated on the plans. The words "Sanitary Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.3.4.2 Manhole Steps

As indicated conforming to 29 CFR 1910.27. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less than 4 feet deep.

2.3.4.3 Manhole Ladders

A steel ladder shall be provided where the depth of a manhole exceeds 12 feet. The ladder shall not be less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A123/A123M.

2.4 REPORTS

Compaction and density test shall be in accordance with Section 31 00 00 EARTHWORK. Submit Test Reports. Submit Inspection Reports for daily activities during the installation of the sanitary system. Information in the report shall be detailed enough to describe location of work and amount of pipe laid in place, measured in linear feet.

2.5 AFFF TANK

Provide a 25,000 gallon tank, 10' diameter by 47'-6" long, with fiberglass double walls. Tank shall be held in place by galvanized steel anchors embedded in 4000 psi concrete. Tank shall include a float sensor that monitors if the tank is 5% full and a 5' diameter access panel for maintenance. Tank penetrations shall be installed at the factory. Field modifications to the tank will not be permitted.

## 2.6 NOT USED

## 2.7 ENVIRONMENTAL PANEL

Control panel for submersible pump and AFFF containment tank. Requires a 24 hour backup battery system. Top strobe light is to indicate when the power has been cut to the submersible pump and shall remain illuminated until power is restored. The bottom strobe light indicates when AFFF tank exceeds 5% capacity and shall remain illuminated until AFFF tank level returns to normal. An audible annunciator must sound when either strobe light is illuminated. Shall also provide an audible tamper tone if the high water level is reached. The panel shall provide power to the submersible pump and power should disengage when AFFF system is deployed. The panel must provide a connection to the AFFF tank float to register when the capacity exceeds 5%. The panel cabinet must be stainless steel and tan in color with any lettering on it or the panel 0.8" all capital letters and black in color.

## 2.8 MANUAL OIL INTERCEPTOR

Provide a 26" X 20" carbon steel container fitted with sludge baffle, underflow baffle and a 3" PVC skimmer. The chamber shall have a max flow rate of 25 GPM and a liquid holding capacity of 55 gal. There should be a 50 gallon capacity oil storage chamber. Access hatch shall be provided for inspection and maintenance.

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

## 2.9 SUMP PUMP

Manhole with 115 V, 60 hertz, single phase NEC Class 1, Division 1, submersible pump, capable of 25 gpm at 15' total dynamic head, with a lifting chain and a float switch. Provide components that are UL listed or FM approved.

## PART 3 EXECUTION

### 3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

#### 3.1.1 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

##### 3.1.1.1 Location

The work covered by this section shall terminate at a point approximately 5 feet from the building. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 10 feet to a water main or service line. Install pressure sewer lines beneath water lines only, with the top of the sewer line being at least 2 feet below bottom of water line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same

distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

#### 3.1.1.1.1 Sanitary Piping Installation Parallel with Water Line

##### 3.1.1.1.1.1 Normal Conditions

Sanitary piping or manholes shall be laid at least 10 feet horizontally from a water line whenever possible. The distance shall be measured edge-to-edge.

##### 3.1.1.1.1.2 Unusual Conditions

When local conditions prevent a horizontal separation of 10 feet, the sanitary piping or manhole may be laid closer to a water line provided that:

- a. The top (crown) of the sanitary piping shall be at least 18 inches below the bottom (invert) of the water main.
- b. Where this vertical separation cannot be obtained, the sanitary piping shall be constructed of AWWA-approved ductile iron water pipe pressure tested in place without leakage prior to backfilling.
- c. The sewer manhole shall be of watertight construction and tested in place.

#### 3.1.1.1.2 Installation of sanitary Piping Crossing a Water Line

##### 3.1.1.1.2.1 Normal Conditions

Lay sanitary sewer piping by crossing under water lines to provide a separation of at least 18 inches between the top of the sanitary piping and the bottom of the water line whenever possible.

##### 3.1.1.1.2.2 Unusual Conditions

When local conditions prevent a vertical separation described above, use the following construction:

- a. Sanitary piping passing over or under water lines shall be constructed of AWWA-approved ductile iron water pipe, pressure tested in place without leakage prior to backfilling.
- b. Sanitary piping passing over water lines shall, in addition, be protected by providing:
  - (1) A vertical separation of at least 18 inches between the bottom of the sanitary piping and the top of the water line.
  - (2) Adequate structural support for the sanitary piping to prevent excessive deflection of the joints and the settling on and breaking of the water line.
  - (3) That the length, minimum 20 feet, of the sanitary piping be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the water line.

