

**LAYON MUNICIPAL SANITARY LANDFILL
ACCESS ROAD AND SEWER SYSTEM
LAYON, INARAJAN, GUAM**

PROJECT NO. SWMD-09-03

TECHNICAL SPECIFICATIONS

(These Specifications cite modifications to the
Standard Specifications for Construction of
Roads and Bridges, cited as FP-03)

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TECHNICAL SPECIFICATIONS

Access Road and Sewer System
Project No. SWMD-09-03

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**SPECIAL CONTRACT REQUIREMENTS
MODIFICATIONS TO FP-03**

The following Sections note modifications to the Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, cited as FP-03. Included in these Sections are only the modifications to FP-03. The full set of FP-03 specifications can be downloaded for free at www.wfl.fhwa.dot.gov/design/specs/fp03.htm.

SECTION 101 TERMS, FORMAT AND DEFINITIONS

101.04 **DEFINITIONS**

The following terms are added to this subsection:

Government - The Government of Guam

Director - The Director of Public Works, Government of Guam, and his authorized representatives

Owner - The term Owner and/or Engineer means the Government of Guam, and /or the Contracting Officer and their authorized representative

State - Territory of Guam

The term "Bid" and "Proposal" as used in this special contract requirements and in the Standard Specifications shall be considered to have the same meaning.

City, Township, Town or District - A subdivision of Guam used to designate or identify the location of the project.

END OF SECTION 101

SECTION 102 BID, AWARD, AND EXECUTION OF CONTRACT

102.01 **ACQUISITION REGULATIONS** - This subsection is replaced with "Bid, award, and execution of the Contract are governed by the Guam Administrative Rules and Regulation (GAR), Volume 1, Title 2, Division 4, Procurement Regulations."

102.02 **PREPARATION OF BIDS** - Delete this subsection in its entirety.

102.03 **BID GUARANTEE** - Delete this subsection in its entirety.

102.04 **INDIVIDUAL SURETY** - Delete this subsection in its entirety.

102.05 **PUBLIC OPENING OF BIDS** - Delete this subsection in its entirety.

102.06 **PERFORMANCE AND PAYMENT BONDS** - Delete this subsection in its entirety.

END OF SECTION 102

SECTION 103 SCOPE OF WORK

103.01 **INTENT OF CONTRACT** - This subsection is modified as follows:

The intent of the contract is to provide construction, completion, and delivery of the facility described. The precise details of performing the work are not stipulated except as considered essential for the successful completion of the work. Furnish all labor, material, equipment, tools, transportation, and supplies necessary to complete the work according to the contract.

103.02 **DISPUTES** - Delete this subsection in its entirety. See Section 9.2, Disputes, of the General Conditions for information regarding the resolution of disputes.

103.03 **VALUE ENGINEERING** - This subsection is supplemented as follows:

a) *General.* The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECP's) voluntarily. The Contractor shall share in any instant contract savings realized from accepted VECP's, in accordance with paragraph (f) below.

b) *Definitions.* "Collateral costs," as used in this clause, means agency cost of operation, maintenance, logistic support, or Government-furnished property.

"Collateral savings," as used in this clause, means those measurable not reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause, means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, means the estimated reduction in Contractor cost of performance resulting from acceptance of VECP, minus allowable Contractor's development and implementation costs, including subcontractor's development and implementation costs (see paragraph (h) below).

"Value engineering change proposal (VECP)", means a proposal that --

- 1) Requires a change to this, the instant contract, to implement; and
- 2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics provided it does not involve a change -
 - (i) In deliverable end item quantities only; or
 - (ii) To the contract type only.

c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

- 1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.
- 2) A list and analysis of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.
- 3) A separate, detailed cost estimate for (i) the affected portions of the existing contract requirement and (ii) the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (h) below.
- 4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.
- 5) A prediction of any effects the proposed change would have on collateral costs to the agency.
- 6) A statement of the time by which a contract modification accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.
- 7) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.

d) Submission. The Contractor shall submit VECP's to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

e) Government Action.

1) The Contracting Officer shall notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer shall notify the Contractor within the 45 calendar day period and provide the reason for the delay and the expected date of the decision. The Government will process VECP's expeditiously; however, it shall not be liable for any delay in acting upon a VECP.

2) If the VECP is not accepted, the Contracting Officer shall notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

3) Any VECP may be accepted, in whole or in part, by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract.

The Contracting Officer's decision to accept or reject all or part of any VECP shall be final and not subject to the Disputes clause or otherwise subject to litigation under the Contract Disputes Act of 1978 (41 U.S.C. 601-613).

f) Sharing.

1) Rates. The Contractor's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by (i) 55 percent for fixed-price contracts or (ii) 25 percent for cost-reimbursement contracts.

2) Payment. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to--

- (i) Accept the VECP,
- (ii) Reduce the contract price or estimated cost by the amount of instant contract savings; and
- (iii) Provide the Contractor's share of savings by adding the amount calculated under paragraph (1) above to the contract price or fee.

g) Collateral savings. If a VECP is accepted, the instant contract amount shall be increased by 20 percent of any projected collateral savings determined to be realized in a typical year of use after subtracting any Government costs not previously offset. However, the Contractor's share of collateral savings shall not exceed (1) the contract's firm-fixed price or estimated cost, at the time the VECP is accepted, or (2) \$100,000, whichever is greater. The Contracting Officer shall determine of the amount of collateral savings, and the amount shall not be subject to the Disputes clause or otherwise subject to litigation under 41 U.S.C. 601-613.

h) Subcontracts. The Contractor shall include an appropriate value engineering clause in any subcontract of \$50,000 or more and may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; provided, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(i) Data. The Contractor may restrict the Government's right to use any part of a VECP or the supporting data by marking the following legend on the affected parts:

"These data, furnished under the Value Engineering-Construction clause of contract..., shall not be disclosed outside the Government duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a value engineering change proposal submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations."

If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification implementing the VECP and shall appropriately mark the data. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

END OF SECTION 103

SECTION 104 CONTROL OF WORK

104.03 **SPECIFICATIONS AND DRAWINGS**- item (a) is supplemented as follows:

The Contractor will be supplied with four (4) sets of contract plans and specifications including special contract requirements. Additional sets will be furnished to the Contractor at their cost for reproduction.

END OF SECTION 104

SECTION 106 ACCEPTANCE OF WORK

106.01 CONFORMITY WITH CONTRACT REQUIREMENTS. The second paragraph is amended as follows:

References to standard test methods of AASHTO, ASTM, GSA, and other recognized standard authorities refer to the methods in effect on the date of solicitation for bids. Use the 26th edition of the AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing, and Appendix A and B of the Federal Lands Highway Field Materials Manual for this project. Use the modified AASHTO procedures for sampling and testing contained in Appendix B of the Federal Lands Highway Field Materials Manual; except, when a specified sampling or test method is not included in Appendix B, sample and test according to the referenced AASHTO test procedure. Appendix A of the Federal Lands Highway Field Materials Manual contains several sampling and testing methods which may be required for this project that are not found in AASHTO.

The eighth paragraph is amended as follows:

Remove, repair, or replace work that does not conform to the contract, or to prevailing industry standards where no specific contract requirements are noted. Removing, repairing, or replacing work; providing temporary traffic control; and any other related work to accomplish conformity will be at no cost to the Government.

The following paragraph is added:

Obtain copies of the following by written request mailed to the Contracts Section, Western Federal Lands Highway Division, 610 East Fifth Street, Vancouver, Washington 98661-3801, faxed request via 360.619.7932, or e-mail sent to contracts@mail.wfl.fhwa.dot.gov:

- Appendices A and B of the Federal Lands Highway Field Materials Manual, dated 02/10/97;
- Standard WFLHD Method of Test for Accelerated Weathering of Aggregate by Use of Dimethyl Sulfoxide (DMSO);
- Highway Research Board Bulletin No. 319, "The Humphres Method of Granular Soils", dated 1962;
- Form FHWA-1641, "Worksheet for Superpave Asphalt Concrete Mix Design, AASHTO R 35";
- Standard WFLHD Test Method for Determining Asphalt Content in Asphalt Paving Mixtures by the Ignition Method;
- Standard WFLHD Test Method for Determining Optimum Asphalt Content for Hot Open-Graded Asphalt Concrete Pavement; and
- Field Note Samples, dated April 2004. For an electronic version see http://www.wfl.fha.dot.gov/construction/field_notes/

106.02 VISUAL INSPECTION. The text of this subsection is amended as follows:

Acceptance is based on visual inspection of the work for compliance with the specific contract requirements. In the absence of specific contract requirements or tolerances, prevailing industry standards may be used.

106.03 CERTIFICATION. The following is added after the second paragraph:

Maintain records of all required certifications according to Subsections 103.04, 153.04, and 154.04. Submit certifications to the CO when requested.

Check certifications, prior to incorporating the materials into the work, to ensure that the requirements of the contract have been met. Mark the certifications with the following information: project name, project number, contract item number, item description, Contractor's signature, and date.

106.07 PARTIAL AND FINAL ACCEPTANCE. Paragraph (a) is amended as follows:

(a) Partial Acceptance. When the Base Schedule, an Option, or any road within an option is completed, a final inspection of that portion of the project may be requested. If the portion is complete and in compliance with the contract, it will be accepted, and the Contractor will be relieved of further responsibility for maintenance of the completed portion. Partial acceptance does not void or alter any of the terms of the contract.

END OF SECTION 106

SECTION 107 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

107.05 **RESPONSIBILITY FOR DAMAGE CLAIMS** - Delete this subsection in its entirety.

107.06 **CONTRACTOR'S RESPONSIBILITY FOR WORK** - The following is added to this subsection

All private driveways and roads affected by change in grades or otherwise affected by the construction, and all public roads damaged by the Contractor's operation on or adjacent to these roads shall be repaired by the Contractor. Driveways and private roads shall be reconstructed according to the typical section shown on the plans or as directed by the Contracting Officer. When shown on the "Bid Schedule," payment for such work will be made under Reconstruction of Driveways and Minor Streets. Private or public roads that are to remain in service shall be repaired by the Contractor at his sole expense if they have been damaged by his operation.

All private driveways and roads affected by construction shall be provided with temporary access to avoid isolation at no additional cost to the Government.

In case of an emergency that threatens loss of life, injury or property damage, the Contractor shall act without instructions from the Contracting Officer as the situation may warrant. He shall then notify the Contracting Officer immediately thereafter and submit any claim for compensation with supporting documents regarding the incurred expenses. The amount of compensation will be decided by agreement or arbitration.

END OF SECTION 107

SECTION 108 PROSECUTION AND PROGRESS

108.01 **COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK** - Delete this subsection in its entirety.

108.02 **SUBCONTRACTING** - Delete this subsection in its entirety.

108.03 **DETERMINATION AND EXTENSION OF CONTRACT TIME** - Delete the first paragraph in this subsection in its entirety. The following is added to this subsection:

No compensation will be made for overhead costs resulting from contract time extensions.

108.04 **FAILURE TO COMPLETE THE WORK ON TIME** - Delete the first paragraph in this subsection in its entirety.

END OF SECTION 108

SECTION 109 MEASUREMENT AND PAYMENT

109.01 **MEASUREMENT OF WORK** - This subsection is supplemented as follows:

This is a lump sum bid contract. There are no unit price bid items. All Bid Schedule of Value items are designated as lump sum. Each FP-03 Section shall be measured as per FP-03 Section 109.02(h) Lump Sum. This is a blanket revision for all affected Sections and each Section will not be individually revised. The Payment Subsection for each FP-03 Section is revised so that payment for lump sum items will be prorated based on the total work completed. This is a blanket revision for all affected Sections and each Section will not be individually revised.

109.02 **MEASUREMENT TERMS AND DEFINITION** - This subsection is supplemented as follows:

(p) **FORCE ACCOUNT (FA)** - Force Account will be used for unforeseen work. All work to be performed under force account must have authorization from the Contracting Officer prior to work execution. The quantity is designated as "FA".

109.06 **PRICING OF ADJUSTMENTS** – Delete this subsection in its entirety.

109.07 **ELIMINATED WORK** – Delete this subsection in its entirety.

109.08 **PROGRESS PAYMENT** - Delete this subsection in its entirety.

109.08 **FINAL PAYMENT** - Delete this subsection in its entirety.

END OF SECTION 109

SECTION 152 CONSTRUCTION SURVEY AND STAKING

152.02 **GENERAL** - The text of this subsection is amended as follows:

The contractor shall reference all points subject for the monumentation including all existing survey monuments (GGTN's and/or GGN) subject for resetting, according to approved surveying standard practices and methods certified by a Guam licensed surveyor preferably by two (2) intersecting lines. Reference points shall be far enough to avoid from being disturbed or displaced during the construction.

Survey and establish controls within the tolerances shown in Table 152-1. The construction survey and staking work may be spot-checked for accuracy, and unacceptable portions of work may be rejected. Resurvey rejected work, and correct work that is not within the tolerances specified in Table 152-1. Acceptance of the construction staking does not relieve the Contractor of responsibility for correcting errors discovered during the work and for bearing all additional costs associated with the error.

Compute and furnish calculations supporting pay quantities. Measure quantities within the tolerances shown in Table 152-2.

All field notes, pay notes, and supporting documentation become the property of the Government upon completion of the work.

END OF SECTION 152

SECTION 153 CONTRACTOR QUALITY CONTROL

153.01 **DESCRIPTION** – The following section is amended as follows:

This work consists of establishing and maintaining an effective system to control and assure that work being performed is according to the contract requirements. Follow the requirements of FAR Clause 52.246-12, Inspection of Construction.

153.02 **GENERAL**. Provide a system to address quality control and quality assurance.

Submit a written quality control and assurance plan for acceptance, 14 days prior to commencing work. Modifications or additions to the plan may be required to meet quality requirements. Supplement the plan as work progresses and whenever there are changes in procedures or personnel. Include work accomplished by subcontractors and suppliers, both on and off-site. Defer submission of a quality control and assurance plan for items of work not immediately scheduled to begin when approved by the CO.

A maximum of 10 percent of the total progress payment amount will be retained if the quality control and assurance plan is not approved, required updates are not submitted and accepted or the plan is not being followed.

Furnish 48 hours notice prior to the start of each segment of work.

153.03 **SAMPLING AND TESTING**. Provide a detailed listing of the sampling and testing to be performed for quality control and quality assurance. Include the type of test and frequency of sampling required for each item of work to ensure proper process controls are in effect. See Table 153-1 for a partial listing of Sections requiring sampling and testing to ensure proper process control. Requirements for acceptance sampling and testing can be found in the Acceptance Subsection of each Section.

Sample and split samples according to AASHTO or other acceptable procedures. Allow the CO the opportunity to witness all sampling. Immediately perform splits when required. Deliver the Government's portion of the sample or split sample in an acceptable container suitable for shipment. Label all samples with the following information:

- (a) Project number;
- (b) Source of material;
- (c) Pay item number;
- (d) Sample number;
- (e) Date sampled;
- (f) Time sampled;
- (g) Location sample taken;

- (h) Name of person sampling;
- (i) Name of person witnessing sampling; and
- (j) Type of test required on sample.

Allow the CO the opportunity to witness all testing. Testing of trial samples may be required to demonstrate testing competence.

153.04 QUALITY MANAGER. Provide an onsite quality manager(s) available during all phases of work. Duties include coordinating and supervising the quality control and assurance system for all work including subcontractors and suppliers. The quality manager is permitted to perform inspection duties. Allow sufficient authority to assure work is performed according to requirements, which includes stopping work that is not in compliance. The quality manager is not to directly supervise crews.

Furnish a manager with at least five years experience in highway or road construction, specifically in the areas of material testing, inspection, management, supervision, quality control or quality assurance. Submit in writing the name, experience, and line of authority for acceptance. Identify an alternate to serve in the event of the manager's absence. Select an alternate with comparable experience and knowledge to the quality manager.

Do not designate the superintendent, project manager, or project foreman as the quality manager.

153.05 QUALITY CONTROL SYSTEM. Establish a system that directly monitors and controls the quality of work. Furnish inspectors with a minimum of 3 years experience in the work to be monitored. Address the following in the plan:

- (a) The name and experience of inspectors, testers, and company(s) providing quality control. Include lines of authority for both individuals and company(s);
- (b) Develop a chart of quality control inspections which includes definable features, inspectors responsible, and inspection frequency of work. In addition to required inspection frequencies, list any additional inspections to ensure a quality project. Include all work of subcontractors and suppliers; and
- (c) Procedures for managing reports, documents, charts, certifications, and submittals.

153.06 QUALITY ASSURANCE SYSTEM. Establish a system that provides assurance the project was constructed according to the contract requirements. Furnish experienced personnel to inspect, verify, test, and evaluate materials and workmanship to assure a quality project. Address the following in the plan:

- (a) The name and experience of individuals and company(s) providing quality assurance. Include lines of authority for both individuals and company(s);
- (b) Method for assuring material incorporated into the work is in compliance;

- (c) Process to assure personnel have received proper training to produce a quality product;
- (d) Procedures to assure necessary preliminary work is accomplished prior to the beginning of work (submittals have been approved, certifications verified, surveys completed, etc.)
- (e) Process that verifies quality control activities are performed and properly documented;
- (f) Process to identify and correct quality deficiencies in work being performed;
- (g) A process to assure that deficiencies are not repeated; and
- (h) Method for assuring subcontractor and supplier work is in compliance.

153.07 **GOVERNMENT INSPECTION.** Provide written notification WFLHD 470 *Notification of Completion of Work* when the following work is ready to be inspected:

- (a) Allow 1 working day for the following work to be inspected.
 - (1) Survey and staking (field stakes and notes). Provide survey notes for the following:
 - (a) Control points – prior to disturbing original control points;
 - (b) Clearing limits – prior to starting clearing and grubbing operations;
 - (c) Slope stakes – prior to starting excavation;
 - (d) Subexcavation – prior to backfilling;
 - (e) Guardrail – prior to starting installation;
 - (f) Bridge – prior to starting work on each component;
 - (g) Walls – prior to starting work; and
 - (h) Fence – prior to starting installation.
 - (2) Construction work.
 - (a) Roadway – prior to placement of pavement structure;
 - (b) Any layer of pavement structure requiring hubs – prior to placing next layer; and
 - (c) Structural excavation – prior to backfilling.

(b) Allow 1 working day (except as noted) to inspect the following work. Do not continue work on items listed below until receipt of WFLHD 470 *Notification of Completion of Work* indicating the work will not be inspected, the work was inspected and no deficiencies were found, or unless authorized by

the CO. Work delayed in excess of the inspection period will be evaluated according to FAR Clause 52.242-14 Suspension of Work.

- (1) Forms and reinforcing steel – prior to placing concrete.
- (2) Concrete deck – prior to placing concrete (perform checks of all deck pour requirements, including dry run results prior to inspection).
- (3) Holes for drilled shafts – prior to placing rebar (inspections within 4 hours of receiving notice).

153.08 **RECORDS.** Submit a list of all records and documentation that track quality control/assurance processes and issues. Indicate who will be responsible for maintaining the records and where the records will be located.

Provide the following documents:

(a) Notification of Completion of Work. Submit a completed WFLHD 470 *Notification of Completion of Work* when work is ready for inspection by the Government according to Subsection 153.06.

(b) Construction Operations Report. For each day of work, submit a completed WFLHD 465 *Contractor's Daily Record of Construction Operations* or an approved alternate form. Include the following certification signed by the person responsible for the construction operations:

"I certify that the information contained in this record is accurate, and that all work documented herein complies with the requirements of the contract. Any exceptions to this certification are documented as a part of this record."

(c) Quality Control and Assurance Report. For each day of work, prepare a Quality Control and Assurance Report. Record the phase all work is in and document all quality control and assurance activities associated with this work. List deficiencies and corrective actions taken or scheduled to be taken. Document meetings or discussions concerning quality control and assurance issues. Attach all test results from the day's operations. Include the following certification signed by the manager:

"I certify that the information contained in this record is accurate, and that all work documented herein complies with the requirements of the contract. Any exceptions to this certification are documented as a part of this record."

(d) Control Charts. Maintain linear control charts that identify the project number, contract item number, test number, each test parameter, the upper and/or lower specification limit applicable to each test parameter, and test results. Use the control charts as part of the quality system to document the variability of the process, identify production and equipment problems, and identify potential pay factor adjustments. Make corrections to the process when problems are evident.

(e) Pay Item Measurement Notes (FHWA 17348 Pay Item Record). Prepare notes according to Subsection 109.01. Calculate and maintain QL-Pay pay factors on appropriate items.

(f) Quality Control and Quality Assurance Test Results. Report test results on forms containing all sample information required by Subsection 153.03. Label clearly all interim measurements used to determine the results. Attach work sheets used to determine test values to the test result forms when submitted.

Submit **(b)** and **(c)** reports within one working day of the work being performed. When requested, resubmit incomplete or erroneous reports within one working day. When chronic errors or omissions occur, correct the procedures by which the reports are produced.

153.09 **ACCEPTANCE.** Quality control and assurance system will be evaluated under Subsection 106.02 based on the demonstrated ability of the quality control and assurance system to result in work meeting the requirements.

If the Government's testing and inspection indicate that the quality control and assurance system is ineffective or the plan is not being followed, make immediate improvements to the system to correct these inadequacies. Furnish notification in writing of improvements and modifications to the system.

