**SECTION** **TECHNICAL SPECIFICATIONS** **PAGES**

DIVISION 1 - GENERAL REQUIREMENTS



**DIVISION 2 - SITEWORK**

**DIVISION 3 - CONCRETE**



**DIVISION 4 - ELECTRICAL**

## PART 1 GENERAL

### 1.1 SCOPE

A. Work under this contract includes furnishing materials, labor, tools, equipment, supervision, and incidentals necessary to construct infrastructure improvements.

### 1.2 GENERAL

A. TECHNICAL SPECIFICATIONS consists of this section, Section 01005, described as TECHNICAL PROVISIONS, pages 01005-1 to 01005-7 and the applicable sections of the City of Fort Lauderdale Design and Construction Standards, the Florida Building Code, Florida Department of Environmental Protection, Broward County Environmental Protection and Growth Management Department and the Florida Department of Transportation (FDOT) latest revision.

B. In case of a conflict between the City of Fort Lauderdale Design and Construction Standards, the project drawings and these TECHNICAL PROVISIONS, the City of Fort Lauderdale Standards will govern.

C. CITY, OWNER and CONTRACT ADMINISTRATOR are described as one in the same and used interchangeably throughout this document.

D. DBF refers to Design Build Firm.

### 1.3 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery, and the like may be specified on the Drawings and not in the Technical Specifications. The DBF shall provide such items in accordance with the General Notes on the Drawings.

### 1.4 FIELD LAYOUT OF THE WORK AND RECORD DRAWINGS

A. After completion of construction, the DBF shall provide two sets of As-Built Drawings with all the As-Built information; all locations, coordinates, dimensions, and elevations of the constructed facilities, certified, signed and sealed thereon by a Professional Surveyor and Mapper per Florida Statute 472.001-472.037. All elevations shall refer to N.A.V.D. 88 (North American Vertical Datum of 1988) and all state plane coordinates shall be NAD 83 (with 1990 adjustment). The cost of such field layout and recording work shall be the responsibility of the DBF. The As-Built utility information shall meet the requirements of the City of Fort Lauderdale.

### 1.5 SALVAGE

A. Any existing equipment or material, including but not limited to valves, pipes, fittings, couplings, etc., which is removed as a result of construction under this project may be designated as salvage by the CITY, and if so, shall be delivered clean to the CITY at a location directed by the CONTRACT ADMINISTRATOR. Any equipment or material not worthy of salvaging shall be disposed of by the DBF at a suitable location in accordance with all applicable regulations, ordinances and laws at no additional cost to the CITY.

### 1.6 POWER

A. The DBF shall furnish and pay for all electrical power required for the construction,

testing and trial operation, prior to final acceptance by the CITY.

## 1.7 WATER SUPPLY

A. All water required for testing, flushing, and construction shall be furnished by the CITY and paid for by the DBF. The purchase price shall be the prevailing rate as published by the CITY. The quantity of water used shall be determined by reading the meter at the start and at the finish of construction. The DBF shall make all arrangements and incur all expense involved in having the CITY furnish and install the necessary water meters. Each water service line shall be provided with a vacuum relief or backflow preventer which shall meet the requirements of ASA A40.6, latest revision, and the local administrative authority.

## 1.8 MAINTENANCE

A. The DBF shall fully cooperate at all times with the CITY in order to maintain the operation of the existing water and/or sewer system with the least amount of interference and interruption possible. The schedule, plans, and work of the DBF shall at all times be subject to alteration and revision if necessary for public health and safety considerations. The creation of a public nuisance will not be permitted.

B. It may be necessary to interrupt the operation of the existing water and/or sewer system. In all cases where the DBF must cause an interruption, DBF shall prepare and submit to the CITY four (4) working days prior to commencing the work, a complete description of the proposed procedure and a time schedule, which DBF will be required to guarantee. At least forty-eight (48) hours prior to the time proposed for starting the work, the CITY will notify the DBF whether or not the work will be permitted as proposed.

   1. The CITY reserves the right to require the DBF to work 24 hours per day in all cases where, in CITY'S opinion, interference with operation of the system may result in dangerous health hazards or offensive conditions.
   2. In no case will the DBF be permitted to interfere with the existing system until all materials, supplies, equipment, tools, and incidentals necessary to complete the work are on the site. Backup equipment on key equipment items shall be required on work necessitating interference with the existing system.

## 1.9 SITE RESTORATION

A. The DBF shall remove all excess material and shall clean up and restore the site to its original condition or better. All damage, as a result of work under this Contract, done to existing structures, pavement, driveways, paved areas, curbs and gutters, sidewalks, shrubbery, grass, trees, utility poles, utility pipelines, conduits, drains, catch basins, flagstones, rocked, graveled, or stabilized areas of driveways, and including all obstructions not specifically named herein, shall be repaired, or replaced, as determined by the CITY. Site restoration shall be done in a timely manner as the work progresses. Site restoration work shall be completed on private property within 30 days after being disturbed.

## 1.10 SANITARY FACILITIES

A. The DBF shall provide temporary facilities at the site as directed by the CITY.

## 1.11 STANDARDS

A. Wherever in these TECHNICAL SPECIFICATIONS or in the drawings name and/or number refer to certain standards or regulations, the applicable publication shall be the latest revision thereof. Reference by abbreviation is made in accordance with the Section 01070, "Abbreviations of Institutions."

## 1.12 QUALITY OF ITEMS

A. All material furnished for this project shall be new and unused. Any material, which has become excessively weathered or damaged since manufacture, shall not be considered as new. CITY shall be the sole judge as to what constitutes excessive weathering or damage.

## 1.13 TESTING

A. The City of Fort Lauderdale may require that materials and equipment supplied meet given standards, and testing may be required to demonstrate conformance to the standards. The cost of these tests shall be the obligation of the DBF, and no extra charge shall be made to the CITY on account of such testing.

B. The CITY can select a recognized, independent testing laboratory to perform tests on concrete, reinforcing steel, soils, and other materials for the construction phase, to determine conformity with the TECHNICAL SPECIFICATIONS. The DBF shall supply the necessary samples for this testing without cost to the CITY. The costs for actual testing shall be paid by the CITY except for tests which fail to meet the minimum specified tolerances set forth in the drawings and the TECHNICAL SPECIFICATIONS. The cost of the tests that fail will be charged to the DBF by deducting the cost from the Contract price or will be paid directly to the testing laboratory by the DBF.

C. Construction in areas where installation and restoration must satisfy the additional requirements of a local, state, or federal authority may require testing to demonstrate conformance. The DBF shall ascertain the extent of testing required by regulatory agencies within these areas. The DBF is responsible for performing such tests, including

but not limited to, tests of compaction, and all costs for these tests shall be the obligation of the DBF and no extra charge shall be made to the CITY on account of such testing.

## 1.14 UTILITY CROSSINGS

A. It is intended that wherever existing utilities must be crossed that the pipe may be deflected up to 75% of the manufacturer's recommended limits but shall not exceed the allowable limits of the CITY. Adequate cover shall be used to adequately clear the obstruction. However, when in the opinion of the CITY, this procedure is not feasible CITY may direct the use of fittings to clear a utility crossing as detailed on the Drawings.

The cost of such crossing including joint restraints shall be on the basis of the schedule of pay items applied.

B. Deflections and adjustments of the proposed water and/or sewer mains to avoid all other existing utilities shall be verified/determined in the field during construction.

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## 1.15 BASIS OF MEASUREMENT

A. Where mains are to be paid for on a unit price per linear foot basis, the number of linear feet will be determined by measurement along the centerline of the pipe in place, including fittings. Square yardage will be determined by the actual number of square yards installed.

## 1.16 ADJUSTMENT AND RELOCATION OF EXISTING LINES

A. See Paragraph 1.14 of this Section. This does not apply to connections to existing system, which is described in Paragraph 1.17, this Section.

## 1.17 CONNECTION TO EXISTING SYSTEM

A. The DBF shall perform all work necessary to locate, excavate and prepare for connection to the existing mains as shown on the Drawings. The cost of this work and for the actual connection to the existing main shall be based upon the unit prices for installing the pipe and appurtenances and shall not result in any additional cost to the CITY The cost of ductile iron sleeves shall be included in the fittings unit price.

B. Additional valves used for the DBF's convenience shall not be considered as an extra cost payable by the CITY for the tie-in to the existing system.

C. During all phases of the work, (i.e., installation, testing and restoration), the DBF shall ensure at all times the safe operation of the existing water and/or sewage systems. Service to the customers shall be maintained with the least amount of interference and interruption as possible.

## 1.18 RELOCATIONS

A. The DBF shall be responsible for the coordination and/or performance of relocated structures that are shown on the drawings, including, but not limited to, light poles, signs, fences, piping, conduits and drains that interfere with the proposed positioning of the water/sewer mains. The cost of all such relocations shall be included in the prices bid for
the appropriate items.

## 1.19 UTILITIES

A. Existing utilities are shown on the Drawings insofar as information is reasonably available; however, it will be the responsibility of the DBF to preserve all existing utilities whether shown on the Drawings or not. DBF is directed to pothole ahead of utility installation to avoid conflict and/or damage to existing facilities. If utility conflicts are encountered by the DBF during construction, DBF shall give sufficient notice to their owners so that they may make the necessary adjustments. Damage to any utility, which in the opinion of the CITY is caused by carelessness on the part of the DBF shall be repaired at the expense of the DBF.

## 1.20 GUARANTEE

A. The DBF shall guarantee the equipment, material and labor performed under the Contract against any and all failures in proper use and operation for a period of one (1) year from date of written acceptance by the CITY.

B. The DBF shall also obtain warranties from manufacturers for each piece of equipment furnished so that the manufacturer's warranty fully covers the equipment for a period of one (1) year from the date of written acceptance by the CITY.

## 1.21 PERFORMANCE OF WORK

A. The DBF shall provide all personnel and equipment required to complete all work specified herein and on the Drawings.

B. DBF shall provide forty-eight (48) hours advance written notice to the CITY for approval of DBF'S intention to work overtime on weekdays or to work on the weekends.

## 1.22 BARRICADING (SAFETY)

A. The DBF shall be responsible for the furnishing and maintaining of all required barricades, either the lighted or the reflector type, to ensure the public's safety during open trench work or for any other potentially unsafe or hazardous construction activities. Barricades shall be located and displayed in conformance with the most stringent regulations required by the governing agencies. All costs for barricading, including any permits, shall be the responsibility of the DBF.

B. All work in public rights-of-way and on private property shall be done in strict compliance with these specifications. Failure to comply will result in cessation of operations and the removal of project related obstructions from the right-of-way until compliance is achieved.

## 1.23 EMERGENCY ACCESS AND SECURITY

A. In order to provide protection to the workers and residents, the DBF shall maintain emergency access to all adjacent properties at all times during construction. If a road is required to be closed to vehicular traffic and the distance of the closure exceeds 150 feet between stabilized surfaces or prevents access to properties for a distance that exceeds 150 feet, the DBF shall provide a 10-foot-wide stabilized access way on one side of the trench capable of supporting a Fire Truck. The DBF shall also provide stabilized access ways across the trench or unstabilized area a minimum of 6 feet in width at a spacing not to exceed 100 feet capable of supporting foot traffic. These access ways shall be protected and delineated with lighted barricades, or other such devices as approved by the regulatory agency. Both ends of the emergency access way shall be blocked in accordance with the MOT permit approved by the CITY with signage indicating that this access way is to be used by emergency vehicles only.

B. No trenches or holes shall be left open after working hours. In the event a trench must be left open after hours, it shall be done so only with the express written permission from the CITY, and it shall be the DBF'S responsibility to provide proper protection of the open trench or hole as required by the regulatory agency. In addition, the DBF shall provide a security guard at the site whenever the DBF'S personnel are not present, 24 hours per
day/ 7 days per week. It shall be the Security Guard's responsibility to protect the open trench or hole from trespassers and to direct emergency personnel on site.

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The Security Guard shall not have any other responsibilities such as operating pumps or equipment but shall be dedicated to protecting the trench or open hole. The Security Guard shall be equipped with a wireless telephone capable of calling 911 to report an emergency and shall keep that telephone on their person at all times. In addition to this provision the DBF shall maintain trench safety and comply with current OSHA regulations and the Trench Safety Act. The DBF shall maintain and keep all safety barricades, signage, flashers, and detours, in operating condition. A copy of the approved MOT plans, and details, shall be on site at all times.

C. Measurement and payment for security guard services shall be included in the utility pipe installation unit price.

D. All roads are to be maintained during the described construction as to always allow Emergency Access. This item will be paid for under the bid item for Mobilization as named in the Bid Schedule.

## 1.24 DEWATERING

A. The DBF shall be aware that there may be contaminated sites, per Broward County Environmental Protection and Growth Management Department (EPD) Pollution Prevention and Remediation Division, located within a one-quarter (1/4) mile radius of the proposed work. Please see Section 02140 Dewatering and dewatering permit requirements. The DBF will be responsible for all costs associated with the means and methods of dewatering which are set forth by EPD dewatering permit including costs for

cleaning existing drainage facilities if used for discharge, installation of injection or monitoring wells and groundwater monitoring testing costs. The CITY has paid for dewatering permit fees as required.

## 1.25 VIBRATORY COMPACTION

A. The use of vibratory compaction equipment shall be limited to a total gross weight of three

(3) tons. The use of vibratory equipment shall be limited to compacting backfill of utility trenches and subgrade of roadways only. If approved in writing by the CITY, larger vibratory compaction equipment may be allowed if operated in a static mode only.