### 3.1.1.1.3 Sanitary Sewer Manholes

No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

### 3.1.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00 EARTHWORK.

### 3.1.1.1.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose. Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D2680; saddles for ABS pipe shall comply with Table 3 of ASTM D2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D3034.

### 3.1.1.1.4 Connections to Existing Lines

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

## 3.1.2 Special Requirements

### 3.1.2.1 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

### 3.1.2.2 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; with the requirements of AWWA C605 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

### 3.1.2.2.1 Pipe Less Than 4 Inch Diameter

#### 3.1.2.2.1.1 Threaded Joints

Make by wrapping the male threads with joint tape or by applying an approved thread lubricant, then threading the joining members together. Tighten the joints with strap wrenches which will not damage the pipe and fittings. Tighten the joint no more than 2 threads past hand-tight.

#### 3.1.2.2.1.2 Push-On Joints

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

#### 3.1.2.2.1.3 Solvent-Weld Joints

Comply with the manufacturer's instructions.

### 3.1.2.2.2 Pipe 4 Inch Diameter Joints

Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to fittings, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of AWWA C605 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners specified for this type joint and assemble in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel.

#### 3.1.2.2.3 Pipe Anchorage

Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to ASTM C94/C94M having a minimum compressive strength of 2,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

### 3.1.3 Concrete Work

Cast-in-place concrete is included in Section 03 30 00 CAST-IN-PLACE CONCRETE. The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

### 3.1.4 Manhole Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Cast-in-place concrete work shall be in accordance with the requirements specified under paragraph entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

### 3.1.5 Miscellaneous Construction and Installation

#### 3.1.5.1 Connecting to Existing Manholes

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

#### 3.1.5.2 Metal Work

##### 3.1.5.2.1 Workmanship and Finish

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

##### 3.1.5.2.2 Field Painting

After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

### 3.1.6 Sewage Absorption Trench Construction

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

### 3.1.7 Installations of Wye Branches

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

## 3.2 FIELD QUALITY CONTROL

### 3.2.1 Field Tests and Inspections

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

### 3.2.2 Tests for Nonpressure Lines

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

#### 3.2.2.1 Leakage Tests

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

##### 3.2.2.1.1 Infiltration Tests and Exfiltration Tests

Perform these tests for sewer lines made of the specified materials, not only concrete, in accordance with ASTM C969. Make calculations in accordance with the Appendix to ASTM C969.

### 3.2.2.1.2 Low-Pressure Air Tests

perform tests as follows:

#### 3.2.2.1.2.1 Clay Pipelines

Test in accordance with ASTM C828. Allowable pressure drop shall be as given in ASTM C828. Make calculations in accordance with the Appendix to ASTM C828.

#### 3.2.2.1.2.2 Concrete Pipelines

Test in accordance with ASTM C924. Allowable pressure drop shall be as given in ASTM C924. Make calculations in accordance with the Appendix to ASTM C924.

#### 3.2.2.1.2.3 Ductile-Iron Pipelines

Test in accordance with the applicable requirements of ASTM C924. Allowable pressure drop shall be as given in ASTM C924. Make calculations in accordance with the Appendix to ASTM C924.

#### 3.2.2.1.2.4 ABS Composite Plastic Pipelines

Test in accordance with the applicable requirements of UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

#### 3.2.2.1.2.5 PVC Plastic Pipelines

Test in accordance with UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

#### 3.2.2.1.2.6 Polypropylene

Test in accordance with ASTM F1417 or UBPPA UNI-B-6. Allowable pressure drop shall be as given in ASTM F1417 or UBPPA UNI-B-6 depending on the specification chosen to follow. Make calculations in accordance with the Appendix to ASTM F1417 or UBPPA UNI-B-6 depending on the specification chosen to follow.

### 3.2.2.2 Deflection Testing

Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads determined in accordance with ASTM D2412. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device.

#### 3.2.2.2.1 Pull-Through Device

This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.

Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the applicable requirements specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall conform to the following:

- a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
- b. Homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface Brinell hardness of not less than 150.
- c. Center bored and through-bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of not less than 70,000 psi, with eyes or loops at each end for attaching pulling cables.
- d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

#### 3.2.2.2.2 Deflection Measuring Device

Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.