**Table 153-1
Minimum Process Control Sampling and Testing Requirements**

Material or Product	Characteristic	Test Method or Specification	Tolerance	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Section 301							
Aggregate base Grading	Gradation	AASHTO T 27	Subsection 703.05	1 for each 6 hours of production but not less than 2 for each day	Flowing aggregate stream (bin or belt discharge) or conveyor belt	Yes when requested	End of shift
	Fractured faces	ASTM D 5821	"	"	"	"	"
	Sand equivalent	AASHTO T 176 Alternate Method No. 2, Referee Method	"	"	"	"	"

SECTION 153
Layon Landfill Access Road and Sewer line
Project No. SWMD 09-03

	Percent Passing No. 200 SE/P ₂₀₀ Index	AASHTO T 11 See Subsection 101.04	" "	" "	" "	" "	" "
Aggregate surface course	Gradation	AASHTO T11 & AASHTO T 27	Subsection 703.05	1 for each 6 hours of production but not less than 2 for each day	Flowing aggregate stream (bin or belt discharge) or conveyor belt	Yes, when requested	End of shift
	Fractured faces	ASTM D 5821	"	"	"	"	"
	Liquid limit	AASHTO T 89	"	"	"	"	"
	Plasticity Index	AASHTO T 90	"	"	"	"	"
Subbase Grading	Gradation	AASHTO T 27	Subsection 703.05	1 for each 6 hours of production but not less than 2 for each day	Flowing aggregate stream (bin or belt discharge) or conveyor belt	Yes, when requested	End of shift
	Fractured faces	ASTM D 5821	"	"	"	"	"
	Sand equivalent	AASHTO T 176 Alternate Method No. 2, Referee Method	"	"	"	"	"

SECTION 153
Layon Landfill Access Road and Sewer line
Project No. SWMD 09-03

	Percent Passing No. 200	AASHTO T 11	"	"	"	"	"
	SE/P ₂₀₀ Index	See Subsection 101.04	"	"	"	"	"
Section 309							
Emulsified asphalt treated aggregate base Grading	Gradation	AASHTO T 27	Subsection 703.05	1 for each 6 hours of production but not less than 2 for each day	Flowing aggregate stream (bin or belt discharge) or conveyor belt	Yes, when requested	End of shift
	Fractured faces	ASTM D 5821	"	"	"	"	"
	Sand equivalent	AASHTO T 176 Alternate Method No. 2, Referee Method	"	"	"	"	"
	Percent Passing No. 200	AASHTO T 11	"	"	"	"	"
	SE/P ₂₀₀ Index	See Subsection 101.04	"	"	"	"	"
Section 401, 402, or 403							
Aggregate source quality	Sand equivalent	AASHTO T 176 Alternate Method No. 2, Referee Method	—	1 per type & not less than 5 per source of material	Source of material	Yes	Before producing

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	Fine aggregate angularity	AASHTO T 304, Method A	—	"	"	"	"
Aggregate	Gradation	AASHTO T 27 & AASHTO T 11	—	1 for each 6 hours of production but not less than 2 for each day	Flowing aggregate stream (bin or belt discharge) or conveyor belt	Yes, when requested	End of shift
	Fractured faces	ASTM D 5821	"	"	"	"	"
	Sand equivalent	AASHTO T 176 Alternate Method No. 2, Referee Method	"	"	"	"	"

Note: If aggregate is separated into two or more stockpiles, sample and test each of the stockpiles at the minimum sampling frequency.

Section 409

Aggregate	Gradation	AASHTO T 27 & AASHTO T 11	See Subsection 703.10	1 for each 6 hours of production but not less than 2 for each day	Flowing aggregate stream (bin or belt discharge) or conveyor belt	Yes, when requested	End of shift
	Clay lumps & friable particles	AASHTO T 112	"	"	"	"	"
	Flat & elongated particles	ASTM D 4791	"	"	"	"	"

	Fractured faces	ASTM D 5821	"	"	"	"	"
	Sand equivalent	AASHTO T 176 Alternate Method No. 2, Referee Method	"	"	"	"	"

Note: If aggregate is separated into two or more stockpiles, sample and test each of the stockpiles at the minimum sampling frequency.

END OF SECTION 153

SECTION 154 CONTRACTOR SAMPLING AND TESTING

154.01 **DESCRIPTION** - This subsection is amended to read as follows:

This work consists of obtaining samples for testing by the government's testing consultant. It also consists of testing and reporting required results. It doesn't include contractor quality control testing required under Section 153. However, include the work required under this section in the Section153 quality control plan.

END OF SECTION 154

SECTION 155 SCHEDULE FOR CONSTRUCTION CONTRACT

155.02 GENERAL – Modify the third paragraph as follows:

Use the Critical Path Method (CPM) described below to develop the construction schedule for the total contract work. Preface each construction schedule as follows:

155.03 BAR CHART METHOD (BCM) – Delete this subsection in its entirety

155.09 PAYMENT- This subsection is modified as follows:

Construction schedule will not be paid directly but will be considered incidental work.

END OF SECTION 155

SECTION 156 PUBLIC TRAFFIC

156.01 **DESCRIPTION** - This subsection is supplemented as follows:

Special consideration shall be made in controlling and protecting pedestrian traffic within the project limits.

156.03 **ACCOMMODATING TRAFFIC DURING WORK** - The first paragraph of this subsection is amended as follows:

Accommodate traffic through work zones according to the MUTCD and Quality Standard for Work Zone Traffic Control Devices. Traffic control shown in the drawing are schematic diagram of possible traffic control that may apply to a construction operation.

Maintain access to private properties at all times.

156.06 **LIMITATIONS OF CONSTRUCTION OPERATIONS** - This subsection is supplemented as follows:

Provide flagmen to direct traffic at all times. Maintain a minimum of 2-way traffic using one lane and flagmen at all times. During non-working hours, provide and maintain 2-way traffic, one lane in each direction at all times.

END OF SECTION 156

SECTION 157**SOIL EROSION CONTROL**

157.01 **DESCRIPTION** - This subsection is revised as follows:

This work consists of furnishing, constructing, and maintaining permanent and temporary erosion and sediment control measures (a) as shown on the plans; (b) as required by the Guam EPA approved Environmental Protection Plan (EPP), Erosion Control Plan (ECP), and Stormwater Pollution Prevention Plan (SWPP); and (c) as ordered by the Contracting Officer during the life of the contract to control water pollution, soil erosion and siltation through the use of berms, dikes, grasses, slope drains, drain inlet protection, silt fences, swale berms and other erosion control devices or methods.

The Contracting Officer shall submit the EPP, ECP, and SWPP to Guam EPA for review and approval at the time of applying for the building permit. The Contractor shall take ownership of these three documents after award of the contract and shall be responsible for fully implementing them and for any proposed or required modifications.

END OF SECTION 157

SECTION 201 CLEARING AND GRUBBING

201.01 **DESCRIPTION** - This work consists of clearing and grubbing within the clearing limits designated on the plans .

201.02 **MATERIAL** – Conform to the following Subsections:

Backfill material	704.3
Tree wound dressing	713.08(g)

CONSTRUCTION REQUIREMENTS

201.03 **GENERAL** – Construct erosion control measures according to Section 157. Perform work within designated limits. Do not damage vegetation designated to remain. If vegetation designated to remain is damaged or destroyed, repair or replace the vegetation in an acceptable manner. Where possible, preserve all vegetation adjacent to bodies of water. Treat cuts or scarred surfaces of trees and shrubs with tree wound dressing.

201.04 **CLEARING** – Within the clearing limits, clear trees, brush, downed timber, and other vegetation as follows:

- (a) Cut all trees so they fall within the clearing limits
- (b) In areas of cut slope rounding, cut stumps flush with or below the final groundline.
- (c) In areas outside the excavation, embankment, and slope rounding limits, cut stumps to within 6 inches of the ground.
- (d) Trim tree branches that extend over the road surface and shoulders to attain a clear height of 20 feet. If required, remove other branches to present a balanced appearance. Trim according to accepted tree surgery practices. Treat wounds with tree wound dressing.
- (e) Clearing and Grubbing limit will be at the top and the toe of slope and rounded edges of the cut and fill

201.05 **GRUBBING** – grub deep enough to remove stumps, roots, buried logs, moss, turf, or other vegetative debris as follows:

- (a) Grub all areas to be excavated, except for cut slope rounding areas.
- (b) Grub all embankment areas, except that undisturbed stumps protruding less than six inches above the original ground and covered with a minimum of four feet of embankment may be left in place.
- (c) Grub pits, channel changes, and ditches only to the depth necessary for the excavation.
- (d) Backfill stump holes and other grubbing holes with backfill material to the level of the

surrounding ground according to Subsection 209.10. Compact backfill according to Subsection 209.11.

201.06 **DISPOSAL** – Merchantable timber is the Contractor's property. Dispose of clearing and grubbing debris according to Subsection 203.05

201.07 **ACCEPTANCE** – Clearing and grubbing will be evaluated under Subsection 106.02.

Material for tree wound dressing will be evaluated under Subsection 106.03.

Backfilling and compacting of stumps and grubbing holes will be evaluated under Section 209.

END OF SECTION 201

SECTION 203 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

203.01 **DESCRIPTION** - This subsection is supplemented as follows:

This work shall additionally include the relocation of existing school bus shelters as shown on the drawings or as directed by the Contracting Officer.

The contractor shall submit a plan of action for the relocation of existing school bus shelters to the Contracting Officer for approval prior to relocation work. The submitted plan shall detail the method of removal, transport, grading to meet ADA requirements, and placement prior to relocating works.

203.05 **DISPOSING OF MATERIAL** - Item (b) is revised to read as follows:

(b) Burn - Burning of debris is not allowed.

Disposal of all materials, debris and other obstruction that are designated as waste will be borne by the contractor.

END OF SECTION 203

SECTION 204 EXCAVATION AND EMBANKMENT

204.02 **DEFINITIONS** - This subsection is amended as follows:

(a) EXCAVATION

(1) Roadway Excavation - The definition of this item shall include sub-excavation of material below sub-grade as shown on the plans. All sub-excavated material suitable for embankment shall be reused.

204.06 **ROADWAY EXCAVATION** -

(a) General. - The following is added to this subsection:

No definition for rock excavation?

Excavation: On the Landfill Access Road, the upper 22 inches of the final roadway subgrade elevation, including the road shoulders, shall be excavated for replacement with non-expansive limestone fill meeting the requirements of Section 703.05 and compacted to 95% of its Maximum Dry Density (Per ASTM D1557).

Re-compaction and proof rolling: After stripping and required excavation are completed, the exposed surface shall be scarified to a depth of approximately 8 to 10 inches, moisture conditioned as necessary and compacted with a heavy vibratory roller at least 10 tons in weight, until it meets the compaction requirements shown on the drawings (Per ASTM D1557). The compacted surface should be relatively uniform, dense, and non-yielding.

Spot Repairs: Where the stripped or excavated ground surface is soft and yielding, and where soft and yielding spots are detected during the above compaction and proof rolling, the soft or yielding soils should be excavated entirely and replaced with limestone sand/gravel fill compacted to at least 95 percent of its maximum dry density. The Contracting Officer shall inspect, evaluate and determine the need for spot repairs.

(b) Rock cuts. - This item is revised as follows:

Blasting is not permitted. Excavate rock cuts to 6 inches below subgrade within roadbed limits. Backfill to subgrade with non-expansive limestone fill meeting the requirements of Section 704.10.

204.06A **ARCHAEOLOGICAL DISCOVERY** (Added Subsection)

Whenever the Contractor encounters sites of potentially historic or archaeological significance such as walls, platform, pavements and mounts, or remains such as artifacts, burials, concentration of charcoal or shells, work shall cease in the immediate vicinity of the site and the site shall be protected from damage. The Contractor shall suspend any work that may affect the site and inform the Contracting Officer immediately. Upon direction by the Contracting Officer, the Contractor shall provide and install

temporary fencing to protect such sites. The Contractor shall not resume the work suspended without prior written direction of and subject to the conditions set by the Contracting Officer. The Contractor and/or Subcontractor shall not claim compensation for any delay of work as a result of any unforeseen archeological site discovery during construction. For delays due to the discovery, time extensions may be allowed in accordance with 108.03 "Determination and Extension of Contract Time".

204.09 **PREPARING FOUNDATION FOR EMBANKMENT CONSTRUCTION** - This subsection is revised as follows:

(a) After stripping and required excavation are completed, the exposed surface shall be scarified to a depth of approximately 8 to 10 inches, moisture conditioned as necessary and compacted with a heavy vibratory roller at least 10 tons in weight, until it meets the compaction requirements shown on the drawings (per ASTM D1557). The compacted surface shall be relatively uniform, dense, and non-yielding.

(d) Embankment on existing slopes steeper than 1:5 (1 unit vertical to 5 units horizontal). Cut horizontal benches in the existing slope to a sufficient width to accommodate placement and compaction operations and equipment. Bench the slope as the embankment is placed and compacted in layers. Begin each bench at the intersection of the original ground and the vertical cut of the previous bench, unless otherwise indicated on plans.

204.10 **EMBANKMENT CONSTRUCTION** - This subsection is revised as follows:

All fill materials should be free of organic matter, debris and rock fragments or silt/clay lumps larger than 4 inches, or one-half the compacted layer thickness, in greatest dimension. The upper 22 inches of the roadway final subgrade shall consist of non-expansive, select or subbase limestone sand and gravel meeting Subsection 703.05.

On-site excavated silty sandy limestone gravel fill (existing road base/subbase) meeting the above requirements may be reused as select or subbase fill as well as general fill. On-site excavated silty or clay soils when properly moisture conditioned to 2% over optimum may be reused as general fill below the 22" thick limestone subbase.

Approved fill materials shall be placed in loose layers 12 inches or less, moisture conditioned as necessary and compacted to the compaction requirements shown on the drawings (Per ASTM D1557).

204.14 **DISPOSAL OF UNSUITABLE OR EXCESS MATERIAL** - This subsection is amended as follows:

Dispose of unsuitable material legally off the project. Dispose of suitable landfill cover material as per the Special Provisions.

204.16 **MEASUREMENT** - This subsection is supplemented as follows:

The excavation as a result of the removal of existing asphalt pavement, subbase course, base course, and spot repairs shall be included in the measurement to be paid under this section.

Archaeological monitoring will be paid for by the Owner.

END OF SECTION 204

**SECTION 402 HOT ASPHALT CONCRETE PAVEMENT BY HVEEM OR MARSHALL
MIX DESIGN METHOD**

General Note: All references to Section 401 should be changed to Section 403

Description

402.03 Composition of Mix (Job-Mix Formula). - Add the following after the first paragraph:

The Class of Mix for both the top course and base course will be a Class A per Table 402-1.

402.03 (b) Delete the text and substitute the following:

(b) Submission. Submit written job-mix formulas with Form FHWA 1607 (Hveem) or Form FHWA 1622 (Marshall) for approval at least 28 days before production. Include the location of all commercial mixing plants to be used and a separate job-mix formula for each plant. Include a signed statement prepared by the testing laboratory that certifies the proposed job-mix formula meets the requirements of the contract and can be compacted in the field during production to meet contract requirements. For each job-mix formula, submit the following:

402.17 Acceptance.

(c) Revise the specification limit to read:

The lower specification limit is 92 percent

402.19 Payment. Delete text and substitute the following:

Payment for work under this section shall be incorporated into Section 403.

Table 402-3 Delete and substitute with the following:

**Table 402-3
Sampling and Testing Requirements**

Material or Product	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Aggregate source quality	Measured and tested for conformance (106.04)	LA abrasion (coarse)	—	AASHTO T 96	1 per type & source of material	Source of material	Yes	Before producing
		Sodium sulfate soundness loss (coarse & fine)	—	AASHTO T 104	“	“	“	“
		Sand equivalent	—	AASHTO T 176, alternate method no. 2, reference method	“	“	“	“
Asphalt concrete (mix design)	Measured and tested for conformance (106.04)	Gradation	—	AASHTO T 27 & T 11	1 per submitted mix design	Stockpiles	Yes	28 days before producing
		Voids	—	AASHTO T 209	“	“	“	“
		Moisture susceptibility	—	AASHTO T 165 & T 167	“	“	“	“
Aggregates (production)	Measured and tested for conformance (106.04)	Gradation	—	AASHTO T 27 & T 11	Once per week during production	Flowing aggregate stream (bin or belt discharge) or off of conveyor belt	Yes, when requested	Weekly
		Sand equivalent	—	AASHTO T 176, alternate method no. 2, reference method,	1 per type & source of material	“	“	“
		Fractured faces	—	ASTM 5821	“	“	“	“

**Table 402-3 (continued)
Sampling and Testing Requirements**

Material or Product	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time
Asphalt concrete mixture (all)	Measured and tested for conformance (106.04) & Section 105	Mix temperature	—	—	First load & as determined by the CO thereafter	Hauling vehicle before dumping or windrow before picking up	—	Upon completing test

END OF SECTION 402

SECTION 402
Access Road and Sewer System
Project No. SWMD-09-03

SECTION 403 HOT ASPHALT CONCRETE PAVEMENT

Material

403.02 - Add the following to subsection:

Aggregate. The aggregate for the hot asphalt concrete wearing surface (friction course) shall be in accordance with Table 703-4, designation D, and shall be basalt or approved equal. Limestone, relatively pure carbonate aggregates or any aggregates known to polish shall not be used in the mix. The Los Angeles abrasion for the aggregate shall not exceed 30.

Construction Requirements

403.03 Composition of Mix (Job Mix Formula). Revise as follows:

Delete from the first sentence "in one of the following:"

Delete the first bullet

Revise the second bullet to read:

- Hveem or Marshall designed asphalt mixture as designated in Subsection 402.03 for class A mix.

Delete the third bullet

Delete the text in paragraph (a) and substitute the following:

(a) Recycled asphalt pavement use. Up to 15 percent recycled asphalt pavement material by mass may be used in the mix base course. No recycled asphalt pavement material is allowed in the top course.

403.03 (b) Submission (1), (2), (3) and (4) - Delete the text and substitute the following:

(1) Aggregate and mineral filler.

(a) Target values:

- (1) Target value for percent passing each sieve size for the aggregate blend;
- (2) Target values for the percent passing each sieve size for each stockpile;
- (3) Stockpile blend ratios;
- (4) Target asphalt content; and
- (5) *Maximum* density value according to AASHTO T 209.

(b) Source and percentage of each aggregate stockpile to be used.

(c) Average gradation of each aggregate stockpile.

(d) Representative samples from each aggregate stockpile. Use split samples of material taken at the same time samples are taken for testing by the Contractor's laboratory.

(1) 800 pounds of aggregates proportioned by stockpile according to the stockpile's proportion in the mix;

(2) 20 pounds of bag house fines if proposed for the mix; and

(3) 20 pounds of mineral filler if proposed for mix.

(e) Results of aggregate quality tests for Contractor selected sources. Include the sand equivalent, fractured faces, Los Angeles abrasion, sodium sulfate soundness, coarse durability, and fine durability results from tests performed within 1 year of aggregate use.

(2) Asphalt binder.

(a) Target asphalt binder content;

(b) Five 1-gallon samples of the asphalt binder to be used in the mix. Do not include antistrip additives in these samples;

(c) Recent test results from the manufacturer for the asphalt binder including a temperature-viscosity curve;

(d) Material safety data sheets; and

(e) Mixing temperature range and minimum compaction temperature for the performance grade asphalt to be used in the mix.

(3) Antistrip additives. If part of the job-mix formula:

(a) 1 pint of liquid antistrip additive or 10 pounds of cement, fly ash, or lime antistrip additive;

(b) Name of product;

(c) Manufacturer;

(d) Material safety data sheet; and

(e) Dosage rate.

(4) Recycled asphalt pavement material. If part of the job-mix formula:

(a) Source and percentage of recycled asphalt pavement material.

(b) Average gradation of the recycled asphalt pavement material.

(c) Percent asphalt binder in the recycled asphalt pavement.

(d) Target value for the asphalt binder content (that considers the percent asphalt binder in the recycled asphalt pavement) and the percent new (virgin) asphalt binder to be added to the mix.

(e) 200-pound representative sample of recycled asphalt pavement material. For existing pavements, mill where designated by the Project Engineer to the pavement removal depth. Sample the removed material and replace it with an approved asphalt concrete mix. Do not use the replacement material in the recycled mix.

(f) One gallon of recycling agent, if part of the job-mix formula.

403.03 (c) Verification - Delete the text and substitute the following:

(c) Verification. The Project Engineer will review and may perform design verification testing. If verification testing is performed, the information supplied in the contractor's design must agree with the verification test results within the tolerances shown below:

(1) Aggregate gradations. Representative aggregate samples from each stockpile, when combined according to the contractor's recommendation for stockpile percentages, shall be within the gradation defined by the target values plus or minus the following tolerance for each sieve.

Sieve Size	Tolerance, % (\pm)
1 inch	3.0
3/4 inch	3.0
1/2 inch	3.0
3/8 inch	3.0
No. 4	3.0
N0.8	3.0
No. 40	2.0
No. 200	1.0

(2) Voids in mineral aggregate (VMA). The Contractor's VMA result is verified if the Project Engineer's result is not below the minimum specification limit.

(3) Voids filled with asphalt (VFA). The Contractor's VFA result is verified if the Project Engineer's result is within the specification limits.

(4) Air voids (Va). The Contractor's Va result is verified if the Project Engineer's result at the same design asphalt binder content is within 1.0 percent of the specification value.

403.03 (d) Changes and resubmissions - Delete the text and substitute the following:

(d) Changes and resubmissions. If a job-mix formula is rejected or a material source or the recycled asphalt pavement is changed, submit a new job-mix formula for acceptance. Up to 21 days may be required to evaluate a change. Approved changes in target values will not be applied retroactively for payment.