## 1.26 REPORTING OF DAMAGE CLAIMS

A. The DBF shall keep the CITY informed of any damage claims made against the DBF during the construction period. All claims for automobile damage, property damage/bodily injury will be reported within 24 hours of receipt of notice. DBF will conduct a timely investigation of the claim and determine if they will honor the claim and/or report to their insurance carrier. DBF will advise the CITY in writing of their decision/referral to carrier. The project is a sewer force main replacement project. As such, the DBF will have close contact with the community. The DBF shall notify the CITY of any and all community concerns or claims arising from the DBF's operations. The claims referenced herein are exclusive of damages or property claims as outlined.

**PART 2 PRODUCTS (NOT APPLICABLE)**

**PART 3 EXECUTION (NOT APPLICABLE)**

**END OF SECTION 01005**

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## PART 1 GENERAL

### 1.1 SCOPE

A. The WORK to be performed under this Contract shall consist of furnishing and installing all tools, equipment, materials, supplies, and manufactured articles and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all work, or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The WORK shall be complete, and all work, materials, and services not expressly indicated or called for in the Contract Documents which may be necessary for the complete and proper construction of the WORK in good faith shall be provided by the DBF as though originally so indicated, at no increase in cost to the OWNER.

### 1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The work of this Contract comprises the construction of the infrastructure site work. The work will include but not be limited to site preparation, earthwork, sanitary sewer system installation, water systems installation, roadway and walkway restoration and construction, landscape restoration, restoring existing irrigation systems, pavement marking restoration and site furnishings.

B. The general location of the Pumping Station A-24 in Flagler Village project is bounded North, to the north right of way lines of NE 6th Street; East, to the center of the line of NE 4th Avenue; South, to the southernly boundaries of the park; and West, along the 3rd Avenue right of way, and from the north right of way of NE 5th street to the northern right of way line of NE 6th Street. The project includes the design, permitting, construction, start up, and testing of a new pump station, sanitary sewer gravity line, forcemain, and related work. It includes a new 16-inch internal diameter forcemain connecting from the proposed A-24 pump station to the existing forcemain on NE 5$^{th}$ Street and NE 3$^{rd}$ Avenue. A new 18-inch gravity sewer and manhole on NE 6$^{th}$ Avenue north of Peter Feldman Park. A new triplex pump station with a capacity of no less than 90 hp per pump, running two pumps at the same time, to handle the flow entering the lift station in the range of 720 to 2520 gpm and a pressure at the connection point to the existing forcemain from 15 to 45 psi. For more detail information about the project, refer to the conceptual layout in **Exhibit C**.

### 1.3 NOTICE OF BIDDERS

A. The successful bidder, in order to be considered responsive, must possess the appropriate License as described in Volume 1 of this document.

B. DBF shall have past experience with large scale utility projects in the right of way of existing residential communities.

### 1.4 STANDARD SPECIFICATION

A. All materials and labor shall meet the requirements of the "The Minimum Standards Applicable to Public Rights-of-Way under City of Fort Lauderdale Jurisdiction", (to be referred to as "Minimum Standards") and the Florida Department of Transportation "Roadway and Traffic Design Standards" latest revision, and

"Structures Standard Drawings," latest revisions:

1. These Special Provisions are supplemental to the above Specifications and Standards.

## 1.5 SITE INVESTIGATION

A. The DBF, by virtue of signing the Contract, acknowledges that DBF and all subcontractors have satisfied themselves to the nature and location of the work, the general and local conditions including, but not restricted to: those bearing upon transportation; demolition, disposal, handling and storage of materials; access roads to the site; the conformation
and conditions of the work area; and the character of equipment and facilities needed preliminary to and during the performance of the work. Failure on the part of the DBF to completely or properly evaluate the site conditions shall not be grounds for additional compensation.

B. Only the soil boring information included in these contract documents will be provided to the DBF for reference. The DBF, by virtue of signing the Contract, acknowledges that DBF and subcontractors are responsible for investigating and satisfying themselves as to the nature and extent of soil and (underground) water conditions on the project site. No additional payment will be made to the DBF because of differences between actual conditions and those shown by the boring logs. Boring logs are attached as Exhibit G.

## 1.6 WORKS BY OTHERS

A. Concurrent Work by Other CONTRACTORS. The DBF'S attention is directed to the fact that other CONTRACTORS may conduct work at the site during the performance of the WORK under this Contract. The DBF shall conduct its operations so as to cause little or no delay to WORK of such other CONTRACTORS and shall cooperate fully with such CONTRACTORS to provide continued safe access to their respective portions of the site, as required to perform work under their respective contracts.

B. Interference with Work On Utilities. The DBF shall cooperate fully with all utility forces of the OWNER or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the WORK, and shall schedule the WORK so as to minimize interference with said relocation, altering, or other rearranging of facilities.

## 1.7 WORK SEQUENCE

A. The DBF shall schedule and perform the work in such a manner as to result in the least possible disruption to the public's use of roadways, driveways, and utilities. Utilities shall include but not be limited to water, sewerage, drainage structures and pipe, ditches and canals, gas, electric, television and telephone. Prior to commencing with the WORK, DBF shall perform a location investigation of existing underground utilities and facilities in accordance with Section 01530 entitled "Protection of Existing Facilities" and shall have obtained all required permits and permissions, DBF shall also deliver written notice to the CITY and property occupants (private and public) of all planned disruption to roadway, driveways,

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temporary displacement of fences, mailboxes, street signs and traffic signs, and utilities 72 hours in advance of disruption.

B. Because other projects will be connected to portions of work constructed as part of this project, it will be necessary to sequence portions of this project. The DBF shall be responsible to coordinate construction activities with DBF of adjacent phases and sections.

## 1.8 WORK SCHEDULE

A. Time is of the essence in completing this project. Because time is of the essence the DBF shall commit the necessary resources to this project to complete it in a timely manner. Those resources may include multiple working crews, working overtime, etc. Because time is of the essence, the DBF'S construction progress will be monitored closely on a

weekly basis. The Construction progress will be measured with the construction schedule submitted by the DBF. If the CITY determines that the DBF does not meet the construction schedule, the DBF will be required to commit those resources necessary to ensure the completion of the project in a timely manner including working overtime, adding other work crews, etc. All costs incurred to implement measure to complete the work in timely manner will be borne by the DBF at no additional cost to the OWNER.

B. SCHEDULE

1. DBF shall submit scheduling information for the work as required by the city.
2. No separate payment shall be made for preparation and/or revision of the schedule.

## 1.9 COMPUTATION OF CONTRACT TIME

A. It is the DBF'S responsibility to provide clear and convincing documentation to the CITY as to the effect additional work will have with respect to additional contract time extension that may be justified. If additional quantities of work can be carried out concurrent with other existing construction activities without disrupting the critical path of the project, then no contract time extension will be granted. The DBF is obligated to provide documentation to the CITY if additional elements of work affect the critical path of the project. If work set forth in the original scope of the project is deleted, the contract time may be reduced. This contract is a calendar day contract. While the DBF may be granted time to suspend work operations for vacations or holidays, contract time will not be suspended. During suspensions, the DBF shall be responsible for all maintenance of traffic and liability without additional compensation from the CITY.

## 1.10 DBF USE OF PREMISES

A. The DBF's use of the project site shall be limited to its construction operations. The DBF

will arrange for storage of materials. A copy of an agreement for use of other property shall be furnished to the CITY prior to its use.

## 1.11 PRE-CONSTRUCTION CONFERENCE

A. After the award of Contract, a Pre-construction Work Conference will be held between the DBF, the CITY, other interested Agencies, representatives of Utility Companies and others affected by the work. The CITY will set the time and place of this conference. The DBF shall bring to the conference a copy of the proposed work schedule for the approval by the CITY of the proposed methods and manner of executing the work including sequences of operation and time schedule. The work shall be performed in accordance with such schedule or approved amendments thereto.

## 1.12 UTILITY LOCATIONS

A. As far as possible, all existing utility lines in the project area have been shown on the plans. However, the City of Fort Lauderdale does not guarantee that all lines are shown, or that said lines are in their true location and the depicted size. It shall be the DBF'S responsibility to identify and locate all underground or overhead utility lines or equipment affected by the project. No additional payment will be made to the DBF because of
discrepancies in actual and plan location of utilities and damages suffered as a result thereof.

B. The DBF shall notify each utility company involved at least thirty (30) days prior to the start of construction to arrange for positive underground location, relocation or support of its utility where that utility may be in conflict with or endangered by the proposed construction. The DBF shall pay for relocation of water mains or other utilities for the convenience of the DBF. The DBF shall pay for all charges by utility companies for temporary support of its utilities. All costs of permanent utility relocations to avoid conflict shall be the responsibility of the DBF and the utility company involved.

C. The DBF shall schedule and coordinate their work in such a manner that they are not delayed by the utility companies relocating or supporting their utilities. No compensation will be paid to the DBF for any loss of time or delay.

D. All overhead, surface, and underground structures and/or utilities encountered are to be carefully protected from damage or displacement. All damage to said structures and/or utilities is to be completely repaired within a reasonable time; needless delay will not be tolerated. The CITY reserves the right to remedy any damage by ordering outside parties to make repairs at the expense of the DBF. All repairs made by the DBF are to be made to the satisfaction of the utility owner and shall be inspected by a representative of the utility owner and the CITY.

E. The DBF should be aware of the Sunshine State One Call Center, which has a free locating service for CONTRACTORS and excavators. Within forty-eight hours before excavating, dial toll free 1-800-432-4770, and a locator will be dispatched to the work location. DBF shall reasonably notify other utility companies not notified by Sunshine State One Call Center.

F. The DBF is responsible for compliance with any and all permit conditions. Permit conditions are attached as Exhibit H of this document, further information regarding permit conditions can be obtained from the CITYS office.

G. The DBF shall obtain construction permit and applicable building and other permits from each City jurisdictions within the project area, if required.

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**1.13 LINE AND GRADE**

A. DBF shall develop and make all detailed surveys needed for construction and shall establish all working points, lines, and elevations necessary to perform the work. A Professional Surveyor and Mapper per Florida Statute 472.001-472.037 shall supervise this surveying work.

**1.14 PROTECTION AND RESTORATION OF SURVEY MONUMENTS**

A. The DBF shall carefully protect from disturbance all survey monuments, stakes and benchmarks, whether or not established by DBF, and shall not remove or destroy any surveying point until it has been properly witnessed by the CITY. All major survey monuments that have been damaged by the DBF such as section corners, 1/4 section corners, property corners or block control points shall be replaced at the DBF'S expense with markers of a size and type approved by the CITY. The replacement shall be under the supervision of a Professional Surveyor and Mapper per Florida Statute 472.001-472.037, where directed by the CITY.

**1.15 EQUIPMENT**

A. All equipment necessary and required for the proper construction of all facilities shall be on the construction site, in first-class working condition.

**1.16 STORAGE SITES**

A. The DBF shall furnish, at DBF's expense, properly zoned areas suitable for field office, material storage and equipment service and storage. No material may be stored in the public right of way without prior authorization by the agency having jurisdiction. The DBF shall keep these areas in a clean and orderly condition so as not to cause a nuisance or sight obstruction to motorists or pedestrians.

**1.17 OWNERSHIP OF EXISTING MATERIAL**

A. All materials removed or excavated from the job site shall remain the property of the City of Fort Lauderdale until released by the CITY, at which time it shall become the property of the DBF, who shall dispose of it in a manner satisfactory to the CITY.

**1.18 EXCESS MATERIAL**

A. Upon direction of the CITY, all vegetation, debris, concrete or other unsuitable materials shall be disposed of in areas provided by the DBF and approved by the CITY. Any excess material desired to be retained by the CITY shall be delivered by the DBF to a designated area within a 5-mile radius of the project, at no extra cost to the CITY.

**1.19 ADJUSTING EXISTING VALVES, METERS, CATCH BASINS, AND MAS**

A. It shall be the DBF'S responsibility to coordinate and have all adjustments made to existing water meters, valves, and structures encountered during construction, in order to meet all final grades, unless otherwise instructed by the CITY or the

respective utility owner. All valves and MAS shall be accessible during all phases of the work for emergency access. Omission of such structures from the Contract Plans does not relieve the DBF from making such adjustments as may be deemed necessary. The DBF shall take this provision into account when personally investigating the site. No additional payment shall be made for these adjustments.

## 1.20 CONFLICT STRUCTURES

A. The DBF shall abide by the following criteria concerning conflicts between new drainage, water, or sewer construction and existing utilities.
   1. The DBF shall verify the location of all utilities suspected of being potential conflicts prior to ordering drainage or sewer structures for these locations and inform the CITY as to DBF'S findings.
   2. The CITY shall have full authority to direct the placement of conflict structures, the relocation of structures shown in the plans, and the addition, deletion, or relocation of any pipe or structure shown in the plans in order to facilitate construction, expedite completion and avoid conflicts with existing utilities.
   3. Where an existing utility is to pass through a conflict structure, the DBF shall protect the utility from damage by whatever means the utility owner and the CITY deem necessary.
   4. In no case shall there be less than six (6) inches between any two (2)-pipe lines within the structure or between pipelines and the structure.

## 1.21 ENVIRONMENTAL PROTECTION

A. The DBF shall furnish all labor and equipment and perform all work required for the prevention of environmental pollution during and as a result of the work under this contract. For the purpose of this contract, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life, affect other species of importance to humankind, or degrade the utility of the environment for aesthetic and recreational purposes. The control of environmental pollution requires consideration of air, water, land and involves noise, solid waste management and management of radiant energy and radioactive materials, as well as other pollutants. Environmental pollution prevention shall be in accordance with NPDES requirements with no additional cost to the CITY.

B. The DBF shall take all steps necessary to protect water quality in the connected waters around the project and shall utilize such additional measures as directed by the CITY. Silt screens adjacent to outfall construction shall not be removed until the turbidity of the affected waters is equal to or lower than the ambient turbidity of undisturbed segments of the surface water body. Any discharge into existing drainage facilities shall require the approval of the owner of the system. This may require the DBF to obtain an engineered plan to be furnished at no additional cost to the CITY.