#### 3.2.2.2.3 Pull-Through Device Procedure

Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.

#### 3.2.2.2.4 Deflection measuring device procedure

Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe which has excessive deflection and completely retest in same manner and under same conditions.

#### 3.2.3 Tests for Pressure Lines

Test pressure lines in accordance with the applicable standard specified in this paragraph, except for test pressures. For hydrostatic pressure test, use a hydrostatic pressure 50 psi in excess of the maximum working pressure of the system, but not less than 100 psi, holding the pressure for a period of not less than one hour. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

#### 3.2.4 Field Tests for Concrete

Field testing requirements are covered in Section 03 30 00 CAST-IN-PLACE CONCRETE

-- End of Section --

## SECTION 33 40 00

STORM DRAINAGE UTILITIES  
02/10

## PART 1 GENERAL

## 1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO HB-17 (2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION  
(AREMA)

AREMA Eng Man (2012) Manual for Railway Engineering

## ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2013) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A48/A48M (2003; R 2012) Standard Specification for Gray Iron Castings

ASTM A536 (1984; R 2014) Standard Specification for Ductile Iron Castings

ASTM B26/B26M (2014; E 2015) Standard Specification for Aluminum-Alloy Sand Castings

ASTM C1103 (2014) Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

ASTM C139 (2014) Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes

ASTM C1433 (2015) Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers

ASTM C231/C231M (2014) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C270 (2014a) Standard Specification for Mortar

	for Unit Masonry
ASTM C32	(2013) Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C425	(2004; R 2013) Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C443	(2011) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C478	(2015) Standard Specification for Precast Reinforced Concrete Manhole Sections
ASTM C55	(2014a) Concrete Brick
ASTM C62	(2013a) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C76	(2015) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C828	(2011) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C877	(2008) External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
ASTM C923	(2008; R 2013) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C969	(2002; R 2009) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C990	(2009; R 2014) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM D1056	(2014) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1171	(1999; R 2007) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D1557	(2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft <sup>3</sup> ) (2700 kN-m/m <sup>3</sup> )

ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2004a; R 2013) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D1784	(2011) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D2167	(2008) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2321	(2014; E 2014) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D3034	(2014a) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	(2007; R 2013) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D6938	(2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM F1417	(2011a) Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air
ASTM F679	(2013a) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F794	(2003; R 2014) Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

## 1.2 SUBMITTALS

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

SD-03 Product Data

Placing Pipe

Submit printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

#### SD-04 Samples

Pipe for Culverts and Storm Drains

#### SD-07 Certificates

Resin Certification  
Pipeline Testing  
Hydrostatic Test on Watertight Joints  
Determination of Density  
Frame and Cover for Gratings

### 1.3 DELIVERY, STORAGE, AND HANDLING

#### 1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

#### 1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

## PART 2 PRODUCTS

### 2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

#### 2.1.1 PVC Pipe

Submit the pipe manufacturer's resin certification, indicating the cell classification of PVC used to manufacture the pipe, prior to installation of the pipe.

##### 2.1.1.1 Type PSM PVC Pipe

ASTM D3034, Type PSM, maximum SDR 35, produced from PVC certified by the

compounder as meeting the requirements of ASTM D1784, minimum cell class 12454-B.

#### 2.1.1.2 Profile PVC Pipe

ASTM F794, Series 46, produced from PVC certified by the compounder as meeting the requirements of ASTM D1784, minimum cell class 12454-B.

#### 2.1.1.3 Smooth Wall PVC Pipe

ASTM F679 produced from PVC certified by the compounder as meeting the requirements of ASTM D1784, minimum cell class 12454-B.

#### 2.1.2 Concrete Pipe

Manufactured in accordance with and conforming to ASTM C76, Class III.

### 2.2 DRAINAGE STRUCTURES

#### 2.2.1 Precast Reinforced Concrete Box

Manufactured in accordance with and conforming to ASTM C1433.

### 2.3 MISCELLANEOUS MATERIALS

#### 2.3.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 4000 psi concrete under Section 03 30 00 CAST-IN-PLACE CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C231/C231M. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to ASTM D1751, or ASTM D1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D1752.

#### 2.3.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed 10 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalis, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

#### 2.3.3 Precast Concrete Segmental Blocks

Precast concrete segmental block shall conform to ASTM C139, not more than 8 inches thick, not less than 8 inches long, and of such shape that joints can be sealed effectively and bonded with cement mortar.