The Project Engineer will deduct all job-mix formula evaluation costs resulting from the following:

- (1) Contractor-requested changes to the approved job-mix formula.
- (2) Contractor requests for additional job-mix formula evaluations.
- (3) Additional testing necessary due to the failure of a submitted job-mix formula.

403.03 (e) Acceptance - Delete the text and substitute the following:

(e) Acceptance. Do not begin mix production until the job-mix formula is accepted by the Project Engineer.

403.04 Mixing Plant - Delete the text and substitute the following:

4030.04 Mixing Plant - Use mixing plants conforming to AASHTO M 156 supplemented as follows:

(a) All plants.

(1) Automated controls. Control the proportioning, mixing, and discharging of the mix automatically.

(2) Dust collector. AASHTO M 156, Requirements for All Plants, Emission Controls is amended as follows:

Equip the plant with a dust collector. Dispose of the collected material. In the case of baghouse dust collectors, dispose of the collected material or return the collected material uniformly. Use of baghouse fines in asphalt concrete mixes requires approval unless included as part of the approved job-mix formula.

(3) Recycled asphalt pavement. When recycled asphalt pavement material is incorporated into the mixture, modify plants according to the plant manufacturer's recommendations to process reclaimed material.

(b) Drum dryer-mixer plants.

(1) Bins. Provide a separate bin in the cold aggregate feeder for each individual aggregate stockpile in the mix. Use bins of sufficient size to keep the plant in continuous operation and of proper design to prevent overflow of material from one bin to another.

(2) Stockpiling procedures. Separate aggregate into at least 2 stockpiles with different gradations. As a minimum, stockpile mostly coarse material in one stockpile and mostly fine material in another.

(c) Batch and continuous mix plants.

(1) Hot aggregate bin. Provide a bin with 3 or more separate compartments for storage of the screened aggregate fractions to be combined for the mix. Make the partitions between the compartments tight and of sufficient height to prevent spillage of aggregate from one compartment into another.

(2) Load cells. Calibrated load cells may be used in batch plants instead of scales.

(3) Recycled asphalt pavement. Modify batch plants so the recycled asphalt pavement is introduced into the mix after bypassing the dryer. Design the cold feed bin, conveyor system, and special bin adjacent to the weigh hopper, if used, to avoid segregation and sticking of the recycled asphalt pavement material. Heat aggregate to a temperature that will transfer sufficient heat to the recycled asphalt pavement material to produce a mix of uniform temperature within the range specified in the approved job-mix formula.

403.05 Pavers - Delete the text and substitute the following:

SECTION 403

Access Road and Sewer System

Project No. SWMD-09-03

403.05 Pavers. Use pavers that are:

- (a) Self-contained, power-propelled units with adjustable vibratory screeds with full-width screw augers;
- (b) Heated for the full width of the screed;
- (c) Capable of spreading and finishing courses of asphalt mix in widths at least 12 inches more than the width of one lane;
- (d) Equipped with a receiving hopper having sufficient capacity to ensure a uniform spreading operation;
- (e) Equipped with automatic feed controls, which are properly adjusted to maintain a uniform depth of material ahead of the screed;
- (f) Operable at forward speeds consistent with satisfactory mix lay down;
- (g) Capable of producing a finished surface of the required smoothness and texture without segregating, tearing, shoving, or gouging the mix; and
- (h) Equipped with automatic screed controls with sensors capable of sensing grade from an outside reference line, sensing the transverse slope of the screed, and providing the automatic signals that operate the screed to maintain grade and transverse slope.

403.06 Surface Preparation - Delete the text and substitute the following:

403.06 Surface Preparation. Clean the existing surface of all loose material, dirt, or other deleterious substances by approved methods. Apply an asphalt tack coat to contact surfaces of pavements, curbs, gutters, manholes, and other structures according to Section 412.

403.07 Weather Limitations - Delete the text and substitute the following:

403.07 Weather Limitations. Place hot asphalt concrete pavement on a dry, unfrozen surface when the air temperature in the shade is above 35 °F and rising and the temperature of the road surface in the shade conforms to Table 403-2.

**Table 403-2
Asphalt Concrete Mix Placement Temperature**

Compacted Lift Thickness	< 2 Inches	2 – 3 Inches	> 3 Inches
Road Surface Temperature °F	Minimum Lay-Down Temperature ⁽¹⁾ °F		
< 35	(2)	(2)	(2)
35 – 39.9	(2)	(2)	280
40 – 49.9	(2)	285	275
50 – 59.9	295	280	270
60 – 69.9	285	275	265
70 – 79.9	280	270	265
80 – 89.9	270	265	260
≥ 90	265	260	255

- (1) Never heat the asphalt concrete mix above the temperature specified in the approved mix design.
- (2) Paving not allowed.

403.08 Asphalt Preparation - Delete the text and substitute the following:

403.08 Asphalt Preparation. Uniformly heat the asphalt binder to provide a continuous supply of the heated asphalt binder from storage to the mixer. Do not heat asphalt binder above 350 °F.

If a liquid heat stable antistripping additive is used, meter it into the asphalt binder transfer lines at a bulk terminal or mixing plant. Inject the additive for at least 80 percent of the transfer or mixing time to obtain uniformity.

403.09 Aggregate Preparation - Delete the text and substitute the following:

403.09 Aggregate Preparation. If nonliquid antistripping additive is used, adjust the aggregate moisture to at least 4 percent by mass of aggregate. Mix the antistripping additive uniformly with the aggregate before introducing the aggregate into the dryer or dryer drum. Mix with the aggregate particles to produce a uniform mixture. Use calibrated weighing or metering devices to measure the amount of antistripping additive and moisture added to the aggregate.

Treated aggregate may be held in stockpiles before mixing with asphalt, but the treated aggregate must be used during the same construction season in which it was produced.

For batch plants, heat, dry, and deliver aggregate for pugmill mixing at a temperature sufficient to produce a mix temperature within the approved range. Adjust flames used for drying and heating to prevent aggregate damage and contamination.

Control plant operations so the moisture content of the mix behind the paver is 0.5 percent or less according to AASHTO T 110 or FLH T 515.

403.10 Mixing - Delete the text and substitute the following:

403.10 Mixing. Measure the aggregate and asphalt into the mixer according to the approved job-mix formula. Mix until all the particles are completely and uniformly coated with asphalt according to AASHTO M 156. Maintain the discharge temperature within the approved range.

403.11 Hauling - Delete the text and substitute the following:

403.11 Hauling. Use vehicles with tight, clean, and smooth metal beds for hauling asphalt concrete mixes.

Thinly coat the beds with an approved material to prevent the mix from adhering to the beds. Do not use petroleum derivatives or other coating material that contaminates or alters the characteristics of the mix. Drain the bed before loading.

Equip each truck with a canvas cover or other suitable material of sufficient size to protect the mix from the weather. When necessary to maintain temperature, use insulated truck beds and securely fastened covers. Provide access ports or holes for checking temperature of asphalt mix in the truck.

403.12 Production Start-Up Procedures - Delete the text and substitute the following:

403.12 Production Start-Up Procedures.

(a) Pre-paving conference. At least 14 days before the start of paving operations, arrange for a pre-paving conference. Coordinate attendance with Project Engineer and all applicable subcontractors. Submit and prepare to discuss the following:

- (1)** Proposed schedule of paving operations;
- (2)** List of all equipment (excavation, compaction, laydown, haul, pugmill, etc.), and personnel used in the production and construction of the work;
- (3)** Proposed traffic control plan for paving operations including provisions for pavement drop-offs and moving operations;
- (4)** Contractor quality control plan for paving and sampling and testing according to Sections 153 and 154;
- (5)** Procedures for constructing the control strip including placing, finishing, compacting, and smoothness procedures; and
- (6)** Acceptance procedures according to Subsections 106.05 and 403.17.

(b) Control strip. Provide 7 days notice before beginning production of an asphalt concrete mix.

On the first day of production, produce sufficient mix to construct a 1000-foot long control strip, one-lane wide, and at the designated lift thickness. Construct the control strip on the project at an approved location.

Construct the control strip using mix production, lay-down, and compaction procedures intended for the entire mix. Cease production after construction of the control strip until the asphalt concrete mix and the control strip are evaluated and accepted.

(1) Mixture. Take and test at least three control strip asphalt concrete mix samples and evaluate according to Subsection 403.17. The mix is acceptable if all test results are within specification limits for asphalt content, VMA, and the VFA.

(2) Compaction. Take nuclear density readings behind each roller pass to determine the roller pattern necessary to achieve required density.

At a minimum of five locations within the control strip, take nuclear gauge readings, and cut and test core samples according to Subsection 403.17. Density is acceptable if all tests are above the specification limit. Furnish the Project Engineer with the nuclear gauge readings and correlations of the readings to the core specific gravities.

Repeat the control strip process until an acceptable control strip is produced. See Subsection 106.01 for the disposition of material in unacceptable control strips. Accepted control strips may remain in place and will be accepted and measured as a part of the completed pavement. Tests used for the control strip will not be included in the evaluation for payment according to Subsection 106.05. When a control strip is accepted, full production may begin.

Use these start-up procedures when producing material from a different plant or when resuming production after a termination of production due to unsatisfactory quality according to Subsection 106.05.

403.13 Placing and Finishing - Delete the text and substitute the following:

403.13 Placing and Finishing. Do not use mixes produced from different plants unless the mixes are produced according to the same job-mix formula, use material from the same sources, and are approved.

Place asphalt concrete mix at a temperature conforming to Table 401-2. Measure temperature of the mix in the hauling vehicle just before dumping into spreader or measure it in the windrow immediately before pickup.

Place the mix with a paver conforming to Subsection 403.05. Control horizontal alignment using a reference line. Automatically control the grade and slope from reference lines, a ski and slope control device, or dual skis. Use skis having a minimum length of 20 feet.

In areas where mechanical spreading and finishing is impractical, place and finish the mix with alternate equipment to produce a uniform surface closely matching the surface obtained when using a mechanical paver.

Offset the longitudinal joint of one layer at least 6 inches from the joint in the layer immediately below. Make the longitudinal joint in the top layer along the centerline of two-lane roadways or at the lane lines of roadways with more than two lanes.

The Engineer will designate the job-mix formula to be used for wedge and leveling courses at each location. Place wedge and leveling courses in maximum 4-inch lifts. Complete the wedge and leveling before starting normal paving operations.

Top wearing course will have a thickness of 1-2" with a tolerance of (-0, +1/4"). The base course will be applied with a minimum thickness of 2" and a maximum thickness of 4". When a base course thicker than 4" is required, multiple layers of approximate equal thicknesses will be applied.

A tack coat is required between all asphalt layers, leveling layers and on any milled asphalt surfaces prior to the next layer being applied.

403.14 Compacting - Change the compaction requirement in the second paragraph to read:

Compact to a pavement specific gravity (density) that is no less than 92 percent nor more than 97 percent of the maximum specific gravity (density) determined according to AASHTO T 209.

403.15 Joints, Trimming Edges, and Cleanup - Delete the text and substitute the following:

403.15 Joints, Trimming Edges, and Cleanup. Complete pavement construction of adjacent traffic lanes to the same elevation within 24 hours. If drop-offs are left overnight, sign the drop-offs in excess of 2 inches with "Uneven Lanes" warning signs and provide a 1V:3H fillet for drop-offs in excess of 4 inches.

At connections to existing pavements and previously placed lifts, make the transverse joints vertical to the depth of the new pavement. Form transverse joints by cutting back the previous run to expose the full-depth course.

To both transverse and longitudinal joints, apply an asphalt tack coat to the joint edge according to Section 412.

Place the asphalt concrete mix as continuously as possible. Do not pass rollers over the unprotected end of a freshly laid mix.

Dispose of material trimmed from the edges and any other discarded asphalt mix according to Subsection 211.02(a)(2).

Table 403-1 Delete and substitute the following:

**Table 403-1
Sampling, Testing and Acceptance Requirements**

Material or Product	Type of Acceptance (Subsection)	Characteristic	Category	Test Methods Specifications	Sampling Frequency	Point of Sampling	Split Sample	Reporting Time	
Hot asphalt concrete pavement	Measured and tested for conformance (106.04)	Job-mix formula verification	—	Subsection 403.03	1 per aggregate stockpile	Flowing aggregate stream (bin or belt discharge) or off of conveyor	—	21 days before approval of job-mix formula	
		Specific Gravity	—	AASHTO T 209	Start of each production day and every 6 hours of production.	Batch Plant from the hauling vehicle	Yes, when requested	Daily	
Asphalt binder		Gradation	—	AASHTO T 30	"	"	"	"	
		Asphalt content	—	AASHTO T 308	"	"	"	"	
		Compaction	—	ASTM D 2950 or other approved procedures	Every 500 linear feet per lane, location selected per ASTM D3665	Completed roadway after rolling	—	—	"
		Smoothness	—	Subsection 403.16	—	—	—	—	—
		Quality	—	Subsection 702.01	1 per 130 tons of liquid	Line between storage tank & asphalt plant	2 — 1-quart samples	—	Tested by Contractor

END OF SECTION 403

SECTION 412 ASPHALT TACK COAT

412.07 **ACCEPTANCE**. The text of the first paragraph is amended as follows:

Emulsified asphalt will be evaluated under Subsections 106.02, 106.03, and 702.09.

412.08 **MEASUREMENT** – This subsection is revised to read as follows:

Asphalt Tack Coat will be not be measured, it is considered incidental work.

412.09 **PAYMENT** - This subsection is revised to read as follows:

Asphalt Tack Coat will be not be paid directly, it is considered incidental work.

END OF SECTION 412

SECTION 601 MINOR CONCRETE STRUCTURES

601.02 **MATERIAL** - Supplement this subsection as follows:

Cement shall be Type I or Type II per AASHTO M 85 or approved equal. All cement stored in Guam for sixty (60) days or longer shall be tested. Test results shall be submitted to the Owner for approval prior to use. Cement reclaimed from cleaning bags, leaking containers, or that has been exposed or damaged during shipping shall not be used. Cement may be accepted based on the Manufacturer's Certification stating compliance with AASHTO M 85, latest revision, errata or addendum from the time the project was advertised.

All aggregate shall be from one source and free from any injurious amount of organic impurities or any substance which may cause a harmful reaction with the alkalis in the cement, thereby causing excessive expansion of the concrete. Fine and course aggregates shall be regarded as separate ingredients and shall meet the following requirements:

Fine Aggregates: Add No. 200 sieve to gradation shown in AASHTO M 6 with 0% to 5% passing the sieve. The Specific Gravity shall be not less than 2.40 Saturated Surface Dry (SSD). Table 1.

Course Aggregates: Course aggregates are per AASHTO M 43 Table 1. Use Size Number 467 for 1 1/2 inch aggregate; Size Number 57 for 1 inch aggregate; and Size Number 67 for 3/4 inch aggregate. The Specific Gravity shall be not less than 2.40 SSD and the Los Angeles Abrasion shall not be greater than 40%.

The following is added to this subsection:

Admixtures: The use of admixtures will be at the Contractors option subject to the approval of the Engineer. Prior to the use of an admixture, the mix design together with certified test reports shall be submitted to the Contracting Officer for approval.

Epoxy Binder: Epoxy binder shall be Type I conforming to Federal Specifications MM-B-350.

Embedded Items: All sleeves, inserts, anchors and embedded items shall be placed prior to concrete pouring as shown or specified. All sleeves, inserts, anchors and other embedded ferrous items exposed to the weather shall be hot dipped galvanized after fabrication in conformance with AASHTO M 111 or AASHTO M 232.

601.03 **CONCRETE COMPOSITION** - The requirements in reference to the size of coarse aggregate as shown on Table 601-1 is revised as follows:

Classes of concrete to be used in each part of the structures shall be as specified herein. Prior to start of construction, the Contractor shall submit for approval design mix on each strength of concrete to be

used. The Contractor, at his own expense, shall have samples of mix designs prepared for the classes of concrete to be used in the work or furnish satisfactory evidence that specified mixes have been previously prepared and results obtained. Unless otherwise provided herein, specification

ACI-2111.1 shall be used in proportioning the mix. Prices for concrete shall be based on the proposed mix including any use of admixture, if permitted. The design mix together with certified test reports for all materials to be incorporated to the mix and the results of the 7-day and 28-day compressive strength tests shall be submitted for approval at least 30 days prior to furnishing of concrete.

The class of concrete to be used on this project is listed below and shall have the corresponding 28-day compressive strength and maximum aggregate size. Table 601-1 is replaced by the following table:

TABLE 601-1 (REVISED)
Requirements for Minor Structure Concrete

<u>Placement</u>	<u>Minimum 28 day: Compressive Strength</u>	<u>Maximum Aggregate Size (inches)</u>	<u>Maximum Slump (inches)</u>
Pre-cast Concrete and Cut-off Walls	4,000 psi	0.75	2
Headwalls, Retaining Walls, Manholes, Handholes and Other Minor Concrete Structures	3,000 psi	0.75	2
Foundations and slab on grade	3,000 psi	1.5	3

CONSTRUCTION REQUIREMENTS

601.04 **GENERAL** - The following is added to this subsection:

- (a) **Setting Miscellaneous Material:** Anchors, frames or edging, pipe sleeves, pipes passing through walls, metal ties, conduits, drain and other materials in connection with concrete construction shall, where practicable, be placed and secured in position when the concrete is placed.
- (b) **Reinforcing Steel:** Shall be provided as indicated. Any placement or movement after placement other than indicated or specified shall be subject to approval by the Contracting Officer.
- (c) **Bonding and Grouting:** Before depositing new concrete against old concrete that has set,

the existing surface shall be roughened and immediately prior to placing the new concrete, the old surface shall be hosed down with water and thoroughly cleaned, using compressed air. All laitance, coatings, stains, debris and other foreign material shall be removed from the surface.

(d) **Mortar for Patching:** Cement mortar for patching shall conform to the requirement of this specification. Cement mortar shall be applied with putty knife while the prime-coat is still soft or tacky. The repairing materials shall be applied flush with the adjacent surfaces.

(e) **Finishing Concrete Surfaces:** The following shall be exercised in finishing concrete surface.

(1) **Rubbed Finish:** Unless otherwise noted all exposed concrete surface specified.

(2) **All Exposed Corner:** Shall be chamfered 3/4-inch except otherwise noted.

(3) **Repair of Defects on Concrete:** All defects consisting of cracks, spalls, voids, cleavages, holes, honeycombed areas and all other defects that occur during the one-year guarantee period shall be repaired as herein specified. Except as otherwise specified, the repairing material shall be two-component, mineral-filled, epoxy-resin-base, grout conforming to Specification MMM-G-650, Type I, Grade C, or repaired with a two-component, epoxy-resin-base material conforming to Specification MMM-B-350, Type I, mixed with fine aggregate.

(4) **Design Mix for Repairing Materials:** The two-component mineral filled, epoxy-resin-base grout shall be mixed without adding any aggregate in strict accordance with the manufacturer's printed instructions. Epoxy mortar shall consist of a two-component, epoxy-resin-base binder material mixed with dry silica sand or stone aggregate in proportions strictly recommended by the manufacturer. The Contractor shall mix trial batches on the job in the presence of the Contracting Officer in strict accordance with the manufacturer's printed instructions which will insure that the proportions of materials will be controlled and accurately maintained during the progress of the repair work. Mortar materials shall be mixed in proportions by volume as recommended. The epoxy-resin-base binder adhesive and the aggregate shall be introduced and mixed in such a manner the materials will be distributed uniformly throughout the mass. Boxes and pans for mixing shall be kept clean and free of debris or dried mortar. Once the components of the epoxy mortar are mixed, the components shall be used before the initial setting of the binder has taken place.

(5) **Preparation of Surfaces:** All surfaces to be repaired shall be dry, free of grease, oil, dirt, deficiency in the strength of the concrete produced. Additional tests at the contractor's expense shall be made and adjust mixes as required to obtain the specified strength.

(6) **Method of Application:** Following the preparation and cleaning of such concrete surface to be repaired, the repairing material of the design mix as recommended by the manufacturer shall be applied.

Thin Hairline Cracks: Thin hairline cracks not measurable by ordinary means (0.01 inch or less) shall be sealed with epoxy grout. The repairing material of the design mix as recommended by the

manufacturer shall be applied.

Large Cracks and Voids: Large cracks and voids shall be square cut, cleaned and primed with pure epoxy-resin binder adhesive to insure a weld bond, after which the epoxy mortar shall be applied with a trowel or putty knife flush with the adjoining surfaces.

Deep Cracks or Cleavages: Where the size of the openings permit, the crack shall be filled with epoxy grout, allowed to harden, then surface-coated with epoxy-mortar. To rejoin narrow voids at maximum depth, the cracked surface shall be sealed with epoxy grout and allowed to harden; then, through this sealed surface, holes large enough to permit insertion of caulking gun tips shall be drilled and epoxy grout without aggregate shall be pumped into the void with the caulking gun. The sealed surface will prevent the outflow of the epoxy grout and force it into the fissure, providing a weld-joint of maximum strength.

Spalls: Defects caused by spalls shall be repaired by providing with a prime coating of pure epoxy binder and then filled with epoxy mortar (with aggregate) by means of steel trowel or as specified for non-shrink grouting of mortar. Surfaces to receive non-shrink grouting mortar shall be thoroughly cleaned.

END OF SECTION 601

SECTION 602

CULVERTS AND DRAINS

Material

602.02 – This Subsection is amended as follows:

Pipe culverts shall be plastic pipes conforming to the attached standard.