## 1.22 MAINTENANCE AND PROTECTION OF TRAFFIC

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A. The DBF shall provide all necessary traffic control devices in order to redirect, protect, warn or maintain existing vehicular and pedestrian traffic during the course of construction.

1. CONSTRUCTION PHASING REQUIREMENTS

Following are general requirements for construction phasing to minimize resident disruption yet maximize cost effectiveness of the construction scheduling.

a. No two adjacent roadways may be under construction at the same time (i.e., construction shall be on alternating roadways, and every other roadway shall remain open for access). In no case shall more than 35% of all roadways in a section be under construction at one time. At least 35% of all roadways shall have an asphalt surface, either original or new asphalt, at all times. The DBF shall make every effort to provide access to driveways at the end of the working day. If a driveway is not accessible, the homeowner should have access to a

neighboring swale area for temporary parking. When vehicular access to homes is not possible for parking of vehicles, an area for parking shall be provided within one block of the furthest home effected. This condition is to be avoided whenever possible and shall last no longer than five (5) working days. The DBF, with the CITY's approval, shall coordinate the parking area location.

The DBF shall lease the property from the landowner, and will provide a compacted, graded parking surface acceptable to the CITY.

1) The DBF shall not begin construction on subsequent roadways until the initial roadways under construction are substantially complete. A roadway shall be considered substantially complete when all work is complete except for the last lift of asphalt. All work on private property and landscaping must also be complete before a road is considered substantially complete.

2) Site restoration work shall be complete on private property within 30 days after being disturbed.

b. Construction within the right of way of affected roads shall be scheduled so that all improvements are completed at once, and the residents are only disrupted for one time period.

c. All affected residents and property owners shall be notified by the DBF in writing a minimum of two (2) weeks, or earlier if required by the CITY, prior to any disruption to or construction in road right of way adjacent to their homes. The notification shall also indicate any special parking or traffic conditions that will affect residents.

d. All affected residents shall be notified by the DBF a minimum of forty-eight (48) hours, or earlier if required by the CITY, prior to a shut off of water supply. Any water supply interruptions shall be rescheduled to be as short as possible and not exceed twelve (12) hours.

e. All affected residents shall be notified by the DBF a minimum of forty-eight (48)

hours, or earlier if required by the CITY, prior to work on the sanitary

sewer main. Any sewer supply interruptions shall be rescheduled to be as short as possible and not exceed twelve (12) hours.

f. At any time, the entire length of two north-south streets and one east-west street shall remain unobstructed and open to through-traffic for the area around each project. Access for emergency vehicles shall be maintained at all times to all homes and businesses. Excavation must be backfilled or barricaded at the end of each workday to prevent hazardous conditions. If a trench, excavation or structure is to be left open, it must be covered with a steel plate and barricaded at the end of each workday or when work will be suspended for more than eight (8) hours.

g. Transportation provisions for handicapped or disabled residents shall be made
by the DBF if construction prevents access to homes.

h. The DBF shall also make provisions with local bus, school bus, garbage collection, mail delivery and other agencies for continuation of service. A traffic maintenance plan indicating proposed street closings, schedules, and alternate routes, approved by the CITY, shall be submitted to all affected agencies for coordination and routing purposes.

i. Materials and equipment shall be stored in a fenced or otherwise enclosed area during non-working hours. Pipe and material shall not be strung out along installation routes for longer than two (2) weeks prior to installation.

B. TRAFFIC CONTROL

1. The DBF is required to submit a conceptual Traffic Control Plan at the Pre-Construction Conference. This preliminary plan should identify the phases of construction that the DBF plans to proceed with and identify traffic flows during each phase. The CITY will have ten (10) days to notify the DBF of any comments. Once the conceptual plan for maintaining traffic has been approved, the DBF will be required to submit a detailed plan showing each phase's Maintenance and Protection Plan prior to starting construction of any phase.

2. The "Maintenance of Traffic" plan shall include pedestrian traffic as well as vehicular traffic.

3. A safe walk route for all schools within the vicinity of the construction zone shall be maintained during the arrival and dismissal of school. DBF shall not block bus access to schools during school hours.

4. In the case that a designated crossing of any portion of the designated walk route
cannot be maintained, then the DBF shall notify the City of Fort Lauderdale and the "School Safety Coordinator" at Broward County Traffic Engineering Division, (954) 484- 9600 a minimum of ten (10) working days prior to ceasing that route so that an alternate route can be established with the school and the enforcing agency.

5. It shall be the responsibility of the DBF for any necessary Construction, Pavement Marking and Signage or any Pedestrian Signalization and/or

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Signal Modification to accommodate an alternate safe walk route.

6. Thirty (30) days prior to the beginning of construction the DBF shall notify the City of Fort Lauderdale and the "School Safety Coordinator" at Broward County Traffic Engineering Division (954) 484-9600, to set up a pre-work meeting.
7. The DBF, at all times, shall conduct the work in such a manner as to insure the least obstruction to traffic as is practical. Convenience of the general public and of the residents adjacent to the work shall be provided for in a satisfactory manner, as determined by the CITY.
8. Sidewalks, gutters, drains, fire hydrants and private drives shall, insofar as practical, be kept in condition for their intended uses. Fire hydrants on or adjacent to the work shall be kept accessible to fire apparatus at all times, and no material or obstruction shall be placed within twenty (20) feet of any such hydrant.
9. Construction materials stored upon the public street shall be placed so as to cause as little obstruction to the general public as is reasonably possible. Stored materials shall not impede pedestrian or vehicular traffic at any time.
10. Streets may be closed only as permitted by the approved Maintenance of Traffic Plan, and as directed by the CITY and, whenever the street is not closed, the work must be conducted with the provision for a safe passageway for traffic at all times. The DBF shall make all necessary arrangements with the CITY concerning maintenance of traffic and selection of detours required.
11. All existing stop and street name signs will be maintained as long as deemed necessary by the CITY.
12. When permission has been granted to close an existing roadway, the DBF shall furnish and erect signs, barricades, lights, flags and other protective devices, which shall conform to the requirements, and be subject to the approval of the CITY. The DBF shall furnish and maintain proper protective devices at such location for the entire time of closure as the CITY may direct. Signage shall be affected one week before closure.
13. The DBF shall furnish a sufficient number of protective devices to protect and divert the vehicular and pedestrian traffic from working areas closed to traffic, or to protect any new work. Failure to comply with this requirement will result in the CITY shutting down the work until the DBF provides the necessary protection.
14. Any time traffic is diverted for a period of time that will exceed one-work day temporary pavement markings will be required. Existing pavement markings that conflict with the new work zone traffic pattern must be obliterated. Painting over existing pavement markings (black out) is not permitted.
15. The DBF may be required to reposition existing traffic signal heads in order to maintain traffic flows at diverted intersections. If this should be necessary, the DBF must submit a plan for approval showing the course of work and the planned repositioning. The Broward County Traffic Engineering Division must approve the plan prior to implementation. No separate payment for repositioning the existing traffic signal heads will be made. The cost of this work shall be included in the bid item for Maintenance of Traffic.

16. If there are schools within the project area: The DBF will be required to shut down all equipment during the school zone commute time periods (approximately 15 minutes prior to and after school is in session).

### 1.23 MAINTENANCE AND PROTECTION OF EXISTING DRAINAGE SYSTEM

A. It shall be the responsibility of the DBF to maintain positive drainage on the surface and to ensure that the existing underground drainage system continues to function as intended during the construction of the new drainage system. The DBF shall submit a plan to maintain the existing drainage patterns and underground system for the approval of the CITY prior to beginning any work on the existing or new drainage systems. The cost of maintaining positive drainage and preparing the maintenance plan shall be included under maintenance of traffic and existing drainage system, of the Schedule of Prices Bid.

### 1.24 APPLICATION FOR PAYMENT FOR STORED MATERIALS

A. Application for payment for stored materials may not be made by DBF.

### 1.25 SPECIAL CONDITIONS FOR CONSTRUCTION BY OTHER AGENCIES

A. It will be the DBF's responsibility to coordinate construction schedules with other contractors so as to minimize disruptions, and inconveniences. The project site shall be safe at all times for construction workers and residents.

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION (NOT APPLICABLE)

## END OF SECTION 01010

.

## PART 1 GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. DBF shall be responsible for all cutting, fitting and patching, including attendant excavation and backfill, required to complete the work or to:
   1. Make its several parts fit together properly.
   2. Uncover portions of the work to provide for installation of ill-times work.
   3. Remove and replace defective work.
   4. Remove and replace work not conforming to requirements of Contract Documents.
   5. Remove samples of installed work as specified for testing.
   6. Provide routine penetrations of nonstructural surfaces for installation of piping and electrical conduit.

### 1.2 RELATED REQUIREMENTS

A. All applicable sections of the Specifications.
B. Conditions of the Contract.

### 1.3 SUBMITTALS

A. Submit a written request to CITY well in advance of executing any cutting or alteration, which affects:
   1. Work of the OWNER or any separate DBF.
   2. Structural value of integrity of any element of the project.
   3. Integrity of effectiveness of weather-exposed or moisture-resistant elements or systems.
   4. Efficiency, operational life, maintenance or safety of operational elements.
   5. Visual qualities of sight-exposed elements.

B. Request shall include:
   1. Identification of the project.
   2. Description of the affected work.
   3. The necessity for cutting, alteration or excavation.
   4. Effect on work of Owner or any separate DBF, or on structural or weatherproof integrity of project.
   5. Description of proposed work:
      a. Scope of cutting, patching, alteration or excavation.
      b. Trades who will execute the work.
      c. Products proposed to be used.
      d. Extent of refinishing to be done.
   6. Alternatives to cutting and patching.
   7. Cost proposal, when applicable.
   8. Written permission of any separate DBF whose work will be affected.

C. Should conditions of work or the schedule indicate a change of products from original installation, DBF shall submit request for substitution as specified in Section 01600, Paragraph 1.08.

D. Submit written notice to CITY designating the date and time the work will be uncovered.

## PART 2 PRODUCTS

### 2.1 MATERIALS

A. Comply with specifications and standards for each specific product involved.

## PART 3 EXECUTION

### 3.1 INSPECTION

A. Inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering the work, inspect conditions affecting installation of products, or performance of work.

C. Report unsatisfactory or questionable conditions affecting installation of products, or performance of work.

### 3.2 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of project from damage.

C. Provide protection from elements for that portion of the project, which may be exposed by cutting and patching, work, and maintain excavations free from water.

### 3.3 PERFORMANCE

A. Execute cutting and demolition by methods, which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs.

B. Execute excavating and backfilling by methods, which will prevent settlement or damage to other work.

C. Employ installer or fabricator to perform cutting and patching for:

1. Weather-exposed or moisture-resistant elements.
2. Sight-exposed finished surfaces.

D. Execute fitting and adjustment of products to provide a finished installation to comply with specified product, functions, tolerances and finishes.

E. Restore work which has been cut or removed; install new products to provide completed work in accordance with requirements of Contract Documents.

F. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:

1. For continuous surfaces, refinish to nearest intersection.
2. For an assembly, refinish entire unit.

**END OF SECTION 01045**

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## PART 1 GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. DBF shall comply with all building codes and regulations appropriate to the project, including those but not limited to:
   1. City of Fort Lauderdale
      a. Florida Building Code (Latest Revision)
      b. Broward County Traffic Engineering Division
      c. Broward County Environmental Protection and Growth Management Department
      d. Broward County Highway Construction and Engineering Department
      e. Florida Department of Environmental Protection
      f. South Florida Water Management District
      g. Florida Department of Environmental Protection
      h. OSHA

B. DBF shall comply with these codes, laws, regulations, rules, directives of all agencies, boards, districts, and governmental bodies having jurisdiction. The most recent guidelines of the regulatory agencies shall be utilized for the design and construction of the project.

C. DBF shall obtain and pay the cost of all building permits, fees, tie-in, or connection charges associated with the project.

D. DBF is responsible for compliance with all agencies and shall obtain all the necessary permits to complete the project. In the event that the CITY must obtain permits in addition to those listed below, the DBF shall not have any claim for damages arising from any delay caused by the CITY'S obtaining said additional permits.

### 1.2 RELATED REQUIREMENTS

A. All applicable sections of the Specifications.
B. Conditions of the Contract.

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION (NOT APPLICABLE)

**END OF SECTION 01060**

## PART 1 GENERAL

### 1.1 GENERAL

Wherever in these Specifications references are made to the standards, specifications, or other published data of the various international, national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these Specifications, the following acronyms or abbreviations, which may appear in these Specifications, shall have the meanings indicated herein.