#### 2.3.4 Brick

Brick shall conform to ASTM C62, Grade SW; ASTM C55, Grade S-I or S-II; or ASTM C32, Grade MS. Mortar for jointing and plastering shall consist of one part portland cement and two parts fine sand. Lime may be added to the mortar in a quantity not more than 25 percent of the volume of cement. The joints shall be filled completely and shall be smooth and free from surplus mortar on the inside of the structure. Brick structures shall be plastered with 1/2 inch of mortar over the entire outside surface of the walls. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course. For round structures, brick shall be laid radially with every sixth course a stretcher course.

#### 2.3.5 Precast Reinforced Concrete Manholes

Conform to ASTM C478. Joints between precast concrete risers and tops shall be made with flexible watertight, rubber-type gaskets meeting the requirements of paragraph JOINTS.

#### 2.3.6 Prefabricated Corrugated Metal Manholes

Manholes shall be of the type and design recommended by the manufacturer. Manholes shall be complete with frames and cover, or frames and gratings.

#### 2.3.7 Frame and Cover for Gratings

Submit certification on the ability of frame and cover or gratings to carry the imposed live load. Frame and cover for gratings shall be cast gray iron, ASTM A48/A48M, Class 35B; cast ductile iron, ASTM A536, Grade 65-45-12; or cast aluminum, ASTM B26/B26M, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans. The word "Storm Sewer" shall be stamped or cast into covers so that it is plainly visible.

#### 2.3.8 Joints

##### 2.3.8.1 Flexible Watertight Joints

- a. Materials: Flexible watertight joints shall be made with plastic or rubber-type gaskets for concrete pipe and with factory-fabricated resilient materials for clay pipe. The design of joints and the physical requirements for preformed flexible joint sealants shall conform to ASTM C990, and rubber-type gaskets shall conform to ASTM C443. Factory-fabricated resilient joint materials shall conform to ASTM C425. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal diameter of the pipe being gasketed exceeds 54 inches.
- b. Test Requirements: Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C443. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed. Alternate types of watertight joint may be furnished, if specifically approved.

#### 2.3.8.2 External Sealing Bands

Requirements for external sealing bands shall conform to ASTM C877.

#### 2.3.8.3 Flexible Watertight, Gasketed Joints

- a. Gaskets: When infiltration or exfiltration is a concern for pipe lines, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band approximately 7 inches wide and approximately 3/8 inch thick, meeting the requirements of ASTM D1056, Type 2, and shall have a quality retention rating of not less than 70 percent when tested for weather resistance by ozone chamber exposure, Method B of ASTM D1171. Rubber O-ring gaskets shall be 13/16 inch in diameter for pipe diameters of 36 inches or smaller and 7/8 inch in diameter for larger pipe having 1/2 inch deep end corrugation. Rubber O-ring gaskets shall be 1-3/8 inches in diameter for pipe having 1 inch deep end corrugations. O-rings shall meet the requirements of ASTM C990 or ASTM C443. Preformed flexible joint sealants shall conform to ASTM C990, Type B.
- b. Connecting Bands: Connecting bands shall be of the type, size and sheet thickness of band, and the size of angles, bolts, rods and lugs as indicated or where not indicated as specified in the applicable standards or specifications for the pipe. Exterior rivet heads in the longitudinal seam under the connecting band shall be countersunk or the rivets shall be omitted and the seam welded. Watertight joints shall be tested and shall meet the test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS.

#### 2.3.8.4 PVC Plastic Pipes

Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

#### 2.3.9 Flap Gates

Flap Gates shall be heavy-duty with circular opening and double-hinged. Top pivot points shall be adjustable. The seat shall be one-piece cast iron with a raised section around the perimeter of the waterway opening to provide the seating face. The seating face of the seat shall be cast iron. The cover shall be one-piece cast iron with necessary reinforcing rib, lifting eye for manual operation, and bosses to provide a pivot point connection with the links. The seating face of the cover shall be cast iron. Links or hinge arms shall be cast or ductile iron. Holes of pivot points shall be bronze bushed. All fasteners shall be either galvanized steel, bronze or stainless steel.

#### 2.4 STEEL LADDER

Steel ladder shall be provided where the depth of the storm drainage structure exceeds 12 feet. These ladders shall be not less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2-1/2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A123/A123M.

## 2.5 RESILIENT CONNECTORS

Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C923.