SECTION 605 UNDERDRAINS, SHEET DRAINS AND PAVEMENT EDGE DRAINS

605.03 GENERAL – This subsection is supplemented as follows:

Percolation Chambers shall be heavy duty Cultec percolation chambers “Recharger 330” HD H-20 (Traffic Type) reinforced with Cultec filter fabric 410 or an “APPROVED EQUAL”. Percolation chambers shall be manufactured from high molecular weight high-density polyethylene. Each unit shall be designed to AASHTO load rating of 32,000 lbs/axle. Chamber storage capacity shall not be less than 7.4 cubic feet per linear foot or design unit capacity shall not be less than 65 cu. ft.. Gallon capacity / ft. shall not be less than 55.5. Each polyethylene unit shall be 30.5 inches high, 52 inches wide and 7.5 feet long. Cultec fabric 410 shall be placed below and beside drain rock, directly over the top of each chamber row and then over the entire bed before backfilling to grade.

6” Perforated PVC Underdrains are not shown on the plans. Contractor will be directed where to install underdrains by the contracting officer. Install per section 605.04 (A) using geotextile. Quantity provided in the bid schedule is an estimate only.

END OF SECTION 605

SECTION 611 WATER SYSTEMS

611.01 **DESCRIPTION** - This subsection is supplemented as follows:

This work shall include the adjustment of waterline appurtenances and relocation of fire hydrants as shown in the plans.

611.03 **GENERAL** -The following is added to this subsection:

Coordinate all work under this section, particularly when making connection to existing systems, adjustments, relocations, realignments, and other activities which will affect water service, with the Contracting Officer and Guam Waterworks Authority (GWA).

The Contractor shall be responsible for repair in all waterline leaks or breakage that will occur during the construction of the highway until the project is officially accepted by the Government. All repairs shall be made immediately after discovery of leaks or breakages and shall be subject to inspection and approval.

611.05 **TESTING AND DISINFECTING LINES.** The following is added to this subsection:

Disinfection of water lines shall conform to AWWA C651-86.

END OF SECTION 611

SECTION 612 SANITARY SEWER SYSTEMS

Materials

612.02 This subsection is supplemented as follows:

Materials for sanitary sewer force main shall comply with the following:

- A. Pipe shall be high density polyethylene (HDPE) pipe as shown on the drawings.
- B. HDPE pipe shall conform to the applicable requirements of ASTM-D3350 as having a cell classification of PE 4534 (black with 2% minimum carbon black). Dimensions and workmanship shall be as specified by ASTM F714. Fittings shall be molded from or manufactured using a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe specified herein. To ensure compatibility of polyethylene resins, all fittings shall be of the same manufacture as the pipe being supplied.
- C. The pipe supplied as specified shall have a nominal IPS (Iron Pipe Size) outside dimension unless otherwise specified. Pipe shall have the SDR (Standard Dimensional Ratio, as defined in ASTM F714) rating shown on the Drawings.

Construction Requirements

612.03 General. This subsection is supplemented as follows:

A. REFERENCES

American Society for Testing and Materials (ASTM):

ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

ASTM D131 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³).

ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

ASTM D2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

ASTM F714 Specification for Polyethylene Pipe (SDR-PR) Based on Outside Diameter.

ASTM D1248 Specification for Polyethylene Plastics Molding and Extrusion.

ASTM D2657 Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.

ASTM D3261 Butt Heat Fusion PE Fittings for PE Pipe & Tubing.

ASTM D3035 Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

ASTM D3350 Specification for Polyethylene Plastic Pipe and Fitting Materials

B. SUBMITTALS

Requirements for submittals.

Product Data: Submit data indicating pipe material used and pipe accessories,

C. QUALITY ASSURANCE

Perform Work in accordance with the Guam Waterworks Authority requirements.

D. UNDERGROUND PIPE MARKERS

Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

Trace Wire: Bare Copper, solid conductor.

E. GROUND CLEANOUTS

SECTION 612

Access Road and Sewer System
Project No. SWMD-09-03

PVC piping with plastic or brass screw plug as indicated on Design Drawings.

Cleanouts shall be 8 inch diameter inside the rights of way and 6 inch outside of the rights of way.

Cleanouts shall be located at ends of pipe line runs and changes in direction and spaced as required by code or as indicated on Design Drawings.

F. SERVICE SADDLE

Service Saddle: Romac Style "CB" Sewer Saddle or approved equal.

612.04 Laying Sewer Lines. This subsection is supplemented as follows:

INSTALLATION – PIPE

- A. Installation shall conform to pipe manufacturer's instructions and recommendations unless otherwise specified. Contractor shall furnish QAC the manufacturer's data on pipe and fittings and printed installation instructions before pipe installation.
- B. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. Handling of pipe shall be done in such a manner that the pipe is not damaged. Segments of pipe having cuts or gouges in excess of 10 percent of the wall thickness of the pipe should be cut out and removed.
- C. Sections of HDPE pipe should be joined in continuous lengths on the job site above ground. The joining method shall be the butt fusion method in conformance with ASTM D3261 and the pipe manufacturer's recommended written instructions including, but not limited to, temperature requirements, alignment and fusion pressures.
- D. Pipe interior shall be maintained smooth after joining is complete.
- E. Whenever pipe laying is stopped, the open end of the line shall be sealed with an approved mechanical watertight or airtight plug.
- F. Pipe shall be supported in a manner which permits construction and accommodates expansion due to temperature changes, and/or as noted on the drawings.
- G. Pipe and fittings shall be carefully inspected for cracks and other defects while suspended immediately before installation in final position. Spigot ends of pipe shall be examined with

particular care. Defective, damaged, or unsound pipe and fittings shall be rejected and removed from the site of the work. Complete specifications, data and detailed drawings covering the items furnished and placed under this specification shall be submitted for approval and records.

- H. The Geosynthetics QAC shall observe, monitor and document that the pipe has been handled, installed, joined and protected in conformance to these project specifications.
- I. For gravity sewer install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.
- J. For gravity sewer lay pipe to slope gradients noted on drawings; with maximum variation from indicated slope of 1/8 inch in 10 feet.
- K. Install bedding at sides and over top of pipe to minimum compacted thickness of 6 inches.
- L. Install General Fill to the finish subgrade elevation.
- M. Do not displace or damage pipe when compacting.
- N. Install plastic ribbon tape and trace wire continuous over top of pipe buried 12 inches below finish grade, above pipe.

The following subsections are added:

612.06A Test Procedures for Pressure Lines:

Force main pressure testing shall be to 150% of the working pressure at point of test, but not less than 125% of normal working pressure at highest elevation. After completion of force main pipeline installation, including backfill, but prior to final connection to existing system, conduct, in presence of Engineer, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.

Provide equipment required to perform leakage and hydrostatic pressure tests.

Test Pressure: Not less than 150 psi or 50 psi in excess of maximum static pressure, whichever is greater.

Conduct hydrostatic test for at least two-hour duration.

No pipeline installation will be approved when pressure varies by more than 5 psi ([34 kPa]) at completion of hydrostatic pressure test.

Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation cocks and apply test pressure. At conclusion of tests, remove corporation cocks removed and plug resulting piping openings.

Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.

Examine exposed piping, fittings, valves, hydrants, and joints carefully during hydrostatic pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.

No pipeline installation will be approved when leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133,200}$$

- L = allowable, in gallons per hour
- S = length of pipe tested, in inches
- D = nominal diameter of pipe, in inches
- P = average test pressure during leakage test, in pounds per square inch (gauge)

When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

Compaction Testing: In accordance with ASTM D1557, compact to 95% of the maximum dry density for backfill materials.

When tests indicate Work does not meet specified requirements, remove work, replace and retest.

Frequency of Compaction Tests: One test for each 12 inches of fill in each 50 feet of trench.

General: The Engineer will conduct field inspections and witness all field tests specified in this section. The Contractor shall perform all field tests and provide all labor, equipment, and incidentals required for testing.

The Contractor shall be able to produce evidence, when required, that any item of work has been constructed properly in accordance with the drawings and specifications.

612.06B Test Procedures for Non-Pressure Lines:

Non-Pressure Lines: Check each straight run of pipeline for gross deficiencies by holding a manhole (lamping); it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line.

Leakage Tests: Test lines for leakage by either infiltration tests or exfiltration tests, as specified in this paragraph. 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 the water table is 2 feet or more above top of pipe at upper end of pipeline section to be tested, measure infiltration using a suitable weir or other acceptable device. When the water table is less than 2 feet above top of pipe at upper end of pipeline section to be tested, make exfiltration test by filling the line to be tested with water so that the head will be at least 4 feet above top of pipe at upper end of pipeline section being tested. Allow filled pipeline to stand until the pipe has reached its maximum absorption as recommended by the pipe manufacturer. After absorption, re-establish the head and measure amount of water needed to maintain this water level during a two-hour test period. Amount of leakage as measured by either infiltration or exfiltration test shall not exceed the 50 gallons per inch of pipe diameter per mile of pipeline. When leakage exceeds the amount specified, make satisfactory correction and retest pipeline section in the same manner as previously specified. Correct all visible leaks regardless of leakage test results.

Alternative Leak Testing Procedure: Air testing subject to the approval of the Engineer may be conducted in lieu of water exfiltration testing. This will establish the minimum requirements for use of air testing.

Deflection Testing: At the direction of the Engineer or Owner, make a deflection test on individual lengths of installed plastic pipeline on completion of all 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 all external loads shall not exceed 4.5 percent of the normal inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of (a) a pull-through device, or (b) a deflection measuring device.

Testing Devices:

Pull-Through Devices: 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 under the same conditions as previously specified.

Deflection Measuring Device: Measure deflection through each run of installed pipe. If the deflection readings in excess of 4.5 percent of normal 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 normal diameter of pipe, replace pipe which has excessive

deflection and completely retest in same manner and under same conditions as previously specified.

Warranty Period Test: Pipe found to have deflection of greater than 5 percent when deflection test is performed just prior to end of one-year warranty period shall be replaced and tested as previously specified for leakage and deflection.

END OF SECTION 612

THIS SECTION IS ADDED TO FP 03

SECTION 612A WASTEWATER PUMPING STATIONS (Pump Stations #3, #4)

PART 1 GENERAL

1.1 SCOPE

Work covers construction of pump stations, supply and installation of pumps, and operational testing of the pump stations complete in place and accepted.

1.2 SUMMARY

- A. Section Includes:
 - 1. Packaged Pumping Stations (submersible wet wells)
 - 2. Initial operation of pumping station.

- B. Related Sections:
 - 1. All applicable sections of FP 03

1.3 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM A48 - Standard Specification for Gray Iron Castings.
 - 2. ASTM A48M - Standard Specification for Gray Iron Castings (Metric).
 - 3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 4. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 5. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 6. ASTM A709/A709M - Standard Specification for Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy.
 - 7. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 8. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).

9. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
10. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
11. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
12. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
13. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
14. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
15. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 SYSTEM DESCRIPTION

- A. Pumping Station (submersible wet well): Duplex, field assembled; with precast concrete basin; submersible, non-clog, centrifugal pumps; automatic control for in ground

Pump Station No.	Low Peak Inflow 1/ (gpm)	High Peak Inflow 2/ (gpm)	Low Peak Discharge 3/ (gpm)	High Peak Discharge 4/ (gpm)
#3 – wet well @ Dandan Road	43	91	86	182
#4 – wet well @ Route 4 Majilolo	43	91	86	182

installation.

1.5 DESIGN REQUIREMENTS

- A. Projected design influent conditions are shown below for three pumping stations. The landfill wastewater life is projected to occur over a 42 year period with the rates of flow influenced by the waste stream, rainfall patterns and cover operations. Pump station #3 - #4 will serve the entire landfill and tributary areas as shown on the plans for a projected 42 year period:

- B. Pump Stations

1/ Low inflow may occur in the first two years,

2/ High inflow may occur at year 17,

3/ Low discharge is 2x peak inflow of the sump and wet wells,

- 4/ High discharge is 2x peak inflow of the sump and wet wells,
- 5/ Submersible pump (PS#3) shall operate at 75 feet of total dynamic head
- 6/ Submersible pump (PS#4) shall operate at 110 feet of total dynamic head

1.6 PERFORMANCE REQUIREMENTS

- A. Pumping Station: Capable of pumping effluent at flow rate as indicated above.
- B. Basin Wall Thickness: Per Plans.
- C. Basin Cover: Provide live load capacity of 150 psf.
- D. Operation:
 - 1. Locate four floats consisting of "common stop", "start lead", "start lag", and "high level" in basin. Start one pump automatically when "start lead" float is activated. Start second pump automatically when "start lag" float is activated. Signal alarm condition automatically when "high level" float is activated. Stop both pumps automatically when "common stop" float is activated. Set float elevations in accordance with Drawings. Set pumps to automatically switch operation from one pump to another after shut off of each pumping cycle.
 - 2. See the manufactures recommendation for the leachate sump collection pumps, both primary and secondary, for level sensor pressure control recommendations.
- E. Sound, Vibration, and Thermal Control: Dampen or suppress noise, absorb vibration, accommodate thermal expansion and stresses, and adjust or correct for misalignment in piping systems.

1.7 SUBMITTALS

- A. Requirements for submittals.
 - 1. Guide Rail System.
 - 2. Miscellaneous metal fabrications.
 - 3. Pump Performance Curves.
 - 4. Wiring diagrams.
 - 5. Pump Outline Drawing.
 - 6. Motor Data.
 - 7. Control Drawing and Data.
 - 8. Operations and Maintenance Data.
- B. Shop Drawings: Indicate layout for both leachate sump collection pumps. Indicate station layout for of pumping station and valve pit for stations 2-5. Show size, materials, and

components of system. Indicate basin size, inlet and discharge location, cover dimensions, vent location, lifting cable location, check valve location, plug valve location, pump location, discharge piping location, junction box location, guide rail assembly location, level control locations, and ballast support flange dimensions.

- C. Product Data: Submit for each:
 - 1. Include catalog data for basin, cover, hinged door, slide rail assembly, discharge piping, valves, junction box, level controls, and control panel.
 - 2. Include pump catalog data, performance curve, breakaway fittings data, and access frame data.
 - 3. Include control panel data and panel wiring schematic.
- D. Test Reports: Submit written report showing factory pump inspections and tests have been successfully performed.
- E. Manufacturer's Installation Instructions: Submit manufacturer's published installation instructions. Submit manufacturer's published instructions for basin, pump, and panel systems procedures.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- G. Manufacturer's Field Reports:
 - 1. Submit report of each visit of manufacturer's representative to provide technical assistance during installation.
 - 2. Submit start-up report before final acceptance of pumps to document pumping station operation meets performance requirements.

1.8 CLOSEOUT SUBMITTALS

- A. Execution Requirements: Requirements for submittals.
- B. Record actual locations of packaged pumping stations including basins and control panel.
- C. Submit executed certification of pumping stations after performance testing.
- D. Submit spare parts list and rebuild kits.
- E. Provide Operations and Maintenance Manual containing operating and maintenance requirements for pumping station and schedule of recommended maintenance.

1.9 QUALITY ASSURANCE

- A. Perform Work in accordance with GWA requirements and standards.

1.10 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years experience. The pump and guide rail equipment shall be products of a manufacturer experienced in the design and manufacture of such equipment. Manufacturer shall have a minimum of 1,000 wastewater pumps currently installed in the U.S. and operating for no less than three years.

1.11 PRE-INSTALLATION MEETINGS

- A. Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping system pieces from entry of foreign materials and water by temporary covers, completing sections of work, and isolating parts of completed system.
- D. Accept system components on site in manufacturer's original containers or configuration. Inspect for damage.
- E. Store sensitive materials for field assembly in dry area in original shipping containers.
- F. Support basin with nylon slings to structural lift points during handling.
- G. Repair damage to basin according to manufacturer's instructions.

1.13 ENVIRONMENTAL REQUIREMENTS

- A. Product Requirements: Environmental conditions affecting products on site.
- B. Do not install concrete basin base when bedding is wet.

1.14 WARRANTY

- A. Execution Requirements: Requirements for warranties.
- B. Furnish five year prorated manufacturer's warranty on pump seals.

1.15 EXTRA MATERIALS

A. Each model of pump/motor shall have the following spare parts provided.

1. Pump Stations # 3 – # 5 shall provide the following:
 - a) One wear ring
 - b) One O-ring kit

PART 2 PRODUCTS

2.1 MATERIALS

A. Bedding and Backfill.

1. Bedding: Limestone Aggregate.
2. Aggregate Backfill: Limestone Aggregate, 3" minus, uniformly graded.

2.2 BASIN SYSTEM

A. Furnish materials in accordance with these specifications and GWA requirements and standards.

B. Product Description:

1. Submersible duplex basin system including cover with vent and door, rail assemblies, discharge and fittings, union ball valves, junction box, and level controls.
2. Inlet Size: as shown on drawings
3. Discharge Sizes: Nominal sizes shown on drawings. Provide HDPE SDR 11 pipe that conforms to a minimum flow velocity of two feet per second.

C. Cover: Reinforced concrete, with 3 inch bug-free vent, lockable hinged aluminum access doors with stainless steel hinges and hardware.

D. Inlet Hub: PVC adapter, size as shown on plans

E. Pump Discharge Piping: The discharge elbow shall be supplied by the pump manufacturer and be permanently installed in the wet well along with the discharge piping. The pumps shall be automatically connected to the discharge connection elbow when lowered into place. Pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be removed for this purpose and no need for personnel to enter the pump well. Sealing of the pumping unit to the discharge elbow shall be accomplished by a simple linear downward motion of the pumps with the entire weight of the pumping units guided to and pressed tightly against the discharge elbow with a metal to metal watertight contact. Sealing of the discharge interface by means of a diaphragm, O-ring or other devices will not be acceptable. No portion of the pump shall bear directly on the floor of

the sump, and there shall be no more than one 90 degree bend allowed between the volute discharge flange and sump piping. Discharge piping shall pass through wet well wall using Link-Seal, or approved equal.

- F. Ductile Iron Pipe: AWWA C151, ANSI A21.15
Fittings: Ductile iron, AWWA C104, A21.4, ANSI A21.10, AWWA C110.
Joints: AWWA C111, rubber gasket with rods.
Jackets: AWWA C105 polyethylene jacket.
- G. Rail System: Slide rail assemblies, as supplied by pump manufacturer. Two guide bars shall be provided for guiding the pump unit in raising and lowering. The guide bars shall not support any portion of the weight of the pump. The lower guide bar holders shall be integral with the discharge elbow. The pump unit shall be guided on the guide bars by a guide bracket which shall be an integral part of the pump. Each pump shall use two guide bars for raising and lowering the pump to the discharge elbow. Single guide bars and guide rope systems are not allowed. The pump shall have 25 feet of 316 stainless steel chain and cable with stainless steel shackles on each end. All miscellaneous steel in the wet well shall be made from 316 stainless steel.
- H. Plug Valves: Eccentric plug valves shall be non-lubricated type rated for 175 psig and bubble tight shut-off with pressure from either direction. Valves 6 inches and smaller shall have manual wrench lever operator, unless otherwise shown. Larger valves shall have totally enclosed, geared, manual operator with handwheel, unless otherwise shown. Valve body and plug shall be cast iron, ASTM A 126, Class B with 125 pound flanged ends. Valves with mechanical joints shall be used when shown. Plug shall be round or rectangular port of at least 80 percent of adjacent pipe. Plug shall have resilient coating. Valve seats shall be nickel. All external and internal surfaces shall be epoxy coated, 8 mils minimum. Stem bearings shall be self-lubricating stainless steel or reinforced teflon. Grit seals shall be provided on the stem to prevent grit from entering bearing. Manufacturers shall be Milliken, DeZurik, or equal.
- I. Check Valves: Unless otherwise shown on the Plans, shall be iron body, bronze facing swing check valves, with external spring or lever weighted. Ends shall be as shown or as required for the connection. Check valves shall be Mueller No. A-2600, Kennedy Figure 106LS, or equal.
- J. Sewage Air Release Valves: Sewage Combination air and vacuum valves for raw sewage shall be installed wherever shown on the Plans. Valves shall be APCO No. 443, Val-Matic Valve & Mfg. Co. of Chicago, Illinois, Crispin by Valve and Primer Corporation of Chicago, Illinois, or equal. Valves shall be designed for a maximum working pressure of 150 psi and have a 3/16-inch orifice diameter. The valves shall be designed for service in raw sewage and shall be equipped with a 2-inch inlet gate valve, a blow-off valve, an air vent fitted to receive 1-inch pipe and a factory installed metal plug in the backflushing inlet when

installed in a box. When installed above ground, the backflushing inlet and blowoff outlet openings shall be plugged with factory installed threaded metal plugs

- K. Junction Box: NEMA 250 Type 6 with cable grips for incoming direct burial cable.
- L. Electrical: Cable grips for direct burial cable for field installation.
- M. Float Pole: ASTM D1785, Schedule 40 PVC, 1/2 inch
- N. Level Controls: Four mechanical float type or mercury type pilot duty liquid level controls with AWG 18-2 SJOW-A cable in polypropylene housing for mounting to PVC support pole for pump stations 1 - 5.

2.3 PUMPS

- A. Manufacturers:
 - 1. Flygt or Gould Models for Stations #3 – #5 as indicated on Plans, or approved equal (by GWA and/or Project Engineer.)
- B. Product Description:
 - 1. Submersible, non-clog, effluent pumps with horizontal discharge, fittings, piping, and pump brackets.
 - 2. Discharge Size: as shown on drawings
 - 3. Any proposed substitution shall have all elements of the pump and motor of equivalent or better quality than the Flygt, or Gould models either indicated on the plans or meeting the flow performance requirements indicated above.
- C. Lifting Device:
 - 1. Stainless Steel wire rope: as recommended by pump manufacturer.