### 1.2 ABBREVIATIONS

| | |
|---|---|
| AAMA | Architectural Aluminum Manufacturer's Association |
| AAR | Association of American Railroads |
| AASHTO | American Association of State Highway and Transportation Officials |
| AATCC | American Association of Textile and Colorists |
| ACI | American Concrete Institute |
| AFBMA | Anti-Friction Bearing Manufacturer's Association, Inc. |
| AGA | American Gas Association |
| AGMA | American Gear Manufacturers Association |
| AHAM | Association of Home Appliance Manufacturers |
| AI | The Asphalt Institute |
| AIA | American Institute of Architects |
| AISC | American Institute of Steel Construction |
| AISI | American Iron and Steel Institute |
| AITC | American Institute of Timber Construction |
| AMCA | Air Moving and Conditioning Association |
| ANS | American Nuclear Society |
| ANSI | American National Standards Institute, Inc. |
| APA | American Plywood Association |
| API | American Petroleum Institute |
| APWA | American Public Works Association |
| ASA | American Standards Association |
| ASAE | American Society of Agricultural Engineers |
| ASCE | American Society of Civil Engineers |
| ASHRAE | American Society of Heating, Refrigerating, and Air Conditioning Engineers |
| ASLE | American Society of Lubricating Engineers |
| ASME | American Society of Mechanical Engineers |
| ASQC | American Society for Quality Control |
| ASSE | American Society of Sanitary Engineers |
| ASTM | American Society for Testing and Materials |
| AWPA | American Wood Preservers Association |
| AWPI | American Wood Preservers Institute |
| AWS | American Welding Society |
| AWWA | American Water Works Association |
| BBC | Basic Building Code, Building Officials and Code Administrators International |

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|---|---|
| BCEPD | Broward County Environmental Protection Department (now known as Broward County Environmental Protection and Growth Management Department) |
| BCHCED | Broward County Highway Construction & Engineering Division |
| BCHD | Florida Department of Health of Broward County |
| BCPHU | Broward County Public Health Unit |
| BCTED | Broward County Traffic Engineering Division |
| BCWRMD | Broward County Water Resource Management Division |
| BCWWS | Broward County Water & Wastewater Services Division |
| BHMA | Builders Hardware Manufacturer's Association |
| CBM | Certified Ballast Manufacturers |
| CEMA | Conveyors Equipment Manufacturer's Association |
| CGA | Compressed Gas Association |
| CLFMI | Chain Link Fence Manufacturer's Institute |
| CMA | Concrete Masonry Association |
| CRSI | Concrete Reinforcing Steel Institute |
| CSI | Construction Specification Institute |
| DIPRA | Ductile Iron Pipe Research Association |
| EIA | Electronic Industries Association |
| ETL | Electrical Test Laboratories |
| EPA | Environmental Protection Agency |
| FAC | Florida Administrative Code |
| FBC | Florida Building Code |
| FDEP | Florida Department of Environmental Protection |
| FDOT | Florida Department of Transportation |
| FM | Factory Mutual System |
| FPL | Florida Power & Light |
| FS | Federal Specifications |
| HI | Hydraulics Institute |
| IAPMO | International Association of Plumbing and Mechanical Officials |
| ICBO | International Conference of Building Officials |
| IEEE | Institute of Electrical and Electronics Engineers |
| IES | Illuminating Engineering Society |
| IME | Institute of Makers of Explosives |
| IP | Institute of Petroleum (London) |
| IPC | Institute of Printed Circuits |
| IPCEA | Insulated Power Cable Engineers Association |
| ISA | Instrument Society of America |
| ISO | International Organization for Standardization |
| ITE | Institute of Traffic Engineers |
| MBMA | Metal Building Manufacturer's Association |
| MPTA | Mechanical Power Transmission Association |
| MSS | Manufacturers Standardization Society |
| MTI | Marine Testing Institute |
| NAAMM | National Association of Architectural Metal Manufacturer's |
| NACE | National Association of Corrosion Engineers |

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|---|---|
| NBS | National Bureau of Standards |
| NCCLS | National Committee for Clinical Laboratory Standards |
| NEC | National Electrical Code |
| NEMA | National Electrical Manufacturer's Association |
| NFPA | National Fire Protection Association |
| NFPA | National Forest Products Association |
| N.I.C. | Not In Contract |
| NLGI | National Lubricating Grease Institute |
| NMA | National Microfilm Association |
| NSF | National Sanitation Foundation |
| NWMA | National Woodwork Manufacturers Association |
| NPDES | National Pollutant Discharge Elimination System |
| OSHA | Occupational Safety and Health Administration |
| PCA | Portland Cement Association |
| PPI | Plastics Pipe Institute |
| RCRA | Resource Conservation and Recovery Act |
| RIS | Redwood Inspection Service |
| RVIA | Recreational Vehicle Industry Association |
| RWMA | Resistance Welder Manufacturer's Association |
| SAE | Society of Automotive Engineers |
| SAMA | Scientific Apparatus Makers Association |
| SB | Southern Bell |
| SFWMD | South Florida Water Management District |
| SMA | Screen Manufacturers Association |
| SMACCNA | Sheet Metal and Air Conditioning Contractors National Association |
| SPI | Society of the Plastics Industry, Inc. |
| SPIB | Southern Pine Inspection Bureau |
| SPR | Simplified Practice Recommendation |
| SSA | Swedish Standards Association |
| SSBC | Southern Standard Building Code, Southern Building Code Congress |
| SSPC | Steel Structures Painting Council |
| SSPWC | Standard Specifications for Public Works Construction |
| TAPPI | Technical Association of the Pulp and Paper Industry |
| TFI | The Fertilizer Institute |
| UL | Underwriters Laboratories, Inc. |
| WCLIB | West Coast Lumber Inspection Bureau |
| WCRSI | Western Concrete Reinforcing Steel Institute |
| WEF | Water Environment Federation |
| WIC | Woodwork Institute of California |
| WRI | Wire Reinforcement Institute, Inc. |
| WWED | Broward County Water and Wastewater Engineering Division |
| WWPA | Western Wood Products Association |

**PART 2 PRODUCTS (NOT APPLICABLE)**

**PART 3 EXECUTION (NOT APPLICABLE)**

.

**END OF SECTION 01070**

## PART 1 GENERAL

### 1.1 GENERAL

A. Titles of Sections and Paragraphs: Captions accompanying specification sections and paragraphs are for convenience of reference only, and do not form a part of the Specifications.

B. Applicable Publications: Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the WORK is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of, or omission from, said standards or requirements.

### 1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all work specified herein shall conform to or exceed the requirements of applicable codes and the applicable requirements of the following documents.

B. References herein to "Building Code" shall mean "Florida Building Code". References to "Mechanical Code" or "Uniform Mechanical Code," "Plumbing Code" or "Uniform Plumbing Code," "Fire Code" or "Uniform Fire Code," shall mean Uniform Mechanical Code, Uniform Plumbing Code and Uniform Fire Code of the International Conference of the Building Officials (ICBO). "Electric Code" or "National Electric Code (NEC)" shall mean the National Electric Code of the National Fire Protection Association (NFPA). The latest edition of the codes as approved by the Municipal Code and used by the local agency as of the date that the WORK is advertised for bids, as adopted by the agency having jurisdiction, shall apply to the WORK herein, including all addenda, modifications, amendments, or other lawful changes thereto.

C. In case of conflict between codes, reference standards, drawings and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the CITY for clarification and directions prior to ordering or providing any materials or furnishing labor. The DBF shall bid for the most stringent requirements.

D. The DBF shall construct the WORK specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed herein.

E. References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

F. References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

G. References to "Minimum Standards" shall mean the City of Fort Lauderdale Minimum Standards.

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## 1.3 REGULATIONS RELATED TO HAZARDOUS MATERIALS

A. The DBF is responsible that all work included in the Contract Documents, regardless if shown or not, shall comply with all EPA, OSHA, RCRA, NFPA, and any other Federal, State, and Local Regulations governing the storage and conveyance of hazardous materials, including petroleum products.

B. Where no specific regulations exist, all chemical, hazardous, and petroleum product piping and storage in underground locations must be installed with double containment piping and tanks, or in separate concrete trenches and vaults, or with an approved lining which cannot be penetrated by the chemicals, unless waived in writing by the OWNER.

1. The DBF may be required to reposition existing traffic signal heads in order to maintain traffic flows at diverted intersections. If this should be necessary, the DBF must submit a plan for approval showing the course of work and the planned repositioning. The Broward County Traffic Engineering Division must approve the plan prior to implementation. No separate payment for repositioning the existing traffic signal heads will be made. The cost of this work shall be included in the bid item for Maintenance of Traffic.
2. If there are schools within the project area: The DBF will be required to shut down all equipment during the school zone commute time periods (approximately 15 minutes prior to and after school is in session).

**PART 2 PRODUCTS (NOT APPLICABLE)**

**PART 3 EXECUTION (NOT APPLICABLE)**

**END OF SECTION 01090**

## PART 1 GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. DBF shall schedule and administer a preconstruction meeting, progress meetings at a minimum of once a month on a day established by the OWNER's Representative and specially called meetings throughout progress of the work.
   1. Prepare agenda meetings.
   2. Distribute written notice of each meeting five (5) days in advance of meeting date.
   3. Preside at meetings.
   4. Record the minutes; include significant proceedings and decisions.
   5. Reproduce and distribute copes of minutes within three (3) days after each meeting.
      a. To participants in the meeting.
      b. To parties affected by decisions made at the meeting.
      c. Furnish digital copies of minutes to OWNER.

B. DBF is to secure a meeting location for progress meetings that is in accordance with the requirements of the Contract Documents.

C. Representative of DBF, subcontractor and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

### 1.2 RELATED REQUIREMENTS

A. All applicable sections of the Specifications.

B. Conditions of the Contract.

### 1.3 PRE-CONSTRUCTION MEETING

A. Schedule after date of Notice to Proceed.

B. Location: A central site, convenient for all parties, designated by OWNER's Representative.

C. Attendance:
   1. The DBF and its superintendent.
   2. ENGINEER
   3. Resident Project Representative.
   4. Representative of the OWNER.
   5. Major subcontractors.
   6. Major Suppliers.
   7. Governmental representatives as appropriate.
   8. Others as requested by DBF, OWNDER, or Engineer.

D. Suggested Agenda:
   1. Distribution and discussion of:
      a. List of major subcontractors and suppliers.
      b. Projected Construction Schedules.
      c. Shop Drawings and other submittals.
      d. Traffic maintenance plan.
      e. Community Public Relations.
   2. Critical work sequencing.

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3. Procurement of major equipment and materials requiring a long lead time.
4. Project Coordination.
    a. Designation of responsible personnel.
5. Procedures and processing of:
    a. Field decisions.
    b. Proposal requests.
    c. Submittals.
    d. Change orders.
    e. Applications for Payment.
6. Adequacy of distribution of Contract Documents.
7. Procedures of maintaining Record Documents.
8. Use of premises:
    a. Office, work, and storage areas.
    b. OWNER requirements.
9. Construction facilities, controls, and construction aids.
10. Temporary utilities.
11. Safety procedures
12. Security procedures.
13. Housekeeping procedures.

## 1.4 PROGRESS MEETINGS

A. Schedule regular monthly meetings on a day established by the OWNER's Representative as required.
B. Hold called meetings as required by progress of the work.
C. Location of meetings: Project field office or as designated by OWNER.
D. Attendance
    1. OWNER's Representative and OWNER's professional consultants as needed.
    2. ENGINEER
    3. Subcontractors as active on the site.
    4. Suppliers as appropriate to the agenda.
    5. Governmental representatives as appropriate.
    6. Others, as requested by DBF, OWNER, or ENGINEER.
E. Suggested Agenda:
    1. Review, approval of minutes of previous meeting.
    2. Review of work progress since previous meeting.
    3. Field observations, problems, and conflicts.
    4. Problems, which impeded Construction Schedule.
    5. Review of off-site, delivery schedules.
    6. Corrective measures and procedures to regain projected schedule.
    7. Revisions to Construction Schedules.
    8. Progress, schedule, during succeeding work period.
    9. Coordination of schedules.
    10. Community Public Relations.
    11. Review submittal schedules; expedite as required.

12. Maintenance of quality standards.
13. Pending changes and substitutions.
14. Review proposed changed for:
    a. Effect on Construction Schedule and on completion date.
    b. Effect on other contracts of the Project.
15. Other business.

**PART 2 PRODUCTS (NOT APPLICABLE)**

**PART 3 EXECUTION (NOT APPLICABLE)**

**END OF SECTION 01200**

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## PART 1 GENERAL

### 1.1 SCOPE:

A. Summary of Work: This SECTION includes definitions, descriptions, transmittal, and review of "Compliance" and "Miscellaneous" Submittals.

### 1.2 GENERAL INFORMATION:

A. Definitions:

1. Compliance Submittals include Shop Drawings, product data, and samples which are prepared by the DBF, Subcontractor, MANUFACTURER, or Supplier and submitted by the DBF to the CITY as a basis for approval of the use of Equipment and Materials proposed for incorporation in the WORK or needed to describe installation, operation, maintenance, or technical properties.
    a. Shop Drawings include custom-prepared data of all types including drawings, diagrams, performance curves, material schedules, templates, instructions, and similar information not in standard printed form applicable to other projects.
    b. Product data includes standard printed information on materials, products and systems not custom-prepared for this Project, other than the designation of selections from available choices.
    c. Samples include both fabricated and unfabricated physical examples of materials, products, and WORK; both as complete units and as smaller portions of units of WORK; either for limited visual inspection or (where indicated) for more detailed testing and analysis. Mock-ups are a special form of samples which are too large to be handled in the specified manner for transmittal of sample Submittals.
2. Miscellaneous Submittals are those technical reports, administrative Submittals, certificates, and warranties not defined as Shop Drawings, product data, or samples.
    a. Technical reports include laboratory reports, tests, technical procedures, technical records, DBF's design analysis and DBF's survey field notes for construction staking, before cross-sections and after cross-sections, and similar type Submittals.
    b. Administrative Submittals are those nontechnical Submittals required by the Contract Documents or deemed necessary for administrative records. These Submittals include maintenance agreements, workmanship bonds, Project photographs, physical work records, statements of applicability, copies of industry standards, as-constructed data, security/protection/safety data, and similar type Submittals also listed in SECTION 01700 and elsewhere in the Contract Documents.
    c. Certificates and warranties are those Submittals on Equipment and Materials where a written certificate or guarantee from the MANUFACTURER or Supplier is called for in the Specifications.
    d. Reports as required by Contract describing DBF's means and methods for items such as dewatering, earth and water retaining, erosion/turbidity

control, safety plans, and similar type Submittals.