## 2.6 HYDROSTATIC TEST ON WATERTIGHT JOINTS

### 2.6.1 Concrete, Clay, PVC, PE, SRPE and PP Pipe

A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced and nonreinforced concrete pipe shall conform to ASTM C990 or ASTM C443. Test requirements for joints in clay pipe shall conform to ASTM C425. Test requirements for joints in PVC, PE, and PP plastic pipe shall conform to ASTM D3212.

### 2.6.2 Corrugated Steel and Aluminum Pipe

A hydrostatic test shall be made on the watertight joint system or coupling band type proposed. The moment strength required of the joint is expressed as 15 percent of the calculated moment capacity of the pipe on a transverse section remote from the joint by the AASHTO HB-17 (Division II, Section 26). The pipe shall be supported for the hydrostatic test with the joint located at the point which develops 15 percent of the moment capacity of the pipe based on the allowable span in feet for the pipe flowing full or 40,000 foot-pounds, whichever is less. Performance requirements shall be met at an internal hydrostatic pressure of 10 psi, for a 10 minute period for both annular corrugated metal pipe and helical corrugated metal pipe with factory reformed ends.

## PART 3 EXECUTION

### 3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 00 00 EARTHWORK and the requirements specified below.

#### 3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 450 mm 18inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheet piling and bracing, where required, shall be placed within the trench width as specified, without any overexcavation. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

#### 3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between

unremoved rock and the pipe of at least 8 inches or 1/2 inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Section 31 00 00 EARTHWORK.

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Plastic Pipe

Bedding for PVC, PE, SRPE and PP pipe shall meet the requirements of ASTM D2321. Use Class IB or II material for bedding, haunching, and initial backfill.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe, excluding SRPE pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (percent)
Corrugated Steel and Aluminum Alloy	5
Concrete-Lined Corrugated Steel	3
Plastic (PVC, HDPE, SRPE, and PP)	5

Note post installation requirements of paragraph DEFLECTION TESTING in PART 3 of this specification for all pipe products including deflection

testing requirements for flexible pipe.

### 3.3.1 Concrete, Clay, PVC, Ribbed PVC, Ductile Iron and Cast-Iron Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

### 3.3.2 Multiple Culverts

Where multiple lines of pipe are installed, adjacent sides of pipe shall be at least half the nominal pipe diameter or 3 feet apart, whichever is less.

### 3.3.3 Jacking Pipe Through Fills

Methods of operation and installation for jacking pipe through fills shall conform to requirements specified in Volume 1, Chapter 1, Part 4 of AREMA Eng Man.

## 3.4 DRAINAGE STRUCTURES

### 3.4.1 Manholes and Inlets

Construction shall be of reinforced concrete, plain concrete, brick, precast reinforced concrete, precast concrete segmental blocks, prefabricated corrugated metal, or bituminous coated corrugated metal; complete with frames and covers or gratings; and with fixed galvanized steel ladders where indicated. Pipe studs and junction chambers of prefabricated corrugated metal manholes shall be fully bituminous-coated and paved when the connecting branch lines are so treated. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.

### 3.5 STEEL LADDER INSTALLATION

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet vertically, and shall be installed to provide at least 6 inches of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

## 3.6 BACKFILLING

### 3.6.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation equal to the midpoint (spring line) of RCP or has reached an elevation of at least 12 inches above the top of the pipe for flexible pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding six inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is

necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

### 3.6.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding eight inches. Use select granular material for this entire region of backfill for flexible pipe installations.

### 3.6.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

### 3.6.4 Compaction

#### 3.6.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

#### 3.6.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

- a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.
- b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

- c. Under nontraffic areas, density shall be not less than that of the surrounding material.

### 3.6.5 Determination of Density

Testing is the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D2167 or ASTM D6938. When ASTM D6938 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D6938 results in a wet unit weight of soil and ASTM D6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D6938. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

## 3.7 PIPELINE TESTING

### 3.7.1 Leakage Tests

Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate. Low pressure air testing for plastic pipe shall conform to ASTM F1417. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C828 or ASTM C969, after consultation with the pipe manufacturer. Testing of individual joints for leakage by low pressure air or water shall conform to ASTM C1103. Prior to exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be reestablished. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed 0.2 gallons per inch in diameter per 100 feet of pipeline per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished.

### 3.7.2 Deflection Testing

No sooner than 30 days after completion of installation and final backfill, an initial post installation inspection shall be accomplished.