2.4 CONTROL PANEL

- A. Manufacturers:
 - 1. As provided by Pump Manufacturer
 - 2. Substitutions: Not Permitted.
- B. Product Description.
 - 1. Factory fabricated, self-contained duplex including common stop, start lead pump, start lag pump, and high level alarms motor control panel at remote location with short circuit and overload protection for pumps and alternator to alternate pump duty between pumps on successive cycles or switch operation of pumps on pump failure. Include high water alarm light and run light to warn of high water condition or failure of pumps.
 - 2. Enclosure Size: As per MFR.
 - 3. Horsepower Rating: as required to meet the flow requirements listed above.

4. Phase: 3.
 5. Voltage: 460-480 volts.
- C. Enclosure: NEMA 3R raintight, outdoor mounting G90 galvanized steel, gray polyester powder finish, padlock hasp/staple with captive stainless screws for door closure. Door-within-Door design. Continuous stainless piano hinge with stainless removable pin. Aluminum panel drilled and tapped, machine screw mounted components.
 - D. Circuit Breaker: For short circuit protection.
 - E. Starter: Electromagnetic.
 - F. Overload Relay: Bimetal type, ambient compensated.
 - G. Heater Element: Class 10 quick trip, one heater for each motor phase.
 - H. Switch: Hand-Off-Automatic, 1/2 inch NEMA 1.
 - I. Light: Pump motor run, 1/2 inch NEMA 1.
 - J. Sub Plate: Switch and light mounting.
 - K. Transformer: For 115 volt control on 3 phase.
 - L. Fuse: Control transformer primary when used. Meet requirements of NEC.
 - M. Fuse: Control circuit, meet requirements of NEC.
 - N. Terminal Strip: Box lugs for wiring.
 - O. Wiring: Color coded to NEC requirements; black power wiring, red numbered control wiring, white numbered neutral wiring, green ground wiring.
 - P. Alternator: For duplex only, automatic.
 - Q. Cabling: Install in PVC sleeves. Type and size as recommended by pump manufacturer.

2.5 ACCESSORIES

- A. Sealant: Industrial silicon sealant for pipe penetrations in basin.
- B. Anchor Bolts, Nuts, and Washers: ASTM A709/A709M, Grade 36, bent anchor bolts; ASTM A307, Grade A, nuts; ASTM A126, gray iron washers. Stainless steel bolts, nuts and washers in accordance with ASTM A316.

- C. Cable Holder: Stainless steel cable holder shall be designed for bolting to the concrete directly below the access hatches and capable of attaching the power cable strain grip and safety cables.
- D. Hoisting Cable: Cable shall be stainless steel sized to the weight of the pump. Provide with removable connectors at the pump and safety cable hook.

2.6 SOURCE QUALITY CONTROL

- A. Quality Requirements: Testing, inspection and analysis.
- B. Perform the following factory inspections and tests:
 - 1. Motor voltage and frequency check as shown on name plate.
 - 2. Motor and cable insulation test for moisture content or insulation defects in accordance with UL criteria
 - 3. Submerged pump run test to determine pump meets hydraulic performance requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of existing conditions before starting work.
- B. Verify inlet and discharge piping connection are size, location, and elevation on Drawings.

3.2 PREPARATION

- A. Establish location and elevations of pumping station to within 0.10 foot.
- B. Establish minimum separation of sanitary sewer and force main from other services piping in accordance with local code.

3.3 EXCAVATION

- A. Excavate direct burial cable trench in accordance with trenching specifications.
- B. Excavate to required elevation to install basin on undisturbed subgrade in accordance with specifications with minimum clearance of 4 inches between basin and surrounding earth.

3.4 BASIN INSTALLATION

- A. Place, compact and level drain rock bedding to minimum 8 inches.
- B. Form and place concrete base pad, trowel top surface level.

- C. Seal cover penetrations with industrial silicone sealant.
- D. Set cover frames and covers level without tipping, to correct elevations.
- E. Assemble basin components including inlet hub/fitting, discharge hub, cover, pump support rail system, level controls, and junction box.
- F. Connect to inlet and discharge piping with flexible connector.
- G. Seal joints water tight between inlet and discharge pipes and sump wall.

3.5 PUMP INSTALLATION

- A. Install pump including fittings, brackets, discharge piping, check valve to basin rail assembly, lifting device, and discharge. Wire pump to junction box. The submersible pumps shall be installed in strict accordance with the manufacturer's instructions. Pumps shall be set plumb with no stresses on the suction and discharge nozzles

3.6 CONTROL PANEL INSTALLATION

- A. Mount and wire control panel for pumping station operation including duplex motor controls, circuit breaker, starter, control transformer, fuse box, terminal block, alternator, alarm and running lights.
- B. Wire in accordance with requirements of National Electrical Code.
- C. Use 16 AWG control wiring for control circuits and white for neutral grounded conductors.
- D. Use minimum 14 AWG black power wiring.
- E. Number each conductor.
- F. Tin ends of wires with 60/40 lead tin alloy solder.
- G. Locate and connect direct burial cable from control panel to basin junction box.

3.7 BACKFILL

- A. Backfill basin and direct burial cable in accordance with specifications.
- B. Maintain optimum moisture content of fill material to attain required compaction density.
- C. After hydraulic test and seven days after placing cast-in-place concrete pad, evenly backfill around entire periphery of basin by hand placing backfill material and hand tamping in 6 inches compacted layers to finish grade. Compact to 95 percent maximum density.

- D. Do not use wheeled or tracked vehicles for tamping.

3.8 STATION STARTUP, INITIAL TESTING AND OPERATION

- A. Notify Project Engineer or GWA three (3) days prior to flow rate testing.
- B. Provide startup and initial testing of system. Coordinate and operate pumps in conjunction with other construction of discharge force main.
- C. Hydraulically test station to performance requirements by receiving, pumping and discharging 250 gallons of water to/from basin.
- D. Correct failures during test by repairing or replacing malfunctioning parts or equipment or faulty workmanship, regardless of cause, within 72 hours after notification from Architect/Engineer.
- E. After correcting failures caused by defective equipment, material, or faulty workmanship, retest until failures are eliminated.
- F. Confirm general sequencing of pump and float operations at basin and control panel are in accordance with performance requirements.
- G. Document and certify startup results in start up report.

3.9 COMPACTION TESTS

- A. Compaction Testing: In accordance with ASTM D1557, ASTM D2922, ASTM D3017.
- B. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- C. Frequency of Compaction Testing: One for each lift.

3.10 MANUFACTURER'S FIELD SERVICE

- A. Quality Requirements: Requirements for manufacturer's field services.
- B. Furnish factory trained representative and field technical assistance during the following periods of pumping station installation:
 1. Unloading of station materials and components.
 2. Start-up, testing, and demonstration of station systems-basin, pump, and control panel.

3.11 ADJUSTING

- A. Execution Requirements: Requirements for starting and adjusting.

- B. Adjust basin, pump, and control panel systems so station operates to performance requirements and in accordance with specifications.

3.12 DEMONSTRATION

- A. Execution Requirements: Requirements for demonstration and training.
- B. Demonstrate operation of pumping station - basin components, pump system, and control panel.

3.13 PROTECTION OF FINISHED WORK

- A. Maintain and protect work until accepted for operation by Government. All debris, grit, petroleum products, rust scale, construction by-products, and foreign matter shall be removed and damaged coatings shall be repaired prior to final acceptance. All cleaning regimen suggested by the manufacturer of products or equipment supplied under the terms of this Contract shall be utilized.

PART 4 MEASUREMENT AND PAYMENT

- 4.1 **MEASUREMENT.** Measure Section 612A items listed in the bid schedule according to Subsection 109.02 and the following as applicable.

Measure each pump station by the lump sum complete in place, tested, and accepted.

- 4.2 **PAYMENT.** The accepted quantities will be paid at the contract price per unit of measurement for the Section 612A pay items listed in the bid schedule. Payment will be full compensation for the work prescribed in this section. See Section 109.05.

END OF SECTION

SECTION 614 LEAN CONCRETE BACKFILL

614.03 COMPOSITION OF MIX - This subsection is supplemented as follows:

The following mix proportions per cubic yard may be used in lieu of a job specific mix design:

Cement	66 pounds
Fly ash	330 pounds
Coarse aggregate	2,480 pounds
Fine aggregate	1,895 pounds
Water	330 pounds

END OF SECTION 614

SECTION 621 MONUMENTS AND MARKERS

621.01 **DESCRIPTION** - The following is added to this subsection:

This work shall also consist of preserving and relocating existing GGN and GGTN monuments and property markers including frame and cover in reasonably close conformity with the plan and these specifications or as directed by the Contracting Officer. The work also includes the necessary coordination with the Department of Land Management.

621.03 **MONUMENTS AND MARKERS** - The following is added to this subsection:

Preservation of existing GGN and GGTN monument and property markers shall include attaching warning reflectors and painting if required.

Monument frame cover shall be adjusted accurately at the required location and elevation and in such manner as to insure it is being held firmly in place not to disturb the existing monument. All excavation near the existing GGN and GGTN monuments and property markers shall be done manually and extra care shall be exercised in order not to disturb the existing GGN and GGTN monuments and property markers.

END OF SECTION 621

SECTION 625 TURF ESTABLISHMENT

625.01 **DESCRIPTION** - The subsection is modified as follows:

Seeding and mulching shall be applied by hydraulic method.

625.02 **MATERIALS** - The following is added to this subsection:

Seed: Seed to be used shall be "Common Bermuda Grass" meeting the following composition:

<u>Min. Percent Pure Seed</u>	<u>Min. Percent Germination & Hard Seed</u>	<u>Max. Percent Weed Seed</u>
95%	85%	0.5%

Seeds that are wet, moldy or damaged will be rejected. Field mix shall be done in the presence of the Engineer.

Pesticides: Pesticides shall be soil fumigant, herbicide, insecticide and fungicide approved by the EPA for the purpose of application for pre-emergence and post-emergence control of crab grass and weeds. Pesticides shall be delivered to the job site in the original, unopened containers with legible labels indicating the EPA registration number and the manufacturer's registered uses.

Fertilizers: Fertilizers shall have the following proportion: nitrogen 14 percent, phosphoric acid 14 percent and soluble potash 14 percent. It shall be composed of pills coated with plastic resin to provide continuous release of fertilizer for at least 6 months.

Soil Conditioners: Soil conditioners shall be non-toxic to plants and approved by the EPA.

625.06 **FERTILIZING** - The following is added to this subsection:

Rate of application is 400 lbs. per acre.

625.07 **SEEDING** - The following is added to this subsection:

Rate of application is 3 lbs. per 1000 sq. ft.

625.08 **MULCHING** - The following is added to this subsection:

Rate of application (wood cellulose) is 3000 lbs. per acre

625.11 **MEASUREMENT** - This subsection is revised as follows:

Measure the Section 625 items listed in the bid schedule according to Subsection 109.02.

END OF SECTION 625

SECTION 625
Access Road and Sewer System
Project No. SWMD-09-03

SECTION 629

ROLLED EROSION CONTROL PRODUCTS AND CELLULAR CONFINEMENT SYSTEMS

629.01 **DESCRIPTION** – This section is supplemented as follows:

Where Turf Reinforcement Mat is called for on plans, it shall be type 5.B Turf Reinforcement Mat per section 713.18

END OF SECTION 629

SECTION 629

Access Road and Sewer System
Project No. SWMD-09-03

SECTION 632 POWER FACILITIES RELOCATION

632.01 **DESCRIPTION** – This work shall consist of the removal, relocation and installation of power poles and lines including adjustment of electrical manholes as indicated on the drawings in accordance with the drawings, Guam Power Authority (GPA) standards specifications as attached, and standard Power Distribution System planning, material and construction.

Unless otherwise specified or defined, electrical equipment, material, details of installation, workmanship and tests provided under this Contract shall conform with the standard rules, regulations and specifications of one or more of the following authorities:

American National Standards Institute	ANSI
American Society for Testing and Materials	ASTM
Institute of Elec. and Electronics Engineers	IEEE
National Electrical Code	NEC
National Electrical Manufacturer's Ass.	NEMA
National Electrical Safety Code	NESC
Underwriter's Laboratories	UL
Guam Power Authority Standards	GPA

Federal Specifications and Standards

SS-AZ81B	(1)	Aggregate for Portland Cement Concrete
DDD-M-148		Mats, cotton (for concrete curing)
SS-C192G	(1)	Cement, Portland
SS-R406C	(1)	Road and Paving materials; methods of testing and sampling
TT-C-00800A		Curing Compound, concrete for new and existing surfaces
MMM-G-650B		Grout, adhesive epoxy resin flexible, filled.
No. 158a		Cement hydraulic, sampling, inspection, and testing.

The above listed codes and standards are referenced to establish minimum requirements and wherever these Contract Documents require higher grades of materials or workmanship than required by the codes and standards, these Contract Documents shall apply. In the event a conflict occurs between the above listed codes and standards and these Contract Documents, the more stringent requirement shall govern.

The Contractor shall comply with applicable laws, building and construction codes and applicable requirements of any governmental agency under whose jurisdiction work is being performed.

632.02 **MATERIALS** – All materials, wires, insulators, hardware, and insulators including concrete poles are standard stock items of the Guam Power Authority and shall be procured from the Guam Power Authority. For none availability of stock items, the Contractor shall ensure that all materials and equipment procured from off-island sources meet the standard specifications of the Authority.

632.03 **CONSTRUCTION** – The Contractor shall construct the 34.5 KV line with distribution underbuilt as specified in Section 650.01. Installation shall be as specified in the appropriate Subdivisions (16100, 16101, 16702, 16801, 16802, 16803, 16804, and 16805) of the guide specifications normally used by the Guam Power Authority for its construction of transmission and distribution lines.

632.04 **TRAFFIC CONTROL SIGNS** – Necessary traffic control signs shall be provided along the installation work route as required to prevent accident to persons or vehicles.

632.05 **COORDINATION AND TECHNICAL ASSISTANCE** – Power Shutdown of Power Circuits:

- A. Due to the nature of and the significance to the customers served by the 34.5 KV and 13.8 KV circuits in the project area, close and careful coordination of the outage requirements of the project is a must:

Submit in writing a request to the Manager, GPA T&D Department and Navy dispatcher two weeks (14 days) prior to the outage date, no outages will be granted without a written request.

- B. Coordinate closely with the Superintendent of Overhead Lines, GPA T&D Department & PSCC or his designate.
- C. Outages are limited to a maximum of 4 hours daily (no GPA customer shall experience a scheduled interruption exceeding four hours per day). Scheduled interruptions affecting the same customer(s) on consecutive days are strongly discouraged. The Contractor shall give serious consideration to preventing such occurrences.
- D. GPA will be responsible for notifying the media and public announcements. GPA will also be responsible for de-energizing and re-energizing circuits as required by the project.

END OF SECTION 632

SECTION 633 PERMANENT TRAFFIC CONTROL

633.02 **MATERIAL** – This subsection is revised as follows:

Retro reflective Sheeting. Revise the subparagraph of this subsection to read as follows:

Retroreflective sheeting materials shall conform to the applicable requirements of Subsection 718.01 and shall have Specific Intensity Per Unit Area (SIA) Type III Sheeting.

END OF SECTION 633

SECTION 634 PERMANENT PAVEMENT MARKINGS

634.02 **MATERIAL** - The following is added to this subsection:

- 1.) **Non-Reflective Raised Pavement Markers** - Non-reflective raised pavement markers shall be Class III, ceramic type, for use on rigid and flexible pavements. Class III pavement markers shall consist of heat-fired vitreous, ceramic base and heat-fired, opaque, glazed surface to produce the properties required. The glazed surface shall not be present on the bottom of the marker which will be cemented to the road surface. The markers shall be produced from any suitable combination of intimately mixed clay, shales, tale flints, or other organic material which will meet the properties herein required. The markers shall be thoroughly and evenly matured and free from defects which will affect the appearance or serviceability.

The top surface of the markers shall be convex with depth of approximately 0.75 inch. The top and sides shall be smooth and free of mold mark, pits, indentations, air bubbles, and other imperfections.

- 2.) **Reflective Raised Pavement Markers** - Reflective raised pavement markers shall be of the prismatic reflector type consisting of methyl metroacrylate or suitable compounded acrylonitrile butadiene thermosetting compound and filler material. The exterior surface of the sheet shall be smooth and contain one methyl methacrylate prismatic reflector faces of the color specified.

The color of the reflector when illuminated by headlights of an automobile shall be an approved clear yellow or red as designated. Off-color reflector shall constitute grounds for rejection.

634.03 **GENERAL** - This subsection is revised as follows:

Revised the 5th paragraph of this subsection and substitute the following:

Arrows, letters, stop lines, and other pre-cut symbols shall be as shown on the drawings or as directed by the Contracting Officer.

Delete the 6th paragraph of this subsection and substitute the following:

Stripes shall be four (4) inches wide unless otherwise shown on the drawings. Broken line segments (dashed or skip traffic stripe) shall be as shown on the drawings or as directed by the Contracting Officer.

634.11 **RAISED PAVEMENT MARKERS** - The following is added to this subsection:

Pavement markers shall be of the type and color specified herein:

Type "BB"	Two-way "blue" reflective markers
Type "CR"	Clear "red" reflective markers
Type "YY"	Two-way "yellow" reflective markers
Type "Y"	One-way "yellow" reflective markers

END OF SECTION 634

SECTION 635 TEMPORARY TRAFFIC CONTROL

635.02 MATERIALS - This subsection is revised as follows:

Barricade type I, II, III (8 ft. long), Plastic cone delineator 28" high with (2"-4" retroreflective band), Construction signs, Tubular markers 28" high, Warning lights- flashing type-low intensity, and Temporary markers-flexible body.

635.13 TEMPORARY PAVEMENT MARKINGS AND DELINEATION - This subsection is amended to read:

Perform work according to MUTCD Part VI and Quality Standards for Work Zone Traffic Control Devices. Temporary pavement markings may be preformed retro reflective tape, flexible plastic body, or temporary raised pavement markers. Temporary pavement markings shall be neat in appearance, free of cracks, true on the edges, straight, and unbroken.

For two-lane two-way roadways, use single line of yellow temporary markers spaced at 10 feet (3.28 m) or closer.

For roadways separating two or more lanes of traffic moving in the same direction, use single line of white temporary markers spaced at 10 feet (3.28 m) or closer. Place markings parallel to the centerline and neat in appearance.

For centerline markings on multilane undivided roadways with no passing in either direction, use double yellow temporary markers spaced at 10 feet (3.28 m) or closer. Place marking parallel to one another approximately 4 inches (100 mm) apart.

Place temporary pavement markings on each lift of the pavement prior to opening the roadway to public traffic. On asphaltic concrete pavement overlays, place markings as soon as practical after a lift has been placed. As a minimum, place pavement markings the same day the asphaltic concrete overlay is placed on those roadways where traffic is to be routed. Remove all temporary pavement markings on the final surface course prior to placing permanent markings.

Remove temporary pavement markings according to the manufacturer's recommendation. Use of sand blasting, grinding and other methods that will stain and damage the surface of the final pavement will not be permitted.

END OF SECTION 635

SECTION 636 SIGNAL, LIGHTING, AND ELECTRICAL SYSTEMS

636.01 **DESCRIPTION** - This subsection is modified as follows:

This work consists of installing street lighting, communication conduits and electrical systems.

Furnish and install incidental parts not shown or specified that are necessary to complete the installation.

636.02 **MATERIALS** - add the following to this subsection:

Telephone cable & pedestals per GTA specifications.

636.03 **REGULATIONS AND CODE** - Add the following to this Subsection:

After approval of materials and equipment called for under Section 636.02, furnish in triplicate spare parts data for each different item of equipment listed. Include a complete list of parts and components with current unit prices and source of supply, list of parts and components that are furnished with the purchase of the equipment, and list of additional spare items recommended by the manufacturer to ensure continuous and efficient operation of the system at no extra cost.

636.09 **WARRANTIES, GUARANTEES AND INSTRUCTION SHEETS** - Add the following to this Subsection:

Furnish guarantee for at least one year from the date of final acceptance. All defects and/or replacements necessary within the duration of the guarantee shall be replaced without cost to the Government.

END OF SECTION 636

SECTION 637 FACILITIES AND SERVICES

637.01 **DESCRIPTION:** This section is supplemented as follows:

This work also consists of furnishing a set of computer and three (3) sets of portable communication systems meeting the minimum requirements or beyond as stated below. The computer set shall be used by the engineer on the project and will be turned over to the Department of Public Works upon completion of the project.

637.03(a) **FIELD OFFICE:** This sub-section is amended as follows:

Furnish and maintain a field office according to Tables 637-1 and 637-2. The contractor shall also provide telephone for local services.