3. Refer to ARTICLE 1.03 and 1.04 of this Part for detailed lists of documents and specific requirements.

B. Quality Requirements:
   1. Submittals such as Shop Drawings and product data shall be of the quality for legibility and reproduction purposes. Every line, character, and letter shall be clearly legible. Drawings such as reproducible shall be useable for further reproduction to yield legible hard copy.
   2. Documents submitted to the CITY that do not conform to these requirements shall be subject to rejection by the CITY, and upon request by CITY, DBF shall resubmit conforming documents. If conforming Submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. DBF's (or his Subcontractor's) failure to initially satisfy the legibility quality requirements will not relieve DBF (or his Subcontractors) from meeting the required schedule for Submittal of Shop Drawings and product data.

C. Language and Dimensions:
   1. All words and dimensional units shall be in the English language.
   2. Metric dimensional unit equivalents may be stated in addition to the English units.

D. Submittal Completeness:
   1. Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable the CITY to review the information effectively.
   2. Where standard drawings are furnished which cover variations of the general class of equipment, each such drawing shall be individually annotated to describe exactly which parts of the drawing apply to the equipment being furnished. Use hatch marks to indicate variations that do not apply to the Submittal. The use of "highlighting" is not an acceptable means of annotating Submittals. Such annotation shall also include proper identification of the Submittal permanently attached to the drawing.
   3. Reproduction or copies of Drawings or portions thereof will not be accepted as complete fabrication or erection drawings. The DBF may use a reproduction of the CITY-prepared Drawings for erection drawings such as to indicate information on erection or to identify detail drawing references. Where the Drawings are revised to show this additional DBF information, the CITY's title block shall be replaced with a DBF's title block and the CITY's professional seal shall be removed from the Drawing. The DBF shall revise these erection drawings for subsequent CITY revisions to the Drawings.

## 1.3 COMPLIANCE SUBMITTALS:

A. Items shall include, but not be limited to, the following:
   1. MANUFACTURER's specifications
   2. Catalogs, or parts thereof, of manufactured equipment
   3. Shop fabrication and erection drawings

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4. General outline drawings of equipment showing overall dimensions, location of major components, weights, and location of required building openings and floor plates
5. Detailed equipment installation drawings, showing foundation details, anchor bolt sizes and locations, baseplate sizes, location of CITY's connections, and all clearances required for erection, operation, and disassembly for maintenance
6. Schematic diagrams for electrical items, showing external connections, terminal block numbers, internal wiring diagrams, and one-line diagrams
7. Bills of material and spare parts list
8. Instruction books and operating manuals
9. Material lists or schedules
10. Performance tests on equipment by MANUFACTURERs
11. Concrete mix design information
12. Samples and color charts
13. All drawings, calculations, catalogs or parts thereof, MANUFACTURER's specifications and data, samples, instructions, and other information specified or necessary:
    a. For CITY to determine that the Equipment and Materials conform with the design concept and comply with the intent of the Contract Documents.
    b. For the proper erection, installation, operation and maintenance of the Equipment and Materials which the CITY will review for general content but not for substance.
    c. For the CITY to determine what supports, anchorages, structural details, connections, and services are required for the Equipment and Materials, and the effects on contiguous or related structures and Equipment and Materials.

B. Compliance Submittal Action Stamps or Designation: The CITY's review action stamp or designation, appropriately completed, will appear on all Compliance Submittals of DBF when returned by the CITY. Review status designations listed on CITY's action designation are defined as follows:
   1. "ACCEPTED AS SUBMITTED": Signifies Equipment or Material represented by the Submittal conforms with the design concept and complies with the intent of the Contract Documents and is acceptable for incorporation in the WORK. DBF is to proceed with fabrication or procurement of the items and with related WORK.
   2. "ACCEPTED AS NOTED": Signifies Equipment and Material represented by the Submittal conforms with the design concept and complies with the intent of the Contract Documents and is acceptable for incorporation in the WORK subject to the condition that as constructed it shall be in accordance with all notations and/or corrections indicated. DBF is to proceed with fabrication or procurement of the items and with related WORK in accordance with CITY's notations.
   3. "RETURNED FOR REVISION": Means that deviations from the requirements

of the Contract Documents exist in the Submittal. DBF is to resubmit revised information responsive to CITY's annotations on the returned Submittal or written in the letter of transmittal. Fabrication or procurement of items represented by the Submittal and related WORK is not to proceed until the Submittal is approved.

4. "NOT ACCEPTABLE (SUBMIT ANEW)": Signifies Equipment and Material represented by the Submittal does not conform with the design concept or comply with the intent of the Contract Documents and is disapproved for use in the WORK. DBF is to resubmit Compliance Submittals responsive to the Contract Documents.
5. "PRELIMINARY SUBMITTAL": Signifies Submittals of such preliminary nature that a determination of conformance with the design concept or compliance with the intent of the Contract Documents must be deferred until additional information is furnished. DBF is to submit such additional information to permit layout and related activities to proceed.
6. "FOR REFERENCE ONLY": Signifies Submittals which are for supplementary information only; pamphlets, general information sheets, catalog cuts, standard sheets, bulletins and similar data, all of which are useful to the CITY in design, operation, or maintenance, but which by their nature do not constitute a basis for determining that items represented thereby conform with the design concept or comply with the intent of the Contract Documents. The CITY reviews such Submittals for general content but not for substance.
7. Resubmit Compliance Submittals the number of times required for CITY's "ACCEPTED AS SUBMITTED" or “FOR REFERENCE ONLY”. However, any need for more resubmittals than the number set forth in the accepted schedule, or any other delay in obtaining acceptance of Submittals, will not be grounds for extension of the Contract Time, provided the CITY completes its reviews within the times stated above.

C. Schedule and Log of Compliance Submittals:
1. Prepare for the CITY, a schedule and log for submission of all Compliance Submittals specified or necessary for CITY's review of the use of Equipment and Materials proposed for incorporation in the WORK or needed for proper installation, operation or maintenance. Submit the schedule and log with the procurement schedule and WORK progress schedule. Schedule submission of all Compliance Submittals to permit review, fabrication, and delivery in time to not cause a delay in the WORK of DBF or his Subcontractors or any other contractors as described herein.
2. In establishing schedule for Compliance Submittals, allow 15 working days in CITY's office for reviewing original Submittals that have been deemed complete and ten (10) working days for reviewing resubmittals of previously reviewed submittals.
3. The schedule shall indicate the anticipated dates of original submission and shall be prepared in accordance with SECTION 01310 and submitted in accordance with this SECTION.
4. Schedule all Compliance Submittals required prior to fabrication or manufacture for submission within [90] days of the Notice to Proceed [NTS:

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Engineer should coordinate with the Project/Construction Manager to determine this time period]. Schedule Compliance Submittals pertaining to storage, installation and operation at the Site for CITY's acceptance prior to delivery of the Equipment and Materials.

D. Transmittal of Compliance Submittals:

1. All Compliance Submittals of Equipment and Materials furnished by Subcontractors, MANUFACTURERs, and Suppliers shall be submitted to the CITY by DBF in electronic PDF format as indicated below. After checking and verifying all field measurements, transmit all Compliance Submittals to the CITY for acceptance as follows:
    a. Identify each Compliance Submittal by Submittal Number, Project name and number, Contract title and number, and the Specification SECTION and article number marked thereon or in the letter of transmittal. Unidentifiable Submittals will be returned for proper identification.
    b. Check and certify Compliance Submittals of Subcontractors, Suppliers, and MANUFACTURERS with DBF's approval prior to transmitting them to the CITY. DBF's certification of approval shall constitute a representation to the CITY that DBF has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or he assumes full responsibility for doing so, and that he has coordinated each Compliance Submittal with the requirements of the WORK and the Contract Documents.
    c. At the time of each submission, call to the attention of CITY in the letter of transmittal any deviations from the requirements of the Contract Documents.
    d. Provide all Submittals in electronic format, compatible with Adobe Professional, Version 8 (or higher), and submitted as a single file, using PDF bookmarks and/or chapters to identify divisions within the Submittal package.
    e. Make all modifications noted or indicated by CITY and return revised copies, or samples until accepted. Revised Submittals must be complete and conformed, including all pages/sheets with the required revisions and any additional or replacement pages/sheets. Direct specific attention in writing, or on revised Submittals, to changes other than the modifications called for by the CITY on previous Submittals. Subsequent review cycles for returned or revised Submittals shall replicate the process described in items d. through e. above.
    f. If the CITY's review action is "ACCEPTED AS NOTED", the Submittal will be designated such, and electronically transmitted back to the DBF. Upon receipt of this notification from the CITY, The DBF shall resubmit one (1) conformed electronic copy in PDF file format to the CITY for final distribution. If the Submittal is required to be signed and sealed by a Professional Engineer registered in the State of Florida, this version of the submittal shall be signed and sealed. Submittal will not be considered final until all copies have been received by the CITY. Submittal will be designated "DISTRIBUTION COPY (PREVIOUSLY ACCEPTED)" by

the CITY. Accepted Submittals transmitted for final distribution will not be further reviewed and are not to be revised. If errors are discovered during manufacture or fabrication, correct the Submittal and resubmit for review.

g. Following completion of the WORK and prior to final payment, furnish those drawings necessary to indicate "AS CONSTRUCTED" conditions, including field modifications. Furnish additional copies for insertion in equipment instruction books as required. All such copies shall be clearly marked "AS BUILT DRAWING."

h. WORK requiring a Compliance Submittal shall not be commenced or shipped until the Submittal has been designated "ACCEPTED AS SUBMITTED" or "ACCEPTED AS NOTED" by the CITY.

i. Keep a legible copy or sample of each Compliance Submittal at the Site.

2. Copies of the equipment DBF's erection drawings and other Compliance Submittals required for the installation of equipment furnished by others under separate Contract for installation under this Contract will be transmitted to DBF by the CITY in the final distribution of such Submittals.

3. Information to MANUFACTURER's District Office: MANUFACTURERs and Suppliers of Equipment and Materials shall furnish copies of all agreements, drawings, specifications, operating instructions, correspondence, and other matters associated with this Contract to the MANUFACTURER's district office servicing the CITY. Insofar as practicable, all business matters relative to Equipment and Materials included in this Contract shall be conducted through such local district offices.

E. CITY's Review:

1. The CITY will review and return Compliance Submittals to DBF with appropriate notations. Instruction books and similar Submittals will be reviewed by the CITY for general content but not for substance.

2. The CITY's acceptance of Compliance Submittals will not relieve DBF from his responsibility as stated in the Section 00700 – General Terms and Conditions.

F. Instruction Books / Operation & Maintenance Manuals:

1. Equipment instruction books and manuals shall be prepared by the MANUFACTURER and shall include the following:

a. Index and tabs

b. Instructions for installation, start-up, operation, inspection, maintenance, parts lists and recommended spare parts, and data sheets showing model numbers

c. Applicable drawings

d. Name of contact person, phone number, and address of the nearest authorized service facility

e. Attached to the above shall be a notice of the exact warranty effective dates, beginning and ending.

f. All additional data specified

2. Information listed above shall be submitted electronically in a PDF file format.

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a. Instruction Books/Operation & Maintenance Manuals shall contain the following:
   1) Equipment name
   2) MANUFACTURER's name
   3) Project name
   4) Contract number
   5) Reference to applicable Drawing No. & Technical Specifications Section

b. Format: The overall manual should be constructed around certain types of structures or equipment in the Project, and not merely assembled by technical specification section, so that all pertinent data needed by personnel to operate or maintain the equipment or structure is in one (1) manual (as far as is practical). The DBF shall coordinate with the CITY as to how the manuals are to be assembled (Bookmarked).

G. Samples: Office samples shall be of sufficient size and quantity to clearly illustrate the following:
   1. Functional characteristics of the product, with integrally related parts and attachment devices
   2. Full range of color, texture, and pattern

## 1.4 MISCELLANEOUS SUBMITTALS:

A. Miscellaneous Submittals are comprised of technical reports, administrative Submittals, and warranties which relate to the WORK, but do not require CITY's approval prior to proceeding with the WORK. Miscellaneous Submittals may include but are not limited to (at CITY's discretion):
   1. Welder qualification tests
   2. Welding procedure qualification tests
   3. X-ray and radiographic reports
   4. Field test reports
   5. Concrete cylinder test reports
   6. Certification on Materials:
      a. Steel mill tests
      b. Paint lab tests
      c. Cement tests
   7. Soil test reports
   8. Temperature records
   9. Shipping or packing lists
   10. Job progress schedules
   11. Equipment and Material delivery schedules
   12. Progress photographs
   13. Warranties
   14. Fire protection and hydraulic calculations
   15. Surveying field notes, preliminary and final Surveyor's Reports
   16. Pump tests
   17. Traffic control plan

18. Technical Reports
19. Written Certificates and Warranties

B. Transmittal of Miscellaneous Submittals:
   a. All Miscellaneous Submittals furnished by Subcontractors, MANUFACTURERS, and Suppliers shall be submitted to CITY by DBF in an electronic PDF file format, unless otherwise specified.
   b. Identify each miscellaneous Submittal by Project name and number, Contract title and number, and the specification section and article number marked thereon or in the letter of transmittal. Unidentifiable Submittals will be returned for proper identification.
   c. Check and certify Miscellaneous Submittals of Subcontractors, Suppliers, and MANUFACTURERS with DBF's approval prior to transmitting them to the CITY. DBF's certification of approval shall constitute a representation to the CITY that DBF has either determined and verified all information, or he assumes full responsibility for doing so, and that he has coordinated Miscellaneous Submittal with the requirements of the WORK and the Contract Documents.
   d. At the time of each submission, call to the attention of the CITY in the letter of transmittal any deviations from the requirements of the Contract Documents.
   e. Make all modifications noted or indicated by CITY and return revised copies until accepted. Direct specific attention in writing, or on revised Submittals, to changes other than the modifications called for by the CITY on previous Submittals. After Submittals have been accepted, submit copies thereof for final distribution.