Clean or flush all lines prior to inspection. Perform a deflection test on entire length of installed flexible pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads. Deflection of pipe in the installed pipeline under external loads shall not exceed limits in paragraph PLACING PIPE above as percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a laser profiler or mandrel.

- a. Laser Profiler Inspection: If deflection readings in excess of the allowable deflection of average inside diameter of pipe are obtained, remove pipe which has excessive deflection, and replace with new pipe. Initial post installation inspections of the pipe interior with laser profiling equipment shall utilize low barrel distortion video equipment for pipe sizes 48 inches or less. Use a camera with lighting suitable to allow a clear picture of the entire periphery of the pipe interior. Center the camera in the pipe both vertically and horizontally and be able to pan and tilt to a 90 degree angle with the axis of the pipe rotating 360 degrees. Use equipment to move the camera through the pipe that will not obstruct the camera's view or interfere with proper documentation of the pipe's condition. The video image shall be clear, focused, and relatively free from roll static or other image distortion qualities that would prevent the reviewer from evaluating the condition of the pipe. For initial post installation inspections for pipe sizes larger than 48 inches, visual inspection shall be completed of the pipe interior.
- b. Pull-Through Device Inspection: Pass the pull-through device through each run of pipe by pulling it by hand. If deflection readings in excess of the allowable deflection of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show excess allowable deflections of the average inside diameter of pipe, remove pipe which has excessive deflection, replace with new pipe, and completely retest in same manner and under same conditions. Pull-through device: The mandrel shall be rigid, nonadjustable having a minimum of 9 fins, including pulling rings at each end, engraved with the nominal pipe size and mandrel outside diameter. The mandrel shall be 5 percent less than the certified-actual pipe diameter for Plastic Pipe, 5 percent less than the certified-actual pipe diameter for Corrugated Steel and Aluminum Alloy, 3 percent less than the certified-actual pipe diameter for Concrete-Lined Corrugated Steel and Ductile Iron Culvert provided by manufacturer. When mandrels are utilized to verify deflection of flexible pipe products, the Government will verify the mandrel OD through the use of proving rings that are manufactured with an opening that is certified to be as shown above.
- c. Deflection measuring device: Shall be approved by the Contracting Officer prior to use.
- d. Warranty period test: Pipe found to have a deflection of greater than allowable deflection in paragraph PLACING PIPE above, just prior to end of one-year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection. Inspect 100 percent of all pipe systems under the travel lanes, including curb and gutter. Random inspections of the remaining pipe system outside of the travel lanes shall represent at least 10 percent of the total pipe footage of each pipe size. Inspections shall be made, depending on the pipe size, with video camera or visual observations. In addition,

for flexible pipe installations, perform deflection testing on 100 percent of all pipes under the travel lanes, including curb and gutter, with either a laser profiler or 9-fin mandrel. For flexible pipe, random deflection inspections of the pipe system outside of the travel lanes shall represent at least 10 percent of the total pipe footage of each pipe size. When mandrels are utilized to verify deflection of flexible pipe products during the final post installation inspection, the Government will verify the mandrel OD through the use of proving rings.

### 3.7.3 Post-Installation Inspection

Check each reinforced concrete pipe installation for joint separations, soil migration through the joint, cracks greater than 0.01 inches, settlement and alignment. Check each flexible pipe (HDPE, PVC, CMP, PP) for rips, tears, joint separations, soil migration through the joint, cracks, localized bucking, bulges, settlement and alignment.

- a. Replace pipes having cracks greater than 0.1 inches in width or deflection greater than 5 percent deflection. An engineer shall evaluate all pipes with cracks greater than 0.01 inches but less than 0.10 inches to determine if any remediation or repair is required. RCP with crack width less than 0.10 inches and located in a non-corrosive environment (pH 5.5) are generally acceptable. Repair or replace any pipe with crack exhibiting displacement across the crack, exhibiting bulges, creases, tears, spalls, or delamination.
- b. Reports: The deflection results and final post installation inspection report shall include: a copy of all video taken, pipe location identification, equipment used for inspection, inspector name, deviation from design, grade, deviation from line, deflection and deformation of flexible pipe systems, inspector notes, condition of joints, condition of pipe wall (e.g. distress, cracking, wall damage dents, bulges, creases, tears, holes, etc.).

### 3.8 FIELD PAINTING

After installation, clean cast-iron frames, covers, gratings, and steps not buried in masonry or concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

-- End of Section --