TABLE 637-1 MINIMUM REQUIREMENTS FOR FIELD FACILITIES

PROPERTY	FIELD OFFICE
Floor Space, 40ft. insulated high cube container	1
Locking Outside Door, dead bolt with keys	1
Steps with slip-proof tread and handrails	(1)
Windows with locks	2
Total window area – square feet	30
Rooms	2
Room size, square foot, minimum	96
Shelves, 12" depth, square foot	12
Electrical Lighting	✓

Air Conditioning, maintain temperature of 72 +/-7 Deg.F	✓
Adequate electrical outlets	✓
Surge protectors	✓
Adequate electricity	✓
Adequate potable water supply	✓
Drinking water cooler with water supply	✓
Parking for 3 vehicles on gravel surface	✓
Portable Restroom	2

(1) As required

TABLE 637-2 MINIMUM FACILITY FURNISHINGS AND SERVICES

PROPERTY	FIELD OFFICE
Table 30" wide x 8' long x 30" high	1
File cabinet, 4-drawer, metal	1
Desk - 12 square foot	2
Office Chair	3
Plan holder (D size plan), hanging type with minimum 4 plan capacity with 4 plan carrier hangers	1
Computer	1
Push to talk radio/phone	3
Fire extinguisher	1

SECTION 637
 Access Road and Sewer System
 Project No. SWMD-09-03

Specifications: This equipment is for the exclusive use of the engineer.

2-Way Radio Portable Communication System

Back-up Battery System (standing vertically) 2" Wide x 11" High x 11" Long

Latest Color inkjet Printer

Latest Scanner

COMPUTER SYSTEM:

Includes:

Intel Pentium IV 2.80 GHZ

D865 Chipset P4/Mother board

PC Memory 512MB RDRAM

ATI EXPERT 64MB AGP VIDEO

SOUND CARD

HARD DRIVE 60GB ATA 100

SPEAKERS

KEYBOARD

CD-RW DRIVE

1.44 MB FLOPPY DRIVE

56 K INTEL PCI V.92 W/VOICE MODEM

ETHERNET 10/100 (C-NET)

CASE MID TOWER 300W

17" LCD MONITOR

WHEEL MOUSE

USB PORT

Software:

Operating System: MS Windows XP Pro

Program: Corel WP Office 2002 Pro OEM

Norton Utilities 2004

NOTE: (All software disks must be provided.)

END OF SECTION 637

SECTION 701 HYDRAULIC CEMENT

701.01 **HYDRAULIC CEMENT.** The requirements for Portland cement type is amended as follows:

Cement shall be Portland cement type meeting the requirements of AASHTO M 85 or approved equal.

The following is added to this subsection:

All cement stored in Guam for sixty (60) days or longer shall be tested. Test results shall be submitted to the Owner for approval before its use. Cement reclaimed from cleaning bags, leaking containers, or that has been exposed or damaged during shipping shall not be used. Cement may be accepted based on the Manufacturer's Certification stating compliance with AASHTO M 85 from the time the project is advertised.

END OF SECTION 701

SECTION 702 ASPHALT MATERIAL

702.03 **EMULSIFIED ASPHALT** - Paragraph (b) is supplemented as follows:

For CMS-2s conform to AASHTO M 208, Table 1 requirements for CMS-2, except that the percent oil distillate, by volume of emulsion must be at least 5.0 and no greater than 20.0.

END OF SECTION 702

SECTION 703 AGGREGATE

703.05 Subbase, Base, and Surface Course Aggregate.

This subsection is revised to read as follows:

- (b)(1) **Subbase Aggregate** - material shall be selected coralline limestone, free from roots, leaves, molds, clay or other organic matter and meeting the following requirements. **Grading B** is revised as follows:

Gradation

Sieve Size	% Passing
4 inches	100
No. 4	50-100
No. 40	20-60
No. 200	5-25

- (a) Liquid Limit Not greater than 25%
(b) Plasticity Index Not greater than 6
(c) California Bearing Ratio (CBR) Not less than 30

On-site excavated old silty sandy limestone gravel fill (existing road base/subbase) meeting the above requirements may be reused as select or subbase fill.

- (b)(2) **Base and Surface Course** - material shall consist of crushed coralline limestone free from roots, leaves, molds, clay, or other organic matter and meeting the following requirements: **Grading C** is revised as follows:

Gradation

Sieve Size	% Passing by Weight
2 inch	100
1 ½ inch	97-100
¾ inch	67-81 (± 6)

No. 4	33-47 (± 6)
No. 40	10-19 (± 4)
No. 200	4-8 (± 3)

SCR 703-1

- (a) Liquid Limit Not greater than 25%
- (b) Plasticity Index Not greater than 6
- (c) Los Angeles Abrasion Not greater than 40
- (d) California Bearing Ratio Not less than 100%

As an alternative, the following gradation may be utilized in lieu of the above gradation requirements for base course.

Gradation (Alternative)

Sieve Size	% Passing by Weight
2 inch	100
1 ½ inch	90-100
¾ inch	50-80
No. 4	30-60
No. 40	15-30
No. 200	5-13*

(* The fraction passing the No. 200 sieve shall not be greater than one-half of the fraction passing the No. 40 sieve)

END OF SECTION 703

SECTION 704 SOIL

704.02 **BEDDING MATERIAL.** This subsection is amended as follows:

Furnish a well graded, free draining material free of excess moisture, muck, frozen lumps, roots, sod, or other deleterious material conforming to the following:

- (a) Maximum particle size 1/2 inch or half the corrugation depth, whichever is smaller
- (b) Material passing No. 200 sieve, AASHTO T 27 and T 11 10% max.

704.07 **SELECT BORROW.** This subsection is amended as follows:

Furnish granular material, uniformly graded from coarse to fine, free of excess moisture, muck, roots, sod, or other deleterious material conforming to the following:

- (a) Gradation Table 704-1
- (b) Liquid limit, AASHTO T 89 30 max.

**Table 704-1
Select Borrow Gradation**

Sieve Size	Percent by Mass Passing Designated Sieve (AASHTO T 27 & T 11)
3 inch	100
1 inch	70-100
No. 4	30-70
No. 200	0-5

END OF SECTION 704

SECTION 706

CONCRETE AND PLASTIC PIPE

706.08 Plastic Pipe. This Subsection is supplemented as follow:

(h) **SANITARY SEWAGE PIPES**

- A. Plastic Pipe: ASTM D3034, Type PSM, Poly (Vinyl Chloride) (PVC) material; inside nominal diameter of 4-inch to 15-inch, bell and spigot style rubber ring sealed gasket joint. Rubber gaskets shall be factory installed and conform to ASTM 477.

Fittings: PVC, ASTM 3034.

Joints: ASTM D3212.

- B. Force Mains: Pipe shall be high density polyethylene (HDPE) pipe.

HDPE pipe shall conform to the applicable requirements of ASTM-D3350 as having a cell classification of PE 4534 (black with 2% minimum carbon black). Dimensions and workmanship shall be as specified by ASTM F714. Fittings shall be molded from or manufactured using a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe specified herein. To ensure compatibility of polyethylene resins, all fittings shall be of the same manufacture as the pipe being supplied.

The pipe supplied as specified shall have a nominal IPS (Iron Pipe Size) outside dimension unless otherwise specified. Pipe shall have the SDR (Standard Dimensional Ratio, as defined in ASTM F714) rating shown on the Drawings.

Pipe shall be perforated or solid wall as shown on the Drawings.

- C. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Sewage Force Main" in large letters.

END OF SECTION 706

SECTION 709 REINFORCING STEEL AND WIRE ROPE

709.01 REINFORCING STEEL

(b) Reinforcing bars. The text of this paragraph is amended as follows:

Furnish deformed, grade 60 bars conforming to AASHTO M 31.

(d) Tie bars. The text of this paragraph is amended as follows:

Furnish deformed, grade 60 bars conforming to AASHTO M 31.

(e) Hook bolts. The text of this paragraph is amended as follows:

Furnish plain, grade 60 bars conforming to AASHTO M 31 with M14 rolled threads or M16 cut threads. Furnish a threaded sleeve nut capable of sustaining a minimum axial load of 15,000 pounds.

END OF SECTION 709

SECTION 718 TRAFFIC SIGNING AND MARKING MATERIAL

718.08 SIGNPOSTS

(b) Steel Posts - The following is added to this item:

Size and shape of steel post to be used in permanent sign are shown on the plans.

718.14 WATERBORNE TRAFFIC PAINT. The text of this subsection is amended as follows:

(g) Daylight reflectance. (Without glass beads)

- | | |
|-------------------------|---|
| (1) White, ASTM E 1347 | 84% relative to magnesium
oxide standard |
| (2) Yellow, ASTM E 1347 | 55% relative to magnesium
oxide standard |

END OF SECTION 718

SECTION 725 MISCELLANEOUS MATERIAL

725.12 **Frames, Grates, Covers, and Ladder Rung** - The following is added to this subsection:

All new frames, grates, covers, and ladder rung shall be hot dipped galvanized conforming to AASHTO M 11.

725.15 **Polyvinyl Chloride (PVC) Pipe for Water Distribution Systems** – This section is amended as follows:

- | | | |
|-----|--------------------------------------|------------|
| (a) | PVC Pipe (size 4" to 12") | AWWA C900 |
| (b) | PVC Pipe (smaller than 4") | ASTM D1785 |
| (c) | Solvent Cement for Pipe and Fittings | ASTM D2564 |

725.21 **Epoxy Resin Adhesive** - Add the following to this subsection:

A. Epoxy Binder - Shall be Type I conforming to Federal Specifications MM B 350.

725.30 **Water System Components** – This subsection is added as follows:

1. Gate valves, 4" and larger, shall meet requirements of AWWA C509.
2. All buried metallic pipe and fittings shall be wrapped in polyethylene per AWWA C105.
3. Hydrants shall meet requirements of Guam Waterworks Authority and Guam Fire Department.
4. Double check backflow preventer assembly shall be CLA-VAL DC7L, or approved equal. Meet AWWA C510-92 and AWWA C506-78.

END OF SECTION 725

THE FOLLOWING SECTIONS ARE ADDED TO FP 03

SECTION 16000 ELECTRICAL SYSTEMS SPECIFICATIONS:

SECTION 16010	GENERAL PROVISIONS
SECTION 16110	RACEWAYS
SECTION 16120	CONDUCTORS
SECTION 16130	BOXES
SECTION 16134	PANELBOARDS
SECTION 16140	WIRING DEVICES
SECTION 16170	DISCONNECTS
SECTION 16180	PROTECTING DEVICES
SECTION 16450	GROUNDING
SECTION 16500	LIGHTING
SECTION 16612	EMERGENCY POWER SYSTEMS

SECTION 16010 GENERAL PROVISIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. This section supplements all sections of this Division and shall apply to all phases of work specified herein, shown on the drawings, or required to provide a complete installation of electrical systems.
- B. Refer to Architectural, Civil, Structural, Plumbing and other drawings and specifications to determine the full extent of related work in other divisions before contract is signed.
- C. The specifications and drawings for electrical work are complementary and are for the complete interpretation of the work.
- D. Unless noted or modified by specific notation to the contract, the indication and/or description of any electrical item in the document carries with it the instruction to furnish, install and connect same. It shall be understood that the intent governs the work, regardless of whether or not this instruction is explicitly stated.
- E. No exclusion from or limitation in drawings or specifications for the electrical work shall be reason for omitting the appurtenances or accessories necessary to complete any required system or item of equipment.
- F. Exceptions and inconsistencies in the Contract Documents shall be brought to the attention of the Owner or his designated representative before the contract is signed. Otherwise, this Contractor will be responsible for any and all changes and additions that may be necessary to accommodate his particular equipment of installation.
- G. The contract drawings are shown in part diagrammatic, intended to convey the scope of work, indicating the general arrangement of equipment, conduit and outlets. Follow the drawings in laying out the work and verify places for the installation of materials and equipment. Wherever a question exists as to the exact intended location of outlets or equipment, obtain instruction from the Owner or his designated representative.
- H. The electrical drawings and specifications are intended to supplement each other and any material or labor called for in one shall be furnished and supplied even though not specifically mentioned in both.
- I. If the required material, installation or work can be interpreted differently from drawing to drawing, or between drawings and specifications, contractor shall provide that material, installation or work

which is of higher standard.

1.2 SCOPE

- A. Furnish all labor, material, services and skilled supervision necessary for the construction, erection, installation, connections, testing and adjustment of all circuits

and electrical equipment specified herein, or shown or noted on the drawings, and its delivery to the Owner complete in all respects ready for use.

- B. Plan all work so that it proceeds with a minimum of interference with other trades. Inform all parties concerned of openings required for equipment or conduit in the building construction for electrical work and provide all special frames, sleeves and anchor bolts as required. Coordinate the electrical work with the mechanical installation.
- C. Work lines and established heights shall be in strict accordance with architectural drawings and specifications insofar as these drawings and specifications extend. Verify all dimensions shown and establish all elevations and detailed dimensions not shown.
- D. Lay out and coordinate all work well enough in advance to avoid conflicts or interferences with other work in progress so that in case of interference the electrical layout may be altered to suit the conditions, prior to the installation of any work and without additional cost to the Owner.

1.3 COOPERATION WITH OTHER TRADES

- A. Perform this work in conformity with the construction called for by other trades and afford reasonable opportunity for the execution of their work. Properly connect and coordinate this work with the work of other trades at such time and in such a manner as not to delay or interfere with their work.
- B. Examine the drawings and specifications for the general and mechanical work and the work of other similar trades. Coordinate this work accordingly.
- C. Promptly report to the Owner or his designated representative any delay or difficulties encountered in the installation of this work which might prevent prompt and proper installation, or make it unsuitable to connect with or receive the work of others.
- D. Major equipment furnished under the mechanical and other sections of the specifications may require different rough-in requirements than indicated on the plans due to the "or equal" equipment change. Secure detailed drawings from the Contractor furnishing the equipment to determine actual rough-in locations and conductor requirements to assure a proper and

workmanlike installation.

- E. Before connecting any piece of equipment, check the name plate data against the information shown on the drawings and report to the Owner or his designated representative if any discrepancies are encountered.

1.4 CODES, PERMITS AND FEES

- A. All work shall meet or exceed the latest requirements of the National Electric Code, all local codes, and other authorities having jurisdiction over electrical construction work at the project.
- B. Comply with all applicable building ordinances and codes. Where the contract documents exceed minimum requirements, the contract documents take precedence.
- C. Comply with all requirements for permits, licenses, fees and codes. Permits, licenses, fees, inspections and arrangements required for the work under this contract shall be obtained by the Contractor at his expense.
- D. Comply with the requirements of the Guam Power Authority. Make all arrangements for proper coordination of the work.

1.5 TEMPORARY ELECTRICAL SERVICE

- A. The Electrical Contractor shall furnish, install, maintain and remove after construction is completed, electrical service for temporary power and lighting. The system shall consist of a service, distribution system panelboards, grounding, branch circuits, grounded type electrical outlets and lighting. Provide sufficient lighting and receptacles to meet section 01500.

PART 2 PRODUCTS

2.1 EQUIPMENT FURNISHED BY OTHERS AND CONNECTED BY ELECTRICAL CONTRACTOR:

- A. The electrical work includes the off loading, handling and connection of equipment furnished by others.
- B. The Electrical Contractor shall do the following:
 - 1. Coordinate all requirements for providing electrical service to equipment.
 - 2. Provide field mark-up and internal wiring necessary for intended operation.
 - 3. Make all connections for a complete operating system.

- C. Examine all items for any damage during delivery for claims prior to beginning work.
- D. Foundations for apparatus and equipment will be furnished by others, unless otherwise noted or detailed.

2.2 EQUIPMENT AND MATERIALS

- A. Equipment and fixtures shall be connected providing circuit continuity in accordance with applicable codes whether or not each piece of conductor, conduit, or protective device is shown between such items of equipment or fixtures and the point of circuit origin.
- B. Unless otherwise specified, equipment and materials of the same type of classifications, and used for the same purpose, shall be products of the same manufacturer.
- C. Use only new, unweathered and unused material, except as specifically noted.

2.3 APPLICABLE DOCUMENTS

- A. Design, manufacture, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications of standard rules of the following:

1. American Institute of Steel Construction	AISC
2. American Society for Testing and Materials	ASTM
3. Federal Specification	Fed. Spec.
4. Institute of Electrical and Electronic Engineers	IEEE
5. Insulated Power Cable Engineers Association	IPCEA
6. National Electrical Code	NEC
7. National Electrical Manufacture's Association	NEMA
8. National Electrical Safety Code	NESC
9. National Fire Protection Association	NFPA
10. Occupational Safety and Health Act	OSHA

11. Underwriter's Laboratories, Inc.	UL
12. United States of America Standard Institute	USASI
13. Illuminating Engineering Society	IES
14. Certified Ballast Manufacturers	CBM
15. Factory Mutual Association	FA

2.4 REVIEW OF MATERIALS

- A. It is the intent of these Specifications to establish quality standards of materials and equipment installed. Therefore, specific items are identified by manufacturer, trade name or catalog designation. Where more than one manufacturer is specified, equipment shall be restricted to one of the listed manufacturers. If only one manufacturer is listed, this contractor shall feel free to submit equal manufacturer as called for below.
- B. Should this Contractor propose to furnish material and equipment other than that specified, he shall submit a written request for any or all substitutions to the Engineer. Such request shall be Alternatives to the original bid, and shall be submitted complete with descriptive (manufacturer, brand name, catalog number, etc.), and technical data for all items.
- C. Where such substitutions alter the design or space requirements indicated on the Drawings, the Contractor shall include all items of cost for the revised design and include cost of all trades involved.
- D. Acceptance or rejection of the proposed substitutions shall be subject to the approval of the Engineer. If requested by the Engineer, the Electrical Contractor shall submit for inspection samples of both the specified and proposed substitute items.
- E. In all cases where substitutions are permitted, the Contractor shall bear any extra cost of evaluating the equality of the material and the equipment to be installed.
- F. The Contractor shall submit to the Engineer detailed dimensioned shop drawings covering all items of electrical equipment. No equipment should be put into manufacture or ordered until these shop drawings or brochures have been approved.
- G. The Contractor shall submit six (6) complete copies of the shop drawings in a looseleaf binder for review. No partial or incomplete submittals will be reviewed.

- H. In the event re-submittal is required, the Contractor shall revise the shop drawings as required. The Contractor shall then re-submit six (6) copies of the corrected shop drawings for final approval.
- I. Shop drawings shall bear Contractor's certification that the item complies in all respects with the item originally specified. It is the Contractor's responsibility to procure the proper physical and electrical sizes, quantities, and arrangement as indicated and specified, and make any structural modifications or other modifications in order for the item to comply with the contract requirements. All shop drawings will be reviewed under the assumption that the Contractor has verified all physical and electrical conditions.

Obtaining approval thereon does not relieve the Contractor of responsibility in the event the material cannot be installed as shown on those drawings.

- J. As soon as practicable and within thirty (30) days after award of contract, and before beginning fabrication of material or installation of equipment, the Contractor shall submit a complete schedule of materials, equipment, apparatus and appurtenances proposed for installation and/or use in this project to the Engineer for approval.
- K. This schedule shall be in the form of a bill of materials and shall include manufacturer's name, catalog numbers, diagrams and other descriptive data as required for approval. Submittal procedure shall be the same as specified above.
- L. Retain a set of drawings on the job, noting daily all changes made in these drawings in connection with the final installation.
- M. Upon completion of the project deliver to the Owner one (1) set of Mylar and one (1) set blueines of "AS-BUILT" drawings, showing all systems as actually installed, locations of all electrical conduits, ducts and cables outside and inside of the buildings, including the location of all underground junction boxes, pull boxes, handholes and manholes. All piping and conduit below grade or in the concrete slab shall be dimensioned. Make all necessary field measurements during the installation of the electrical work, and record all changes from Original Contract Drawings as work progresses.

PART 3 EXECUTION

3.1 WORKMANSHIP

- A. Install equipment and material in a neat and workmanlike manner and align, level and adjust for satisfactory operation. Install equipment so that all parts are easily accessible for inspection,

operation, maintenance and repair.

- B. Provide the design, fabrication and erection of supplementary structural framing required for attachment of hangers or other devices supporting electrical equipment.
- C. Locate switches, receptacles and pull boxes to provide easy access for operation, repair and maintenance, and, if concealed, provide access doors.
- D. Provide 4" concrete equipment base for all floor-mounted equipment furnished under this contract. Concrete foundations shall be 6" wider and 6" longer than the base of the equipment being installed.
- E. Provide Belleville washers on all bolted connections for all risers. Split ring washers are not acceptable.
- F. Take such precautions as necessary to properly protect all apparatus, fixtures, appliances, material, equipment and installation from damage of any kind. The Owner's Representative may reject any particular piece or pieces of material, apparatus or equipment scratched, dented or otherwise damaged.
- G. Prepare all fittings, boxes, supports and panelboards exposed for painting by removing all oil, grease and dirt. Employ the necessary precautionary methods to prevent scratching or defacing of all electrical apparatus and devices.
- H. Exposed conduit installed after room has been painted shall be painted to match room finish by the General Contractor.
- I. Provide hot dip galvanized components for ferrous materials exposed to the weather.
- J. The use of roof deck for support of lighting fixtures, conduits, raceways, and other electrical equipment is not permitted.

3.2 OUTLET LOCATION

- A. Center all outlet boxes with regard to paneling, furring and trim. Repair or replace damaged finishes. Set outlet boxes plumb and extend to the finished surface of the wall, ceiling or floor without projecting beyond same.
- B. Install symmetrically all receptacles, switches, and devices shown and where necessary set the long dimension of the plate horizontal or ganged in tandem.

- C. More than one device installed in same location shall be grouped under common (multi-toggle) plate.