   2. Test Reports:
      a. Responsibilities of DBF and CITY regarding tests and inspections of Equipment and Materials and completed WORK are set forth elsewhere in these Contract Documents.
      b. The party specified responsible for testing or inspection shall in each case, unless otherwise specified, arrange for the testing laboratory or reporting agency to distribute test reports in an electronic PDF file format to the following parties, unless otherwise specified:
         1) CITY
         2) Resident Project Representative
         3) DBF
         4) MANUFACTURER or supplier

C. CITY'S Review:
   1. CITY will review Miscellaneous Submittals for indications of WORK or material deficiencies within fifteen (15) working days in CITY's office for original Submittals and ten (10) working days for reviewing resubmittals.
   2. CITY will respond to DBF on those Miscellaneous Submittals which indicate WORK or material deficiency.

## 1.5 WEN BASED CONSTRUCTION DOCUMENT MANAGEMENT:

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A. The CITY, and DBF shall use the internet Web Based Project Construction Document Management tool (the Construction Document Management tool), e-Builder® ASP software, and protocols included in that software during this Project for submission of all documents specified in this SECTION and elsewhere in the Contract Documents. The use of Construction Document Management as herein described does not replace or change any contractual responsibilities of the DBF.

B. The intent of using the Construction Document Management tool (i.e. e-Builder®) is to improve the Project work efforts by promoting timely initial communications and responses. This will also reduce the number of paper documents while providing improved record keeping by creation of electronic document files.

C. The Construction Document Management tool is available through e-Builder® in the form and manner required by the CITY.

D. The Construction Document Management tool is on-line and fully functional. User registration, electronic and computer equipment, and Internet connections are the responsibility of CITY, Engineer of Record and DBF.

E. DBF's Responsibility:
   1. DBF shall be responsible for the validity of their information placed in Construction Document Management tool and for the abilities of their personnel.
   2. Entry of information exchanged and transferred between the DBF and its subcontractors and suppliers on Construction Document Management tool shall be the responsibility of the DBF.
   3. Accepted users shall be knowledgeable in the use of computers, including Internet Browsers, email programs, cad drawing applications, and Adobe Portable Document Format (PDF) document distribution program.
   4. DBF shall utilize the existing forms in Construction Document Management tool (i.e. e-Builder®) to the maximum extent possible. If a form does not exist in Construction Document Management tool, the DBF must include a form of their own (subject to review and acceptance by CITY) or provided by CITY as an attachment to a submittal.
   5. Adobe PDF documents shall be created through electronic conversion to be searchable, rather than optically scanned, whenever possible. DBF is responsible for the training of their personnel in the use of the Construction Document Management tool (outside training that is provided by CITY) and the other programs indicated above as needed.
   6. User Access Limitations:
      a. Provide a list of DBF's key the Construction Document Management tool personnel for the CITY's acceptance. The CITY reserves the right to perform a security check on all potential users. The DBF will be allowed to add additional personnel and subcontractors to Construction Document Management tool.
      b. The CITY will grant initial access to the Construction Document Management tool by creating user profiles to accepted DBF personnel.

F. Authorized Users: The DBF shall:
   1. Request the User Application form from the CITY Project Manager.

2. Submit completed User Application Form to the CITY Construction Document Management tool (i.e. e-Builder®) Administrator.
3. Authorized users will be contacted directly by the web site provider, e-Builder®, who will assign the temporary user password.
4. Authorized users shall be responsible for the proper us of their passwords and access to data as agents of the company in which they are employed.
5. Sharing usernames and passwords are strictly prohibited.

G. Training: Group training sessions will be scheduled by the CITY on as needed bases. Users are required to attend the scheduled training sessions they are assigned to.

H. Support: e-Builder® will provide on-going support through online help files. The second level of help will be to contact the CITY Construction Document Management tool Administrator with the help of CITY Project Manager.

I. Copyrights and Ownership: Nothing in this Specification or the subsequent communications supersedes the DBF's obligations and rights for copyright or document ownership as established by the Contract Documents. The use of CAD files, processes or design information distributed in this system is intended only for the Project specified herein.

J. Communications: The use of fax, email and courier communication for this Project is discouraged in favor of using the Construction Document Management tool to send messages. Communication functions are as follows:
   1. Document Integrity and Revisions:
      a. Documents, comments, drawings and other records posted on the Construction Document Management tool will remain for the Project record. The authorship time and date will be recorded for each document submitted to the system. Submitting a new document or record with a unique ID, authorship, and time stamp will be the method used to make modifications or corrections.
      b. The Construction Document Management tool will make it easy to identify revised or superseded documents and their predecessors.
   2. Document Security: The Construction Document Management tool will provide a method for communication of documents. Do not post private or your company confidential items in the database.
   3. Notifications and Distribution:
      a. Document distribution to Project members shall be accomplished both within the Construction Document Management tool and via email as appropriate. Project document distribution to parties outside of the Construction Document Management tool shall be accomplished by secure email of outgoing documents and attachments, readable by a standard email client.
      b. Minimum Equipment and Internet Connection: DSL, local cable company's Internet connection or T1 connection is required.
   4. Automated System Notification and Audit Log Tracking:
      a. Review comments made (or lack thereof) by CITY on DBF submitted documentation shall not relieve DBF from compliance with requirements

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of the Contract Documents.

b. DBF is responsible for managing, tracking, and documenting the Work to comply with the requirements of the Contract Documents. CITY's acceptance via the Construction Document Management tool notifications or audit logs extends only to the face value of the submitted documentation and does not constitute validation of the DBF's submitted information.

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION

### 3.1 SUBMITTAL LOG:

A. DBF shall maintain an accurate Submittal Log and a Distribution List for the duration of the WORK, showing current status of all Submittals and Distributees at all times in a form acceptable to the CITY. DBF shall make the Submittal Log available to the CITY for its review on request and shall bring a copy of the Submittal Log to all Progress Meetings.

**END OF SECTION 01300**

## PART 1 GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. Submit Shop Drawings, Product Data and Samples required by the Contract Documents.

### 1.2 RELATED REQUIREMENTS

A. All applicable sections of the Specifications.
B. Conditions of the Contract.
C. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that reviewed Shop Drawings, Product Data and Samples will be needed.

### 1.3 SHOP DRAWINGS

A. Drawings shall be presented in a readable and thorough condition.
   1. Drawing size shall be in standard sizes 8 ½ inch X 11 inch through 24 inch X 36 inch as appropriate for detail.
   2. Details shall be identified by reference to City of Fort Lauderdale Project Number, sheet, detail, specification section, equipment numbers, I.D. numbers and schedule numbers shown on Contract Drawings.

### 1.4 PRODUCT DATA

A. Preparation
   1. Clearly mark each copy to identify pertinent products or models.
   2. Show performance characteristics and capacities.
   3. Show dimensions and clearances required.
   4. Show wiring or piping diagrams and controls.
B. Manufacturer's standard schematic drawings and diagrams:
   1. Modify drawings and diagrams to delete information, which is not applicable to the work.
   2. Supplement standard information to provide information specifically applicable to the work

### 1.5 SAMPLES

A. Office samples shall be of sufficient size and quantity to clearly illustrate:
   1. Functional characteristics of the product with integrally related parts and attachment devices.
   2. Full rand of color, texture and pattern.

### 1.6 DBF RESPONSIBILITIES

A. Review Shop Drawings, Product Data and samples prior to submission.
B. Determine and verify:
   1. Field measurements.
   2. Field construction criteria.
   3. Catalog numbers and similar data.
   4. Conformance with specifications.
C. Coordinate each submittal with requirements of the work and of the Contract

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Documents.

D. Notify the OWNER's Representative in writing, at time of submission, of any deviations in the submittals from requirements of the Contract Documents.

## 1.7 SUBMISSION REQUIREMENTS

A. DBF shall furnish the CITY for review, 3 copies of each shop drawing submittal. The term "Shop Drawing" as used herein shall be understood to include detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items.

B. Normally, a separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of a submittal of various items using a single transmittal form will be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole. A multiple-page submittal shall be collated into sets, and each set shall be stapled or bound, as appropriate, prior to transmittal to the CITY. In any case, every separate item submitted for shop drawing approval will be uniquely numbered and dated, between the submittal and transmittal for proper tracking.

C. Except as may otherwise be indicated herein, the CITY will return prints of each submittal to the DBF with its comments noted thereon, within twenty-one (21) calendar days following their receipt by the DBF. It is considered reasonable that the DBF shall make a complete and acceptable submittal to the CITY by the second submission of a submittal item. The CITY's maximum review period for each submittal, including all resubmittals, will be 15 days per submittal. In other words, for a submittal that required two resubmittals before it is complete, the maximum review period for that submittal could be 45 days.

D. If 3 copies of a submittal are returned to the DBF marked "NO EXCEPTIONS TAKEN", formal revision and resubmission of said submittal will not be required.

E. If 3 copies of a submittal are returned to the DBF marked "MAKE CORRECTIONS NOTED," formal revision and resubmission of said submittal will not be required.

F. If a submittal is returned to the DBF marked "REVISE AND RESUBMIT" or "AMEND- RESUBMIT," the DBF shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the CITY.

G. If a submittal is returned to the DBF marked "REJECTED-RESUBMIT", the DBF shall revise said submittal and shall resubmit the required number of copies of said revised submittal to the CITY.

H. Fabrication of an item shall be commenced only after the CITY has reviewed the pertinent submittals and returned copies to the DBF marked either 'NO EXCEPTIONS TAKEN" or 'MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis for changes to the contract requirements.

I. All DBF shop drawing submittals shall be carefully reviewed by an authorized representative of the DBF, prior to submission to the CITY. Each submittal shall be dated, signed, and certified by the DBF, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so

dated, signed, and certified. No consideration for review by the CITY of any DBF submittals will be made for any items, which have not been so certified by the DBF. All non-certified submittals will be returned to the DBF without action taken by the CITY, and any delays caused thereby shall be the total responsibility of the DBF.

J. The CITY's review of DBF shop drawing submittals shall not relieve the DBF of the entire responsibility for the correctness of details and dimensions. The DBF shall assume all responsibility and risk for any misfits due to any errors in DBF submittals. The DBF shall be responsible for the dimensions and the design of adequate connections and details.

K. Submittals shall contain:
   1. The date of submission and the dates of any previous submissions.
   2. The project title and Project Number.
   3. Contract identification.
   4. The names of:
      a. Contactor
      b. Supplier
      c. Manufacturer
   5. Identification of the product, with specification section number.
   6. Field dimensions clearly identified as such.
   7. Relation to adjacent or critical features of the work or materials.
   8. Applicable standards, such as ASTM or Federal Specification numbers.
   9. Identification of deviations from Contract Documents.
   10. Identification of revisions on resubmittals.
   11. DBF's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

## 1.8 RESUBMISSION REQUIREMENTS

A. Make any corrections or changes in the submittals required by OWNER's Representative and resubmit until approved.

B. Shop Drawings and Product Data:
   1. Revise initial drawings or data and resubmit as specified for the initial submittal.
   2. Indicate any changes which have been made other than those requested by the OWNER’s Representative.

C. Samples: Submit new samples as required for initial submittal.

## 1.9 DISTRIBUTION

A. Distribute reproduction of Shop Drawings and copies of Product Data, which carry the OWNER's Representative or ENGINEER's stamp of approval to:
   1. Job site file.
   2. Record Document File.
   3. Other affected CONTRACTORs.
   4. Subcontractors.

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5. Supplier or Fabricator.

B. Distribute samples which carry the OWNER's Representative or ENGINEER's stamp of approval as directed by the CITY.

### 1.10 OWNER'S REPRESENTATIVE OR ENGINEER DUTIES

A. Review submittals with reasonable promptness and in accord with schedule.

B. Affix stamp and initials or signature, and indicate requirements for submittals, or approval of submittal.

C. Return submittals to DBF for distribution

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION (NOT APPLICABLE)

**END OF SECTION 01340**

# PART 1 GENERAL

## 1.1 GENERAL

A. Employ competent photographer to take construction record photographs periodically, monthly at a minimum, during course of the work.

## 1.2 RELATED REQUIREMENTS

A. Section 01010: Summary of Work.
B. Section 01720: Project Record Documents.

## 1.3 PHOTOGRAPHY REQUIRED

A. Provide photographs taken on cutoff date for each scheduled application for Payment.
B. Provide photographs taken at each major stage of construction.
C. Provide photographs taken of change order work.
D. Provide five prints of each view.
E. Digital Images:
    1. Remain property of photographer.
    2. Require that photographer maintain digital images for a period of two years from Date of Substantial Completion of entire Project.
    3. Photographer shall agree to furnish additional prints to OWNER and the ENGINEER at commercial rates applicable at time of purchase.

## 1.4 COSTS OF PHOTOGRAPHY

A. DBF shall pay costs for specified photography and prints.
    1. Parties requiring additional photography or prints will pay photographer directly.

## 1.5 DIGITAL PHOTOGRAPHY

A. At OWNER and ENGINEER's discretion, digital photography may be used for all construction photographs except aerial progress photographs.

# PART 2 PRODUCTS

## 2.1 PRINTS

A. Color:
    1. Paper: Single weight, color print paper.
    2. Finish: Smooth surface, glossy.
    3. Size: 8-inch x 10-inch.
B. Identify each print on back, listing:
    1. Name of Project.
    2. Specific Location.
    3. Date and time of exposure.
    4. Name and address of photographer.
    5. Photographer's numbered identification of exposure.

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## PART 3 EXECUTION

### 3.1 TECHNIQUE

A. Factual presentation.
B. Correct exposure and focus.
   1. High resolution and sharpness.
   2. Maximum depth-of-field.
   3. Minimum distortion.