3.3 CUTTING PATCHING AND PIERCING

- A. Obtain written permission of the Owner's representative before cutting or piercing structural members.
- B. Use craftsmen skilled in their respective trades for cutting, fitting, repairing, patching of plaster and finishing of materials including carpentry work, metal work or concrete work required for this work. Do not weaken walls, partitions or floors with cutting. Holes required to be cut in floors must be drilled without excessive breaking out around the holes. Patching and/or refinishing to return to existing condition is required of this contractor.
- C. Sleeves shall be installed flush with finished walls, finished ceilings or finished floors, sized to accommodate the raceway, unless otherwise specified.
- D. Use care in piercing waterproofing. After the part which pierces the waterproofing has been set in place, seal opening and make absolutely watertight. Work shall be done according to specifications pertaining to membrane penetrations.
- E. Seal equipment or components exposed to the weather and make watertight and insect proof. Protect equipment outlets and conduit openings with temporary plugs or caps at all times that work is not in progress.
- F. Contractor shall coordinate services with roof mounted equipment to allow service to be routed within equipment curb wherever possible.
- G. A firestop system shall be used to seal all penetrations of electrical cables, pipes, conduits or other penetrating items through fire rated walls and floors to maintain its original rating, as required by NEC 300-21 and NEC 800-52 (b).

3.4 IDENTIFICATION OF EQUIPMENT

- A. Identify individually each piece of equipment with a laminated micarta nameplate black/white core and 3/16" high engraved letters. Attach plates to equipment with chromium plated screws.
- B. Include the following:
 - 1. Panelboards.

2. Disconnect Switches.
 3. Any switch for load that cannot be seen from the control point.
- C. Do not use abbreviated terms for identification. Spell out in full the proper name and number of each identified equipment, i.e.,

PANEL-LPA-1

AIR HANDLING UNIT - AH 5

3.5 NOISE LIMITATION

- A. Perform all work to assure minimal noise produced by the electrical equipment and installation.
- B. Check and tighten all plates, covers, doors and trims used in conjunction with electrical equipment.
- C. Remove and replace any device or equipment which is found to emit noise level higher than industry standards. Perform all work in accordance with the field instructions issued by the Owner's representative to alleviate such conditions.

3.6 TESTS

- A. After all equipment and materials have been installed, test the installation for the following:
 1. Short circuits and ground faults.
 2. Insulation resistance at 500V DC of all feeders and subfeeders.
 3. Grounding continuity.
- B. Perform all other tests deemed necessary to establish full conformance with the specifications, their intent, drawings and suitable operation of each system.
- C. Tests shall be conducted under the supervision of the Owner's representative and be arranged to suit their convenience.
- D. Before application for final acceptance will be considered, all prescribed tests shall be performed and statement to that effect be submitted, signed by the party responsible for conducting such test and the party responsible witnessing same.

- E. Correct promptly all defects and deficiencies discovered in any of the electrical work during testing, and demonstrate compliance to this effect.
- F. Furnish all water, fuel, electricity, instruments, test equipment and personnel that are required for the particular test. Certify that all equipment and gauges are in good working order. Remove equipment subject to damage during test from line before test is applied.

3.7 GUARANTEE

- A. This Subcontractor shall furnish a written guarantee warranting all materials, equipment and labor furnished by him to be free of all defects for a period of one year from the date of opening. He shall further furnish a written guarantee that all equipment shall meet the characteristics, capacities, and workmanship specified and should any defects appear or performance of equipment be inadequate within the warranty period, the defects and/or the equipment will be replaced or made good without cost to the Owner.

END OF SECTION 16010

SECTION 16110 RACEWAYS

PART 1 GENERAL

1.1 DESCRIPTION

- A. This section covers raceways and fittings, complete.
- B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 RACEWAYS

- A. Rigid conduit shall be zinc-coated heavy wall as manufactured by Republic, Triangle, or approved equal.
- B. Electrical metallic tubing (EMT) shall be zinc-coated thin wall as manufactured by Republic, Triangle, or approved equal.
- C. Flexible metallic conduit shall be galvanized steel tape formed into an industry standard interlocking coil as manufactured by Republic, Triangle, or approved equal.
- D. Liquid - Tight Flexible Metal conduit shall be constructed of single strip, interlocked, and double-wrapped steel, galvanized inside and outside, coated with liquid - tight jacket of flexible polyvinyl chloride (PVC) as manufactured by Carlon, AFC, Sealtite, or approved equal.
- E. Rigid polyvinyl chloride conduit (PVC) shall be heavy wall schedule 40 as manufactured by Carlon Electrical, Visqueen, or approved equal.
- F. Intermediate Metallic Tubing (IMC) shall be zinc-coated as manufactured by Republic, Triangle, or approved equal. BX is not permitted.
- G. Thin wall nonmetallic conduit, schedule A PVC shall be EB 120 type as manufactured by Carlon Electrical, for use as communications duct or approved equal.
- H. Wireways shall be sheet steel with cover, provided with a corrosion resistant phosphatizing primer and epoxy finish. All hardware shall be plated to prevent corrosion. All screws installed towards the inside shall be protected by spring nuts or otherwise guarded to prevent wire insulation damage. Interior parts shall be smooth and free of sharp edges and burrs. Wireways shall be as manufactured by Square D, Hoffman or approved equal.

2.2 CONDUIT FITTINGS

- A. Rigid metal conduit fittings for heavy wall conduit shall be of the threaded type. Double locknuts and insulating bushings shall be used on all rigid conduit runs. Where necessary "Ericson" fittings or threaded split couplings will be accepted. Running threads will not be accepted.
- B. EMT fittings shall be of the set screw or compression, concrete-tight or raintight type as required by location. Indenter type fittings not acceptable. No set screw type fittings permitted on conduits imbedded in the floor slab.
- C. Flexible metallic conduit fittings shall be specifically designed for use with same and shall have smooth rounded ends for wire protection.
- D. Liquid - Tight Flexible Metal Conduit fittings shall be specifically designed for use with same, shall provide positive liquidtight seal, have insulated throat, and be corrosion resistant, as manufactured by O-Z/Gedney, Sealtite, Carlon or approved equal.
- E. PVC conduit fittings shall be recommended by the company whose conduit is used. Utilize solvent cement joints for all fittings and make all joints water-tight. Provide adapters for connections to metal components.
- F. Special fittings shall be as listed or approved equal
 - 1. Sealing Gland Assembly OZ, Type FSK
 - 2. Expansion Joints OZ, Type AX or TX
with bonding jumpers
and clamps
 - 3. Expansion and Deflection Fittings OZ, Type DX
 - 4. Cast Metal Conduit Fittings Crouse-Hinds,
Condulets

2.3 APPLICATION

- A. Rigid heavywall galvanized conduit and IMC shall be used for:
 - 1. All exterior (outside of building), exposed requirements. (Rigid heavywall aluminum conduit may be substituted for exterior exposed installations.)
 - 2. Interior primary service or distribution. (Rigid heavywall aluminum conduit may be

substituted for interior primary installations above grade and not in contact with concrete or cement mortar.)

3. Concealed within slabs on grade.
 4. Exposed, below 12' AFF.
- B. Galvanized steel thinwall conduit (EMT) shall be used:
1. For branch circuits:
 - Concealed within hung or furred ceilings or soffits.
 - Concealed within floor slabs other than slabs on grade.
 - Concealed within concrete walls.
 - Concealed within block partitions, plasterboard partitions, and within wall furring.
 2. For above grade, interior, feeders, subfeeders and distribution, below 600 volts, concealed or exposed as delineated above for branch circuits.
 3. For interlock or control wiring, 120 volts or above:
 - Concealed in hung ceiling areas or partitions.
- C. Heavywall nonmetallic conduit, Schedule 40 PVC, shall be used for:
1. Concealed within floor slabs and slabs on grade or within concrete or block walls.
- D. Thinwall nonmetallic conduit, Schedule A PVC, may be used for:
1. Below grade secondary (below 600 volt) service.
 2. Below grade feeders, subfeeders and distribution.
- E. Flexible metallic conduit (Greenfield) shall be used for:
1. Three foot connections to the terminal boxes of motors and vibrating equipment located four feet or more above the floor.
 2. Six foot tails between recessed accessible lighting fixture outlet box and recessed

fluorescent lighting fixtures.

- F. Weatherproof flexible conduit (Sealtite Type UA) shall be used for connection to the terminal boxes of motors and vibrating equipment located within four feet of the floor or in potentially wet locations.
- G. Outdoor grade weatherproof flexible conduit (Sealtite Type HC) shall be used for:
 - 1. Connections to motor terminal boxes and vibrating equipment outdoors, on roofs, etc.
 - 2. Where required for connection to outdoor lighting fixtures.

PART 3 EXECUTION

3.1 INSTALLATION

- A. No conduit shall be less than 1/2" trade size, except for homeruns which shall not be less than 3/4".
- B. No conduit shall be larger than 4" trade size.
- C. All conduits to run concealed, except as follows:
 - 1. Mechanical and Electrical Equipment Rooms.
 - 2. Unfinished spaces.
 - 3. Where indicated on the contract drawings.
- D. Utilize factory manufactured elbows 1-1/4" trade size and larger.
- E. Make all cuts square with no reduction in trade size and ream out all burrs.
- F. Make all joints tight, electrically continuous. No running threads are accepted. If necessary, use ERICKSON type couplings.
- G. Provide locknut and bushing for termination. Bushing shall be insulated 1-1/4" trade size and above.
- H. Provide expansion fittings for conduits crossing building expansion lines.
- I. Cap all conduits with proper fittings until wires are pulled in.

- J. All conduits exposed to mechanical injury shall be rigid or IMC.
- K. All conduits installed in hollow metal, stud and wallboard, any movable or semi-permanent partition shall originate from ceiling plane or stub-up from floor slabs.
- L. All conduits concealed in inaccessible spaces shall be minimum 3/4" trade size.
- M. Conduits in or under grade slab shall be rigid hot-dip galvanized steel, Schedule 40 PVC or Schedule A PVC (refer to Section 16450, "Grounding").
- N. Seal off all conduits with appropriate fittings penetrating:
 - 1. Foundation Walls.
 - 2. Roof Seal.
 - 3. Waterproof Deck and/or Wall.
- O. Conduits in concrete shall conform to the following.
 - 1. They shall not displace structural steel.
 - 2. They shall be routed not to cause structural weakness.
 - 3. Single conduits shall be supported and tied down and multiple conduits shall be spaced, supported and tied down with manufactured spacers equal to McGraw Edison WUS Series.
 - 4. They shall have a minimum of 1" separation from any surface of the concrete.
 - 5. They shall be routed in accordance with field instructions issued for extenuating conditions by others.
 - 6. No conduit shall be permitted in unreinforced concrete slabs on grade. Conduit in these locations shall be placed in gravel base beneath such slabs.
- P. Exposed conduit shall run straight at right angles and parallel with building lines.
- Q. Stub-ups or sleeves through concrete slab shall be 12" high rigid steel.
- R. All equipment requiring motion or noise separation to be terminated with flexible metallic conduit.
- S. Steel conduits installed in wet areas or underground shall be coated with bituminous paint.
- T. Support all conduits with straps, hangers and clamps to provide a rigid installation. All supports to

be independent from other equipment and in a manner not to impede the ready removal of other pipes.

- U. Provide all empty conduits with appropriate pulling cord or wire.
- V. All conduits shall be installed with acceptable workmanship, pleasing in appearance and practical in application.
- W. No conduits may be run on the floor surface or in such a manner as to be hazardous to traffic.
- X. Provide 2-1" empty conduits from each flush mounted lighting and receptacle panel to the hung ceiling above, terminating in elbows.
- Y. Conduits above a hung ceiling shall be metallic only. Conduits shall be supported from the structure above, not from the ceiling grid system hanger wires, T-bars and cross T-members. Penetration of roof deck is not permitted for hangers, clamps, etc.
- Z. All flexible metallic conduit installed exposed to weather, moist or humid atmosphere or subjected to dripping oil, grease or water shall be liquid-tight type.
- AA. Owner shall be contacted prior to pouring of concrete to allow time for inspection of all underground electrical work.
- BB. Steel or die cast set screw or compression type fittings shall be used for all EMT couplings and connectors.
- CC. EMT connectors in sizes 1-1/4" and above shall have plastic nylon bushings.
- DD. Where schedule 40 PVC conduit is turned out of concrete slabs, rigid steel elbows shall be utilized. No PVC shall be exposed unless specifically called for on the contract drawings.
- EE. Seal all conduits serving roof mounted equipment with approved sealant. Do not run conduits exposed on the roof unless approval is obtained prior to installation.
- FF. Flexible Metallic Conduit shall be used only for:
 - 1. Three foot connections to the terminal boxes of vibrating equipment located four feet A.F.F.
 - 2. Three foot connections to primary and secondary conduits of dry type transformers.
 - 3. Six foot connections between accessible outlet boxes and recessed lighting fixtures.
- GG. Conduit penetration from dry to wet environments shall be sealed to prevent moisture migration.

Conduit shall be sealed internally at all connections to exterior equipment.

- HH. All Schedule A PVC conduit shall be encased in a concrete envelope affording a minimum of 2" cover all around and 3" between parallel runs.
- II. Do not place conduits in close proximity to equipment, systems and service lines, such as hot water supply and return lines, which could be detrimental to the conduit and its contents. Maintain a minimum 3" separation, except in crossing, which shall be a minimum 1".
- JJ. Provide vapor seal fittings as shown on the drawings and as required by the NEC for all conduits entering or leaving 'Classified' areas.

END OF SECTION 16110

SECTION 16120 CONDUCTORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This section covers all conductors.
- B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All conductors shall be 98% minimum conductivity soft, properly refined copper. #10 AWG and smaller shall be solid, #8 AWG and larger shall be stranded.
- B. Minimum size conductor for power and light circuiting shall be #12 AWG.
- C. Maximum size conductor for feeders and power circuiting shall be 500 kcmil copper.
- D. Minimum size conductor for control wiring shall be #14 AWG.
- E. Wires and cables shall be as manufactured by Advance Wire and Cable, Rome Cable Corp., Southwire Company or approved equal.
- F. Connectors shall be as manufactured by Burndy Corp., O-Z/Gedney Co., Panduit Corp., T & B Co. or approved equal.

2.2 INSULATION

- A. All conductor insulation shall be rated for 600 volt, unless otherwise noted.
- B. Utilization of insulation shall be as follows:
 - 1. Lighting and appliance branch circuit conductors shall be THHN (dry or damp locations), THWN (wet locations). THW may be substituted if conductor and conduit sizes are upgraded accordingly.
 - 2. Mains, Feeder and Subfeeder conductors shall be XHHW or THHN/THWN. THW may be substituted if conductor and conduit sizes are upgraded accordingly.

3. Fixture wires shall be TFN, TFFN, SF, RHH, or THHN.
4. Direct burial or underground shall be RHW-USE, UF or RR.

Wet locations are defined as in-conduit installations underground or in concrete slabs or masonry in direct contact with the earth, and locations subject to saturation with water or other liquids, and locations exposed to weather and unprotected.

- C. Exterior of wires shall be color coded. Color coding shall be as follows:

120/208 Volt Systems:

Phase A Black

Phase B Red

Phase C Blue

277/480 Volt Systems:

Phase A Brown

Phase B Orange

Phase C Yellow

Neutral White or Grey

All ground wires shall be green.

- D. In sizes and insulation types where factory applied colors are not available, colored plastic tape in overlapping turns shall be applied at all terminal points and in all points of splicing. Tape shall be applied at a minimum of 6" along the wires and cables.

2.3 SPLICING AND TERMINATING

- A. Maintain all splices and joints in accessible enclosures, where easy inspection is available.
- B. Join solid conductors with expandable type insulated coiled steel spring connections (wire nut).
- C. Terminate solid conductor by means of a neat and fast application directly to the binding screw or post of the equipment.
- D. Join, tap and terminate stranded conductors #6 AWG and larger by means of bolted saddle type or pressure indent type connectors, taps and lugs. Exclude connectors and lugs of the types which apply set screws directly to conductors. Apply pressure indent type connectors, taps and lugs utilizing tools manufactured specifically for the purpose and having features preventing their release until the full pressure has been exerted on the lug or connector. Connectors for conductors 250 kcmil and larger shall have two clamping elements or compression indents.

Terminals for bus connections shall have minimum two bolt holes.

- E. Except where wire nuts are used, build up insulation over conductor joint to a value, equal both in thickness and dielectric strength, to that of the factory applied conductor insulation. Insulation of conductor taps and joints shall be by means of half-lapped layers of rubber tape, with an outer layer of friction tape; by means of half-lapped layers of approved plastic electric insulating tape; or (in the case of bolted type connector joints) by means of split insulating casings molded specifically to insulate the particular connector and conductor, and fastened with stainless steel or non-metallic snaps or clips.
- F. Exclude splicing procedures for neutral conductors in lighting and appliance branch circuitry which utilize device terminals as the splicing point.
- G. Exclude joints or terminations utilizing solder in any conductors used for grounding or bonding purposes.
- H. Exclude all but pressure indent type joints in conductors used for signalling or communication purposes.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All conductors shall be continuous from outlet to outlet. Avoid unnecessary splicing except where lengths are greater than standard manufacture.
- B. Leave sufficient slack on all runs to permit secure connection of equipment.
- C. Provide recently manufactured wires and cables and submit evidence that they are new.
- D. All conductors shall be installed simultaneously in a single raceway. Delay pulling until the project progresses to a point where conductors shall not be exposed to injury and moisture. Wire shall not be installed prior to distribution equipment being in place.
- E. Use only specifically manufactured lubricant for wire pulling purposes.
- F. Dress and lace wires and cables in all cabinets and pull boxes and use necessary insulated support to prevent shifting.
- G. Identify feeders at each pull box and cabinets with permanent non-metallic band or tag.

3.2 VOLTAGE DROP

- A. Home run wiring (from panel to first active outlet) for home runs greater than 50 feet in lengths shall be a minimum of #10 AWG.

END OF SECTION 16120

SECTION 16130 BOXES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This section covers junction, pull and outlet boxes.
- B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 MATERIAL

- A. All boxes shall be manufactured from galvanized industry standard gage steel, cast iron or cast aluminum, Steel City Electric Company, Appleton Electric Company, HUBBELL or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All boxes shall be installed in accessible areas with removable covers.
- B. All boxes shall be firmly supported from the building structure.
- C. All outlet boxes shall be set flush with the surface of the wall, floor or ceiling in concealed installation.
- D. All boxes installed shall conform to the criteria governing the displacement and bending radius of wires and cables contained within them.
- E. Provide segregated boxes or proper barriers where different services or systems are following the same routing.
- F. Include all boxes required for a complete system regardless of indication on the contract drawings.
- G. Provide pull or junction boxes to limit conduit runs to the equivalent of 360 degree bends and to facilitate wire pulling.
- H. Close up all unused openings in boxes with approved fittings.
- I. Provide an outlet box for each individual wiring device, lighting fixture, and communication component, unless otherwise noted.

- J. Multiple devices indicated at a single location shall utilize gang mounted under common cover where possible. Lexan or aluminum covers are not permitted.
- K. Provide each outlet box with the appropriate extension ring to suit wall thickness.
- L. Provide weatherproof outlet boxes, corrosion-resistant cast-metal with threaded conduit hubs where exposed to moisture, with or next to water connection and where indicated as weatherproof on drawings. Provide cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, including plate gaskets and corrosion resistant fasteners.
- M. A receptacle installed outdoors where exposed to weather or in other wet locations and intended for use with plug left connected to it indefinitely, shall be in a weatherproof enclosure, the integrity of which is not affected when the receptacle is in use.
- N. Provide support racks for boxes with multiple sets of conductors so conductors do not rest on any metal work inside box.

END OF SECTION 16130

SECTION 16134 PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This section covers lighting and power panels.
- B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Panels shall consist of complete dead-front assemblies including the following.
 - 1. Back Pan.
 - 2. Bus Bars.
 - 3. Sheet Metal Cabinet.
 - 4. Switching and Over-Current Units.
 - 5. Trim and Door for Lighting and Miscellaneous Power panels.
- B. Sheet metal cabinets shall be minimum 20" wide for lighting panels fabricated from industry standard gauge galvanized sheet steel with corners lapped and fastened by approved methods.
- C. Trims and doors shall be suitable for the required mounting. When installed the whole assembly shall present a smooth flush appearance. Provide combination catch and lock with 2 sets of keys. All panels within same facility shall be keyed alike. Mount a clear plastic cover and metal frame with a typewritten directory --identifying each circuit--inside of panel door. Trims shall be fastened with adjustable screw clamps and self-supporting on cabinets if screws are removed. Overlap flush cabinets at least 1/2" all around. Paint the inside and outside of trims and doors with factory applied rustproofing and one finished coat to which field applied paint will adhere.
- D. Switching and overcurrent units shall be bolted circuit breakers as specified in the appropriate section of these specifications.
- E. Bus bars for panels shall have current capacities as indicated and sized for such capacities in accordance with Underwriters' Laboratories standards.

The bussing shall be braced throughout to conform to industry standard practice. Phase bussing shall be full height and tap for sequence phasing of the branch circuit devices. Unless otherwise noted, ground bus and full size neutral bus bar shall be included. Provide correct number, size and type of lugs or connectors for each phase bus, neutral bus, ground bus, main device and branch circuit. All panels shall be fully bussed.

- F. Panelboard shall be provided with the following bus design.
 - 1. Lighting and power panels bussing shall be copper or tin-plated aluminum.
 - 2. All bussing to be bolted.
- G. The voltage, number of phases and wires, short circuit rating, size of main lugs or main device (ampacity), number of branch circuits and their rating, and the number of spares and spaces as noted on the contract drawings.
- H. Panelboards shall be:

As manufactured by General Electric, ITE, Square "D" Company, Westinghouse or equal.
- I. Provide micata laminated identification plate for each panelboard. Provide temporary identification as panels are installed.
- J. Provide bussing behind all spaces.
- K. All elements (load and line side) of a series rated system shall have marking according to NEC-90, Sec. 110-22 and 240-88(c), L.C. with phrase "Identical Component Replacement Required" added to it.

PART 3 INSTALLATION

3.1 INSTALLATION

- A. Install panels with adequate support independent of the connecting raceways.
- B. Mount all panels level and plumb. Flush panels not to extend beyond the face of the wall. All trim around panels shall be furnished and installed by Electrical Contractor. Handle of top circuit breaker or switch shall not be higher than 6-6" from finished floor.
- C. Protect panels during construction with adequate covering.
- D. Insulate panels mounted flush on outside walls with 1/2" solid Fiberglass insulation to prevent

condensation.

- E. Complete all directory cards and submit a reproducible copy to the Owner.
- F. Panelboard shall not be used as a raceway for any conductors not terminating therein.
- G. Clean panelboard interior and remove foreign matter prior to installing cover trim.
- H. Provide permanent blanking plates over unused circuit breaker positions and hole plugs over unused knockouts and conduit openings.

END OF SECTION 16134

SECTION 16140 WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This section covers line voltage wiring devices.
- B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All devices shall be specification grade, heavy duty, standard as per indication for the purpose of application.
- B. Switches for local control shall be rocker arm, quiet type, with screw type terminals.
 - 1. Rating: 120-277 volts, 20 AMPS, AC only.
 - 2. Color: ivory.
 - 3. They shall be rated to handle 50,000 cycles of operation without deterioration, regardless of whether inductive or resistive (including tungsten) loads are controlled.
 - 4. Non-standard switches shall incorporate applicable requirements for the standard type and shall be as indicated.
 - 5. Key switches where indicated shall be as follows.
 - a. Flush, lock type, momentary contact with positive "off" center as Arrow-Hart #4354-LA. Electrical Contractor to furnish six (6) keys.
- C. Receptacles for convenience outlets shall be specification grade, heavy duty, and as specified below:
 - 1. Rated 125 VOLTS, 20 AMPS NEMA 5-20R.
 - 2. Colored to match wall treatment as determined by the Architect.

3. Self-grounding type, 3 or more wires, single or duplex, as indicated, with NEMA standard face slot configuration.
 4. With screw type terminals only.
 5. Non-standard type outlets and special purpose power supply receptacles shall incorporate applicable requirements for standard type and shall be as indicated.
 6. For each non-standard receptacle or power supply outlets installed, furnish one matching attachment plug and connect same to the cord of the associated equipment at no additional compensation.
 7. Provide definitive grounding method for all special outlets and power supply receptacles.
 8. Flush type, Pass & Seymour Sierraplex type or equal in finished areas.
- D. Plates for all devices shall be selected as follows.
1. Of the same color as their associated devices, with correct shape opening. Screw heads shall have color to match plate.
 2. Phenolic plastic ivory in finished areas.
 3. For recessed outlet boxes or raised surface covers for exposed outlet boxes in all unfinished areas use .030 brushed stainless steel.
- E. Dimming equipment for incandescent switching shall be provided as follows.
1. Select the dimmer to match the total load served.
 2. Derate dimmers if they are ganged in common enclosure.
 3. Use only solid state electronic type dimmers in 600W, 1000W, 1500W, or 2000W rating, as manufactured by General Electric, Lutron or approved equal.
 4. Use only slide type dimmers.
- F. Floor outlets shall be as depicted in the following.
1. Flush cap combination cover as Hubbell S-2525.
 2. Flush duplex screw type cover as Hubbell S-3725 with standard duplex receptacle.

2.2 MANUFACTURERS

- A. Acceptable manufacturers are Arrow-Hart, General Electric, Hubbell, Pass & Seymour or Slater. Provide all devices by same manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install all devices indicated complete with cover plates.
- B. Where necessary, set the long dimension of the plate horizontal.
- C. All devices in common enclosure shall be gang-mounted under common cover (tandem).
- D. All receptacles shall maintain a consistent orientation for neutral connection; use the silvered terminal if supplied with device.
- E. All plates shall have full contact with the wall and boxes.

3.2 MOUNTING HEIGHTS

- A. Mounting heights of devices shall be as follows unless noted otherwise on contract drawings.
 - 1. Receptacles - 15" to centerline above floor.
 - 2. Switches - 48" to centerline above floor.
 - 4. Telephone outlets - 15" to centerline above floor.

END OF SECTION 16140

SECTION 16170 DISCONNECTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This section covers individually mounted switching and over-current devices.
- B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Fused disconnect switches shall be heavy duty, horse-power rated with quick-make, quick-break (QMQB) mechanism.
 - 1. Enclosures shall be of a NEMA type as required and/or noted on the contract drawings with nameplates with a permanent record of type, size, and horse-power ratings.
 - 2. Disconnect switches shall have operating handles with definite "OFF" indications and defeatable door interlocks in the "ON" position.
 - 3. Provide switch assembly, where the operating handle is an integral part of the enclosure base.
 - 4. Provide reinforced rejection type fuse clips for both standard and time delay fuses. Clips to accept Class R or L fuses only.
 - 5. Provide multi-padlock capability for the operating handle.
 - 6. Provide six-pole disconnects where 2 speed motors are used.
 - 7. Provide equipment ground kit in all disconnect switches.
 - 8. Provide neutral assemblies where required.
- B. Non-fused disconnect switches shall have the same features and characteristics as the fused disconnect, except no fuse clips.

2.2 MANUFACTURERS

- A. General Electric, ITE, Square D, Westinghouse.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install fused or non-fused disconnect switches where indicated on the contract drawings or required by the latest issue of NEC.
- B. Disconnect switches shall be installed with adequate hand access to the handle and clearance for operation and fuse replacement.
- C. Seal all conduit penetrations with approved sealant where switches are installed outdoors.
- D. All connections to fans shall be made thru back of switch.
- E. Install disconnect switches used with motor-driven appliances, motors and controllers within sight of controller, motor, and motor driven machinery location.
- F. Where manufacturer's warranty of HVAC equipment requires fuses, install disconnect switches fused as required in the warranty.
- G. Unless otherwise indicated, disconnect switches shall be mounted with top of the handle while in "ON" position not higher than 6'-6" above finished floor, properly aligned and adequately supported independently of the connecting raceways. All steel shapes, etc., necessary for the support of the disconnect shall be furnished and installed where the building structure is not suitable for mounting the equipment directly thereon.
- H. Disconnect switch shall not be used as a raceway or a junction box for any conductors not terminating therein.

END OF SECTION 16170

SECTION 16180 PROTECTING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This section covers circuit breakers, fuses and all over-current protecting devices.
- B. Submit shop drawings for approval.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Circuit breakers shall be molded case, completely enclosed bolted connection devices, with the following features:
 - 1. Quick-break, trip free, trim indicating one-, 2- or 3-pole switching units.
 - 2. All multi-pole breakers shall have common trip handles and all poles shall close, open or trip simultaneously. Multiple handles with clips or pins shall not be acceptable.
 - 3. Inverse time delay overload with instantaneous short circuit protection by means of a thermal-magnetic element.
 - 4. Rated to withstand the available short circuit current at the line side of connection.
 - 5. With non-welding contact surfaces and arc chutes.
 - 6. All single pole circuit breakers rated 15A and 20A shall be listed for switching duty.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install current limiting fuses in accordance with drawings and diagrams.
- B. Install fuses of proper type, and voltage rating for all fusible devices, including equipment furnished by others. When selecting fuses, follow the recommendation of the protected equipment manufacturer. Coordinate selectivity with other equipment and over-current devices on line.
- C. Fasten circuit breakers without mechanical stresses, twisting or misalignment being exerted by

clamps, supports or cables.

END OF SECTION 16180

SECTION 16450 GROUNDING

PART 1 GENERAL

1.1 GENERAL

- A. All electrical systems shall be grounded in accordance with the National Electrical Code, Local Codes, these specifications and the contract drawings.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Use green colored and coded insulated copper conductors.
- B. Use approved ground clamps manufactured for such purpose.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Ground all systems and equipment with the best applicable industry practice.
- B. Thoroughly clean all contact surfaces before making any grounding connections.
- C. Install metallic raceways mechanically and electrically secure at all joints and at all boxes, cabinets, fittings and equipment. Bond all boxes as specified for equipment.
- D. Provide separate green equipment ground conductor in all electrical raceways, to effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and non-current carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through No. 10 AWG. Use NEC Table 250-95 for conductor size with phase conductors No. 8 and larger, if not shown on the contract drawings.
- E. Permanently connect the green ground conductor to each receptacle junction box (self-tapping screw).
- F. Connect the ground conductor to the conduit with an approved grounding bushing, and to the metal frame with a bolted solderless lug. Bolts, screws and washers shall be bronze or

cadmium-plated steel. Ground conduits to metal frame with double locknuts or grounding bushings.

- G. Ground rods shall be installed by first drilling a 2" diameter hole deep enough to accommodate the ground rod. After the rod is installed, the area around the rod shall be filled with Bentonite. Ground rods shall not be driven. Holes for the enhanced or chemical rods shall be increased to 4" diameter and covered with appropriate test well.

END OF SECTION 16450

SECTION 16500 LIGHTING

PART 1 GENERAL

1.1 SCOPE

- A. Provide lighting system, complete.

1.2 APPLICABLE DOCUMENTS

- A. National Electrical Code References: Lighting Fixtures; Article 410.

- B. **QUALITY ASSURANCE**

- 1. Electric Lighting Fixtures: UL 57.
- 2. Lampholders: UL 542.
- 3. Fluorescent Lamp Ballasts: UL 935.
- 4. High-Intensity Discharge Lamp Ballasts: UL 1029

- C. **Manufacturing Standards**

- 1. Fixtures: NEMA LE1
- 2. Ballasts: CBM
- 3. Lamps: ANSI C78
- 4. Lampholders: ANSI C81

1.3 SUBMITTALS

- A. **Manufacturer's Data:** Submit certified photometric data including CU. The data shall be verified by ETL or ITL reports.
- B. **Shop Drawings:** Submit shop drawings detailing construction, dimensions and performance of lighting fixtures.
- C. **Samples:** Submit samples upon request.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fixtures:

1. Provide lighting fixtures of rigid construction, dimensionally stable, and assembled with secure fastenings. Protect ferrous parts from corrosion by plating or finish with high reflectance enamel. Firmly support shielding materials, make tight, with no loose panels or parts, and showing no leaks of unshielded or unintentional light. All plastics used in shielding shall be virgin acrylic, minimum 0.125" thick.
2. Where fixtures are subject to moisture, providing DL or WL label on fixtures as required for the location.

B. Ballasts:

1. Provide electronic fluorescent ballasts.
2. Provide high power factor HID ballasts. Provide CWA mercury and metal halide ballasts and regulated high pressure sodium ballasts. Recessed HID lighting fixtures shall have ballasts mounted adjacent to the housing of the fixture. Ballasts shall limit starting current to a value no greater than operating current.

C. Lamps:

1. Provide lamps as scheduled in all lighting fixtures unless otherwise noted.
2. Provide energy saving, high phosphor T-8 type fluorescent lamps.
3. See fixture schedule for lamp types.
4. Only the self-extinguishing lamps shall be used when metal halide lamps are specified in open type lighting fixtures.

D. Sockets:

1. Provide sockets in fluorescent fixtures of high strength plastic construction, with heavy gage spring brass contacts.

2. Enclose screw-shell sockets for fixtures in one piece high density porcelain insulation, with corrosion resistant metal contact surfaces for corrosion resistance and low electrical resistance. Provide center contact of spring material, or supported by a spring material, to maintain good contact.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Provide fixture wiring suitable for the temperature rating of the fixture. Where a junction box is required to change from branch circuit to fixture wiring the Contractor may use approved feed pre-wired fixtures or install a separate junction box at his option. Provide fully accessible junction box after installation of covering materials. Where flexible conduit or portable cord is used, install a grounding jumper; ground all fixtures.
- B. Suspend lighting fixtures from structural members or from ceiling structural members, by minimum 1-1/2 inch channels, by standard bar hangers, or other approved means. Under no circumstances will they be suspended from the ceiling. Coordinate fixture locations with ceiling patterns. Refer to architectural room finish schedule for ceiling construction details and mounting heights. Coordinate all recessed fixtures for specific conditions encountered.
- C. Provide structural steel necessary to support the fixtures under this section. Provide plaster frames as required. Where lighting fixtures located in plaster ceilings have a square or rectangular pattern, provide necessary corner plaster frames for a complete system.
- D. The lighting fixture schedule shown on the contract document indicates the type of fixture required but contractor shall provide the proper fixture for the ceiling type as indicated in the architectural finish schedule.

END OF SECTION 16500

SECTION 16612 EMERGENCY POWER SYSTEMS

PART 1 GENERAL

1.1.1 SCOPE:

1.1.1.1 This specification covers requirements for the design, fabrication, testing and furnishing of a complete and operable emergency electrical generating system, including all devices and equipment specified herein, shown on the drawings, or as required for the service. Materials and equipment furnished under this specification shall be delivered to the site completely equipped, wired, tested, and ready for installation.

1.1.2 SUBMITTALS

1.1.2.1 Product Data: Manufacturer's brochures describing equipment ratings, performances, specification and construction.

1.1.3 Shop Drawings: Layout (to scale), giving dimensions, schematic and wiring diagrams, interconnection diagrams.

1.1.3.1 Operation and Maintenance Data: Manufacturer's brochures.

1.1.4 Quality Assurance

1.1.4.1 Reference Standards: NEMA MG1, applicable UL standards, NEC, and applicable local codes.

1.1.5 WARRANTY

1.1.5.1 All new components shall be warranted for a period of one year from date of acceptance of the installation. Multiple warranties for individual components (alternator, engine, controls, etc.), will not be acceptable. Satisfactory warranty documents must be provided.

PART 2 PRODUCTS

1.2.1 ENGINE GENERATOR SET: As manufactured by Onan, Caterpillar, Kohler, Cummins or equal.

1.2.2 General: The generator set shall include but not be limited to the following:

1.2.2.1 Rated at 100 KW at .8 power factor.

1.2.2.2 60 Hertz, 277/480 volt, 3 phase, 4 wire.

1.2.2.3 Diesel Engine Driver.

- 1.2.2.4 Engine-Generator control console.
 - 1.2.2.5 Batteries and Charging System.
 - 1.2.2.6 Vibration Isolators.
 - 1.2.2.7 Exhaust System, Critical Residential.
 - 1.2.2.8 Weather-resistant engine - generator set enclosure.
 - 1.2.2.9 Belly fuel tank sized for 24 hour fuel supply.
 - 1.2.2.10 Engine-generator Control:
- 1.2.3 Provide a lighted, unit mounted control console that is factory built, wired, tested, and shock mounted by the generator manufacturer.
- 1.2.3.1 Engine-generator control shall include the following:
 - 1.2.3.2 24 volt DC engine monitor including oil pressure gage, coolant temperature gauge, charge rate ammeter and running time meter.
 - 1.2.3.3 The Control shall provide for automatic engine shut down for the following fault conditions:
 - 1.2.3.4 Overcrank
 - 1.2.3.5 Overspeed
 - 1.2.3.6 Low oil pressure
 - 1.2.3.7 High engine temperature
 - 1.2.3.8 Indicator lamps shall be provided to signal the following functions:
 - 1.2.3.9 RUN- indicates start disconnect
 - 1.2.3.10 FAULT - indicates overcrank, overspeed, high coolant temperature, or low oil pressure
 - 1.2.3.11 RE LOW OIL PRESSURE - indicates oil pressure is marginally low
 - 1.2.3.12 RE HIGH ENGINE TEMPERATURE - indicates engine temperature is marginally high

- 1.2.3.13 LOW OIL PRESSURE - indicates engine has shut down because of critically low oil pressure
- 1.2.3.14 HIGH ENGINE TEMPERATURE - indicates engine has shut down because of critically high temperature
- 1.2.3.15 OVERSPEED - indicates engine has shut down because of excessive rpm
- 1.2.3.16 OVERCRANK - indicates the starter has been locked out because time was excessive.
- 1.2.3.17 LOW ENGINE TEMPERATURE - indicates engine temperature is marginally low for starting
- 1.2.3.18 LOW FUEL - indicates fuel supply is marginally low
- 1.2.3.19 SWITCH OFF (flashing) - indicates control switch is in the "STOP" position
- 1.2.3.20 Provide two additional fault condition lamps to be designated later
- 1.2.3.21 A potentiometer shall be provided to adjust the voltage $\pm 5\%$ from rated value.
- 1.2.3.22 Fused disconnect switch or circuit breaker.
- 1.2.3.23 Provide relay contacts (negative ground) for remote indication alarms and shutdown.

1.2.4 ENGINE EQUIPMENT

- 1.2.4.1 Engine: Engine shall be stationary, liquid-cooled, diesel for use with number 2 diesel fuel. Design shall be four cycle, six (6) cylinders, turbocharged and intercooled where required by engine manufacturer. Engine shall be certified by the engine manufacturer as capable of driving a generator yielding a KW rating as specified on the plans. Engine shall be capable of driving the generator of this rating on a continuous standby basis for the duration of normal utility source interruptions. Engine shall be arranged for direct connection to an alternating current generator.
- 1.2.4.2 Engine Cooling System:
 - 1.2.4.2.1 Engine shall be radiator cooled by engine mounted radiator system including belt-driven pusher fan, coolant pump, and thermostat temperature control. Performance of components shall be as required by set manufacturer.
 - 1.2.4.2.2 Provide ethylene glycol antifreeze solution to fill engine cooling system.

1.2.4.3 Engine Exhaust System:

1.2.4.3.1 Exhaust silencer shall be provided for engine of size as recommended by manufacturer. Silencer shall be of the residential type.

1.2.4.3.2 Provide an exhaust condensation trap with manual drain valve to trap and drain off exhaust condensation and to prevent condensation from entering the engine.

1.2.4.3.3 Provide a suitable rain cap at the stack outlet. Provide all necessary flanges and special fittings, etc. for proper installation.

1.2.4.4 Engine Fuel System:

1.2.4.4.1 Skid mounted tank shall be provided for generator, with float switch, of minimum capacity for not less than twenty-four (24) hours full-demand operation of the system or as recommended by generator set manufacturer which ever is greater. Tank shall be provided with all required accessories. Tank shall be new, unused, of double-wall type and shall not be galvanized.

1.2.4.5 Generator:

1.2.4.5.1 Generator shall be single bearing, and self-aligning with brushless excitation; revolving field and amortisseur windings. Generator shall be directly connected to the engine housing and driven through a flexible coupling. Insulation shall be Class F, but temperature rise at rated continuous output shall not exceed 90 degrees C at 40 degrees C ambient. Generator shall be 3 phase, 4 wire, 60 Hz, voltage as shown on the plans, operations at rated RPM. Voltage regulator shall be solid state design providing no load to full load regulation within 2% of rated voltage during steady state conditions. Generator shall provide for motor starting with 10% or less sustained RMS voltage dip.

1.2.4.6 Automatic Transfer Switch:

1.2.4.6.1 Transfer switch as shown on the drawings shall be listed by Underwriters Laboratories, Inc. and shall have withstand rating equal or exceeding 22,000 AIC. Switches shall have positive mechanical interlock to prevent simultaneous contact closure to both normal and emergency sources.

1.2.4.6.2 Complete AL-CU lugs (UL listed and CSA approved) shall be provided for normal, emergency, and load connections.

1.2.4.6.3 The transfer switch shall be mounted in a separate NEMA 1 cabinet with locking doors.

1.2.4.6.4 The switch shall have three (3) operable poles with neutral bar with lugs and shall have

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ampere ratings as shown on the drawings.

1.2.4.7 Battery Charger

1.2.4.7.1 Battery charger shall be solid state, fully automatic, two rate equalize/float charge type with electronic overcharging protection, constant voltage, 10A minimum and shall be self-protected against shorted or reversed battery connections and overload currents.

PART 3 EXECUTION

1.3.1 INSTALLATION

1.3.1.1 Emergency system shall be installed, including all connections, as indicated on drawings and wiring diagrams, as specified herein, and in accordance with approved shop drawings and manufacturer's instructions.

1.3.2 On-Site Tests

1.3.2.1 The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel No. 2 domestic burner oil provided by the Contractor. The Engineer shall be notified in advance and shall have the option to witness the test. Certified copies of test procedures and results shall be forwarded to the Owner's Representative. Test to be conducted on-site shall include:

1.3.2.2 Simulated Power Failure Test: Engine generator shall be made ready for automatic operation and started by means of the test transfer switch on the automatic transfer switches. Units shall run for the duration of all time delays and then automatically shut down. This test shall be made with Owner's personnel present to familiarize them with the system operation. All emergency loads shall be available and be used for this test. Test and adjust the following:

1.3.2.2.1 Oil pressure

1.3.2.2.2 Water temperature

1.3.2.2.3 AC voltage

1.3.2.2.4 AC amperage (all phases)

1.3.2.2.5 Frequency

1.3.2.2.6 Kilowatts

1.3.2.2.7 Battery charge rate

1.3.2.2.8 Ambient temperature

1.3.3 INSTRUCTIONS

1.3.3.1 Complete instructions shall be specifically prepared for this project and delivered to the Owner's engineer no later than at time of load test.

END OF SECTION 16612