### 3.2 VIEWS REQUIRED

A. Photograph from locations to adequately illustrate condition of construction and state of progress.

### 3.3 DELIVERY OF PRINTS

A. Deliver prints to the ENGINEER to accompany each Application for Payment.
B. Distribution of prints as soon as processed, is anticipated to be as follows:
   1. OWNER (one set).
   2. ENGINEER (two sets).
   3. Project Record File (one set to be stored by DBF).
   4. DBF (one set).

**END OF SECTION 01380**

## PART 1 GENERAL

### 1.1 DEFINITION

A. Specific quality control requirements for the WORK are indicated throughout the Contract Documents. The requirements of this Section are primarily related to performance of the WORK beyond furnishing of manufactured products. The term "Quality Control" includes inspection, sampling and testing, and associated requirements.

### 1.2 INSPECTION AT PLACE OF MANUFACTURE

A. Unless otherwise indicated, all products, materials, and equipment shall be subject to inspection by the CITY at the place of manufacture.

B. The presence of the CITY at the place of manufacturer, however, shall not relieve the DBF of the responsibility for furnishing products, materials, and equipment which comply with all requirements of the Contract Documents. Compliance is a duty of the DBF and said duty shall not be avoided by any act or omission on the part of the CITY.

### 1.3 SAMPLING AND TESTING

A. Unless otherwise indicated, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered; however, the OWNER reserves the right to use any generally-accepted system of sampling and testing which, in the opinion of the CITY will insure the OWNER that the quality of the work is in full accord with the Contract Documents.

B. Any waiver by the OWNER of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial WORK, shall not be construed as a waiver of any requirements of the Contract Documents.

C. Notwithstanding the existence of such waiver, the CITY reserves the right to make independent investigations and tests, and failure of any portion of the WORK to meet any of the requirements of the Contract Documents, shall be reasonable cause for the CITY to require the removal or correction and reconstruction of any such work in accordance with the General Conditions.

### 1.4 INSPECTION AND TESTING LABORATORY SERVICE

A. Inspection and testing laboratory service shall comply with the following:

1. DBF will appoint, employ, and pay for services of an independent firm to perform inspection and testing or will perform inspection and testing itself.
2. The DBF or independent firm will perform inspections, testing, and other services specified in individual specification sections and as required by the CITY.
3. Reports will be submitted to the CITY in duplicate, indicating observations

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and results of tests and indicating compliance or non-compliance with Contract Documents.

4. The DBF shall cooperate with the independent firm and furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.
5. The DBF shall notify CITY 48 hours prior to the expected time for operations requiring inspection and laboratory testing services.
6. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the CITY.
7. The DBF shall bear all costs from such retesting at no additional cost to the CITY.
8. For samples and tests required for DBF's use, the DBF shall make arrangements with an independent firm for payment and scheduling of testing. The cost of sampling and testing for the DBF'S use shall be included in the Contract Price.
9. DBF shall bear all costs if materials for testing are not ready for testing at time specified by DBF for the test.

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION

### 1.1 INSTALLATION

A. Inspection: The DBF shall inspect materials or equipment upon the arrival on the job site and immediately prior to installation and reject damaged and defective items.

B. Measurements: The DBF shall verify measurements and dimensions of the WORK, as an integral step of starting each installation.

C. Manufacturer's Instructions: Where installations include manufactured products, the DBF shall comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in Contract Documents.

**END OF SECTION 01400**

## PART 1 GENERAL

### 1.1 GENERAL

A. Mobilization shall include the obtaining of all permits; moving onto the site of all equipment; temporary buildings, and other construction facilities; and implementing security requirements; all as required for the proper performance and completion of the WORK. Mobilization shall include the following principal items:

1. Moving on to the site of all DBF's equipment required for first month operations.
2. Installing temporary construction power, wiring, and lighting facilities.
3. Developing construction water supply.
4. Providing all on-site communication facilities, including cellular telephones and internet service.
5. Providing on-site sanitary facilities and potable water facilities
6. Arranging for and erection of DBF's work, site access, and storage.
7. Obtaining all required permits.
8. Having all OSHA required notices and establishment of safety programs.
9. Having the DBF's superintendent at the job site full time.
10. Submitting initial submittals.
11. Project identification and signs as described in Section 01580.

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION

### 3.1 PAYMENT FOR MOBILIZATION

A. The DBF's attention is directed to the condition that no payment for mobilization, or any part thereof will be approved for payment under the Contract until all mobilization items listed in Paragraph 1.01.A. above have been completed as specified. Furthermore, if DBF does not have required trailer, sanitary and potable facilities in order within the first month of construction, a prorated amount of mobilization will be removed from the mobilization line item, for the extent of time taken to furnish said facilities.

**END OF SECTION 01505**

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## PART 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

A. The types of utility services required for general temporary use at the project site include the following:
   1. Water service (potable for certain uses)
   2. Storm sewer
   3. Sanitary sewer
   4. Electrical power service
   5. Telephone service/Cellular service
   6. Internet service
   7. Gas service

B. It shall be the DBF's responsibility to provide equipment that is adequate for the performance of the WORK under this Contract within the time specified. All equipment shall be kept in satisfactory operating condition, shall be capable of safety and efficiently performing the required WORK, and shall be subject to inspection and approval by the OWNER's representative at any time within the duration of the Contract. All work hereunder shall conform to the applicable requirements of the OSHA Standards for Construction.

### 1.2 JOB CONDITIONS

A. Scheduled Uses: The DBF shall, in conjunction with establishment of job progress schedule, establish a schedule for implementation and termination of service for each temporary utility or facility; at earliest feasible time, and when acceptable to OWNER change over from use of temporary utility service to permanent service.

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION

### 3.1 INSTALLATION OF POWER DISTRIBUTION SYSTEM

A. Power: The DBF shall provide all necessary power required for its operations under the Contract and shall provide and maintain all temporary power lines required to perform the WORK in a safe and satisfactory manner.

### 3.2 INSTALLATION OF LIGHTING

A. Construction Lighting: All WORK conducted at night or under conditions of deficient daylight shall be suitably lighted to insure proper WORK and to afford adequate facilities for inspection and safe working conditions.

### 3.3 WATER SUPPLY

A. General: The OWNER will furnish reasonable quantities of water required by the DBF for performance of the WORK under the Contract; however, the DBF shall provide all facilities necessary to convey the water from the OWNER-designated source to the points of use in accordance with the requirements of the Contract Document. The DBF shall pay all permit and water charges.

B. Potable Water: All drinking water on the site during construction shall be furnished

by the DBF and shall be bottled water or water furnished in acceptable metal dispensers. Notices shall be posted conspicuously throughout the site warning the DBF's personnel that piped water may be contaminated.

C. Water Connections: The DBF shall not make connection to, or draw water from, any fire hydrant or pipeline without first obtaining permission of the authority having jurisdiction over the use of said fire hydrant or pipeline and from the agency owning the affected water system. For each such connection made, the DBF shall first attach to the fire hydrant or pipeline a valve and a meter, if required by the said authority, of a size and type acceptable to said authority and agency. The DBF shall pay all permit and water charges.

D. Removal of Water Connections: Before final acceptance of the WORK on the project, all temporary connections and piping installed by the DBF shall be entirely removed, and all affected improvements shall be restored to their original condition, or better, to the satisfaction of the CITY and to the agency owning the affected utility.

## 3.4 INSTALLATION OF SANITARY FACILITIES

A. Toilet Facilities: Fixed or portable chemical toilets shall be provided wherever needed for the use of DBF's employees. Toilets at construction job sites shall conform to the requirements of Subpart D, Section 1926.51 of the OSHA Standards for Construction.

B. Sanitary and Other Organic Wastes: The DBF shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the DBF or organic material wasted from any other source related to the DBF's operations shall be disposed of away from the site in a manner satisfactory to the CITY and in accordance with all laws and regulations pertaining thereto.

## 3.5 INSTALLATION OF FIRE PROTECTION

A. Fire Protection: The construction of the WORK shall be connected with the DBF's water supply system and shall be adequately protected against damage by fire. Hose connections and hose, water casks, chemical equipment, or other sufficient means shall be provided for fighting fires in the temporary structures and other portions of the WORK, and responsible persons shall be designated and instructed in the operation such fire apparatus so as to prevent or minimize the hazard of fire. The DBF's fire protection program shall conform to the requirements of Subpart F of the OSHA Standards for Construction.

## 3.6 INSTALLATION OF COMMUNICATIONS

A. Telephone and Internet Services: The DBF shall provide and maintain at all time during the progress of the WORK not less than one telephone and one internet connection in

good working order, at CITY's field office and its own field construction office which shall be located at or near the site of the WORK included in the Contract.

B. Telephone Use: The DBF shall permit the CITY, the OWNER, or their authorized representatives or employees free and unlimited use of said telephone facilities for

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all calls that do not involve extended long-distance charges.

**END OF SECTION 01510**

## PART 1 GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. Furnish, install and maintain required construction aids, remove on completion of work.

### 1.2 RELATED REQUIREMENTS

A. All applicable sections of the Specifications.
B. Conditions of the Contract.

## PART 2 PRODUCTS

### 2.1 MATERIALS, GENERAL

A. Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.

### 2.2 CONSTRUCTION AIDS

A. Provide construction aids and equipment required by personnel and to facilitate execution of the work; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other such facilities and equipment.
   1. Refer to respective sections for particular requirements for each trade.
   2. Provide protective coverings for finished surfaces.
B. Maintain facilities and equipment in first-class condition.

## PART 3 EXECUTION

### 3.1 PREPARATION

A. Consult with OWNER's Representative, review site conditions and factors which affect construction procedures and construction aids including adjacent properties and public facilities which may be affected by execution of the work.

### 3.2 GENERAL

A. Comply with applicable requirements specified in sections of Division 2 through 4 (as applicable).
B. Relocate construction aids as required by progress of construction, by storage or work requirements, and to accommodate legitimate requirements of OWNER and other Contractors employed at the site.

### 3.3 REMOVAL

A. Completely remove temporary materials, equipment and services:
   1. When construction needs can be met by use of permanent construction.
   2. At completion of project.
B. Clean, repair damage caused by installation or by use of temporary facilities.
   1. Remove foundations and underground installations for construction aids.
   2. Grade areas of site affected by temporary installations to required elevations and slopes and clean the area.
C. Restore permanent facilities used for temporary purposed to specified condition.

**END OF SECTION 01520**

## PART 1 GENERAL

### 1.1 GENERAL

A. The DBF shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, all in accordance with requirements of the Contract Documents.

B. The DBF shall verify the exact locations and depths of all utilities shown and the DBF shall make exploratory excavations of all utilities that may interfere with the WORK. All such exploratory excavations shall be performed as soon as practicable after award of the contract and, in any event, a sufficient time in advance of construction to avoid possible delays to the DBF's work. When such exploratory excavations show the utility location as shown to be in error, the DBF shall so notify the CITY.

C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.

### 1.2 RIGHTS-OF-WAY

A. The DBF shall not do any work that would affect any oil, gas, sewer, or water pipeline; any telephone, cable or electric transmission line; any fence; or any other structure, nor shall the DBF enter upon the rights-of-way involved until notified that the OWNER has secured authority from the proper party. After authority has been obtained, the DBF shall give said party due notice of its intention to begin work, if required by said party, and shall remove, shore, support or otherwise protect such pipeline, transmission line, ditch, fence, or structure or replace the same. When two or more contracts are being executed at one time on the same or adjacent land in such manner that work on one contract may interfere with that on another, the OWNER shall determine the sequence and order of the WORK. When the territory of one contract is the necessary or convenient means of access for the execution of another contract, such privilege of access or any other reasonable privilege may be granted by the OWNER to the DBF so desiring, to the extent, amount, in the manner, and at the times permitted. No such decision as to the method or time of conducting the WORK or the use of territory shall be made the basis of any claim for delay or damage, except as provided for temporary suspension of the WORK in the General Conditions of the Contract.

### 1.3 PROTECTON OF STREET OR ROADWAY MARKERS

A. The DBF shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking, or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced. All survey markers or points disturbed by the DBF shall be accurately restored after all street or roadway resurfacing has been completed.

### 1.4 RESTORATION OF PAVEMENT

A. General: All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials and of equal thickness

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to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing the permit. All temporary and permanent pavement shall conform to the requirements of the affected pavement OWNER. All pavements which are subject to partial removal shall be neatly saw cut in straight lines.

B. Temporary Resurfacing: Wherever required by the public authorities having jurisdiction, the DBF shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.

C. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, the DBF shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.

D. Restoration of Sidewalks or Private Properties: Wherever sidewalks or private properties and driveways have been removed for purposes of construction, the DBF shall place suitable temporary sidewalks or driveways promptly after backfilling and shall maintain them in satisfactory condition for the period of time fixed by the authorities having jurisdiction over the affected portions before proceeding with the final restoration or, if no such period of times is so fixed, the DBF shall maintain said temporary sidewalks or driveways until the final restoration thereof has been made. The DBF shall restore all private properties within thirty (30) days after a complaint is received by the OWNER.

## 1.5 EXISTING UTILITIES AND IMPROVEMENTS

A. General: The DBF shall protect all Underground Utilities and other improvements which may be impaired during construction operations. It shall be the DBF's responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The DBF shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

B. Utilities to be Moved: In the case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon request of the DBF, be notified by the OWNER to move such property within a specified reasonable time. When utility lines that are to be removed are encountered within the area of operations, the DBF shall notify the CITY a sufficient time in advance for the necessary measures to be taken to prevent interruption of service.

C. Where the proper completion of the WORK requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is indicated, the DBF shall remove and, without unnecessary delay, temporarily

replace or relocate such utility or improvement in a manner satisfactory to the OWNER of the facility. In all cases of such temporary removal or relocation, restoration to former location shall be accomplished by the DBF in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.

D. OWNER's Right of Access: The right is reserved to the OWNER and to the OWNERs of public utilities and franchises to enter at any time upon any public street, alley, right-of- way, or easement for the purpose of making changes in their property made necessary by the WORK of this Contract.

E. Underground Utilities Indicated: Existing utility lines that are indicated or the locations of which are made known to the DBF prior to excavation and that are to be retained, and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired or replaced by the DBF at no cost to the CITY.

F. Underground Utilities Not Indicated: In the event that the DBF damages any existing utility lines that are not indicated or the locations of which are not made known to the DBF prior to excavation, a written report thereof shall be made immediately to the CITY. If directed by the CITY, repairs shall be made by the DBF under the provisions contained in these Contract Documents.

G. All costs of locating, repairing damage not due to failure of the DBF to exercise reasonable care, and removing or relocating such utility facilities not shown in the Contract Documents with reasonable accuracy, and for equipment on the project which was actually working on that portion of the work which was interrupted or idled by removal or relocation of such utility facilities, and which was necessarily idled during such work will be paid for in accordance with the provisions of the Contract Documents.

H. Approval of Repairs: All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the utility or improvement OWNER before being concealed by backfill or other work.

I. Maintaining in Service: All oil and gasoline pipelines, power, and telephone or the communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the WORK shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the CITY are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, or wire or cable. The DBF shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

J. Existing Water Services: DBF shall protect and provide temporary support for existing water services. Any water service damaged by the DBF, shall be replaced at the DBF's expense, with a new water service complete with new water main tap.

## 1.6 TREES WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS

A. General: The DBF shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way and

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project limits, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or OWNER. All existing trees and shrubs which are damaged during construction shall be trimmed or replaced by the DBF or a certified tree company under permit from the jurisdictional agency and/or the OWNER. Tree trimming and replacement shall be accomplished in accordance with the following paragraphs.

B. Trimming: Symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to the trunk or large branch. Spikes shall not be used for climbing live trees. All cuts over 1-1/2 inches in diameter shall be coated with an asphaltic emulsion material. There shall be no additional compensation for trees that require trimming due to damage by the DBF's operation.

C. Replacement: The DBF shall immediately notify the jurisdictional agency and/or the OWNER if any tree is damaged by the DBF's operations. If, in the opinion of said agency or the OWNER, the damage is such that replacement is necessary, the DBF shall replace the tree at DBF's own expense. The tree shall be of a like size and variety as the tree damaged, or, if of a smaller size, the DBF shall pay to the OWNER of said tree a compensatory payment acceptable to the tree OWNER, subject to the approval of the jurisdictional agency or OWNER. The size of the trees shall be not less than 1-inch diameter, nor less than 6 feet in height.

### 1.7 NOTIFICATION BY THE DBF

A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way the DBF shall notify the respective authorities representing the OWNERs or agencies responsible for such facilities not less than 3 days nor more than 7 days prior to excavation so that a representative of said OWNERs or agencies can be present during such work if they so desire. The DBF shall also notify the Sunshine State One Call Center 1-800-432-4770 at least 2 days, but no more than 14 days, prior to such excavation.

## PART 2 PRODUCTS

### 2.1 MATERIALS, GENERAL

A. Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.

### 2.2 FENCING

A. Materials to DBF's option, minimum fence height = 6 feet.

### 2.3 BARRIERS

A. Materials to DBF's option, as appropriate to serve required purpose.

## PART 3 EXECUTION

### 3.1 GENERAL

A. Install facilities with a neat and reasonable uniform appearance, structurally adequate for required purposes.
B. Maintain barriers during entire construction period.
C. Relocate barriers as required by progress of construction.

## 3.2 TREE AND PLANT PROTECTION

A. Preserve and protect existing trees and plants adjacent to work areas.
B. Consult with OWNER's Representative and remove agreed-on roots and branches which interfere with work.
    1. Employ qualified tree surgeon to remove branches, and to treat cuts.
C. Protect root zones of trees and plants.
    1. Do not allow vehicular traffic and parking.
    2. Do not store materials or products.
    3. Prevent dumping of refuse or chemically injurious materials or liquids.
    4. Prevent puddling or continuous running water.
    5. Provide temporary tree protection in accordance with City/County requirements.
D. Carefully supervise all work to prevent damage.
E. Replace trees and plants which are damaged or destroyed due to work operations under this contract.

## 3.3 REMOVAL

A. Completely remove barricades, including foundations, when construction has progressed to the point that they are no longer needed, and when approved by OWNER's Representative.
B. Clean and repair damage caused by installation, fill and grade areas of the site to required elevations and slopes, and clean the area

**END OF SECTION 01530**

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## PART 1 GENERAL

### 1.1 HIGHWAY LIMITATIONS

A. The DBF shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the WORK. It shall be the DBF's responsibility to construct and maintain any haul roads required for its construction operations.

### 1.2 TEMPORARY CROSSINGS

A. General: Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, and hospitals. Safe and adequate public transportation stops and pedestrian crossings at intervals not exceeding 300 feet shall be provided. The DBF shall cooperate with parties involved in the delivery of mail and removal of trash and garbage so as to maintain existing schedules for such services. Vehicular access to residential driveways shall be maintained to the property line except, when necessary, construction precludes such access for reasonable periods of time.

B. Temporary Bridges: Wherever necessary, the DBF shall provide suitable temporary bridges or steel plates over unfilled excavations, except in such cases as the DBF shall secure the written consent of the individuals or authorities concerned to omit such temporary bridges or steel plates, which written consent shall be delivered to the CITY prior to excavation. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation. Temporary bridges or steel plates for street and highway crossing shall conform to the requirements of the authority having jurisdiction in each case, and the DBF shall adopt designs furnished by said authority for such bridges or steel plates, or shall submit designs to said authority for approval, as may be required.

C. Street Use: Nothing herein shall be construed to entitle the DBF to the exclusive use of any public street, alleyway, or parking area during the performance of the WORK hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized work of utility companies or other agencies in such streets, alleyways, or parking areas. No street shall be closed to the public without first obtaining permission of the CITY and proper governmental authority. Where excavation is being performed in primary streets or highways, one lane in each direction shall be kept open to traffic at all times unless otherwise indicated. Toe boards shall be provided to retain excavated material if required by the CITY or the agency having jurisdiction over the street or highway. Fire hydrants on or adjacent to the WORK shall be kept accessible to fire- fighting equipment at all times. Temporary provisions shall be made by the DBF to assure the use of sidewalks and the proper functioning of all gutters, storm drain inlets, and other drainage facilities.

D. Traffic Control: For the protection of traffic in public or private streets and ways, the DBF shall provide, place, and maintain all necessary barricades, traffic cones,

warning signs, lights, and other safety devices in accordance with the requirements of The City of Fort Lauderdale and the "Manual of Uniform Traffic Control Devices, Part VI - Traffic Controls for Street and Highway Construction and Maintenance Operations," published by U.S. Department of Transportation, Federal Highway Administration (ANSI D6.1).

E. The DBF shall take all necessary precautions for the protection of the WORK and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. The DBF shall station such guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals, and barricades shall conform to the requirements of the Florida Department of Transportation.

F. The DBF shall submit 3 copies of a traffic control plan to the CITY for approval a minimum of 2 weeks prior to construction. The CITY reserves the right to observe these traffic control plans in use and to make any changes as field conditions warrant. Any changes shall supersede these plans and be done solely at the DBF's expense. Submittal to CITY of traffic control plan does not alleviate DBF from requirements of submitting plan to authorizing authority.

G. The DBF shall remove traffic control devices when no longer needed, repair all damage caused by installation of the devices, and shall remove post settings and backfill the resulting holes to match grade.

H. Temporary Driveway Closure: The DBF shall notify the OWNER or occupant (if not OWNER-occupied) of the closure of the driveways to be closed more than one eight-hour workday at least 3 working days prior to the closure. The DBF shall minimize the inconvenience and minimize the time period that the driveways will be closed. The DBF shall fully explain to the OWNER/occupant how long the work will take and when closure is to start. Total closure time shall not exceed 5 days.

## 1.3 DBF'S WORK AND STORAGE AREA

A. The DBF shall designate and arrange for the use of a portion of the property, adjacent to the WORK for its exclusive use during the term of the Contract as a storage and shop area for its construction operations relative to this Contract.

B. The DBF's use of the project site shall be limited to its construction operations. The DBF shall make its own arrangements for any necessary off-site storage or shop areas necessary for the proper execution of the WORK. A copy of an agreement for use of other property shall be furnished to the CITY. No material may be stored in the public right of way without prior authorization by the agency having jurisdiction. No material shall be stored within the public right of way in excess of 15 days. The DBF shall keep these areas in a clean and orderly condition so as not to cause a nuisance or sight obstruction to motorists or pedestrians.

C. The DBF shall construct and use a separate storage area for hazardous materials used in constructing the WORK.

1. For the purpose of this paragraph, hazardous materials to be stored in the separate area are all products labeled with any of the following terms: Warning, Caution, Poisonous, Toxic, Flammable, Corrosive, Reactive, or Explosive. In addition, whether or not so labeled, the following materials shall

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be stored in the separate area: diesel fuel, gasoline, new and used motor oil, hydraulic fluid, cement, paints and paint thinners, two-part epoxy coatings, sealants, asphaltic products, glues, solvents, wood preservatives, sand blast materials, and spill absorbent.

2. Hazardous materials shall be stored in groupings according to the Material Safety Data Sheets.
3. The DBF shall develop and submit to the CITY a plan for storing and disposing of the materials above.
4. The DBF shall obtain and submit to the CITY a single EPA number for wastes generated at the site.
5. The separate storage area shall meet all the requirements of all authorities having jurisdiction over the storage of hazardous materials.
6. All hazardous materials which are delivered in containers shall be stored in the original containers until use. Hazardous materials which are delivered in bulk shall be stored in containers which meet the requirements of authorities having jurisdiction.

### 1.4 PARKING

A. The DBF shall:

1. The DBF shall direct its employees to park in designated areas secured by the DBF.
2. Traffic and parking areas shall be maintained in a sound condition, free of excavated material, construction equipment, mud, and construction materials. The DBF shall repair breaks, potholes, low areas which collect standing water, and other deficiencies.

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION (NOT APPLICABLE)

**END OF SECTION 01550**

## PART 1 GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. Provide and maintain methods, equipment, and temporary construction, as necessary, to provide controls over environmental conditions at the construction site and related area under DBF's control; remove physical evidence of temporary facilities at completion of work.

### 1.2 RELATED REQUIREMENTS

A. All applicable sections of the Specifications.
B. Conditions of the Contract.

### 1.3 NOISE CONTROL

A. Provide all necessary requirements for noise control during the construction period.
   1. Noise procedures shall conform to all applicable OSHA requirements and local ordinances having jurisdiction on the work.
   2. Noise levels during nighttime hours shall not exceed 55 db measured at the property line of a residence.

### 1.4 DUST CONTROL

A. Provide positive methods and apply dust control materials to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from dispersing into the atmosphere.

### 1.5 WATER CONTROL

A. Provide methods to control surface water to prevent damage to the project, the site, or adjoining properties.
   1. Control fill, grading and ditching to direct surface drainage away from excavations, pits, tunnels and other construction areas; and to direct drainage to proper runoff.
B. Provide, operate and maintain hydraulic equipment of adequate capacity to control surface and water.
C. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas.

### 1.6 PEST CONTROL

A. Provide pest control as necessary to prevent infestation of construction or storage area.
   1. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties.
   2. Should the use of pesticides be considered necessary, submit an informational copy of the proposed program to OWNER with a copy to CITY. Clearly indicate:
      a. The area or areas to be treated.
      b. The pesticide to be used, with a copy of the manufacturer's printed instructions.

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c. The pollution preventative measures to be employed.

B. The use of any pesticide shall be in full accordance with the manufacturer's printed instructions and recommendations.

## 1.7 RODENT CONTROL

A. Provide rodent control as necessary to prevent infestation of construction or storage area.
   1. Employ methods and use materials, which will not adversely affect conditions at the site or on adjoining properties.
   2. Should the use of rodenticide be considered necessary, submit an informational copy of the proposed program to OWNER with a copy to OWNER's Representative. Clearly indicate:
      a. the area or areas to be treated.
      b. the rodenticide to be used, with a copy of the manufacturer's printed instructions.
      c. the pollution preventative measures to be employed.

B. The use of any rodenticide shall be in full accordance with the manufacturer's printed instructions and recommendations.

## 1.8 DEBRIS CONTROL

A. Maintain all areas under DBF's control free of extraneous debris.

B. Initiate and maintain a specific program to prevent accumulation of debris at construction site, storage and parking area, or along access roads and haul routes.
   1. Provide containers for deposit of debris as specified in Section 01710 - Cleaning.
   2. Prohibit overloading of trucks to prevent spillage on access and haul routes
      a. Provide periodic inspection of traffic areas to enforce requirements.

C. Schedule periodic collections and disposal of debris as specified in Section 01710 - Cleaning.
   1. Provide additional collections and disposal of debris whenever the periodic schedule is inadequate to prevent accumulation.

## 1.9 POLLUTION CONTROL

A. Provide methods, means and facilities required to prevent contamination of soil, water, or atmosphere by the discharge of noxious substances from construction operations.

B. Provide equipment and personnel, perform emergency measures required to contain any spillage, and to remove contaminated soils or liquids.
   1. Excavate and dispose of any contaminated earth off-site and replace with suitable compacted fill and topsoil.

C. Take special measures to prevent harmful substances from entering public waters.
   1. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams or in sanitary or storm sewers.

D. Provide systems for control of atmospheric pollutants.
   1. Prevent toxic concentrations of chemicals.

2. Prevent harmful dispersal of pollutants into the atmosphere.

**1.10 EROSION CONTROL**

A. Plan and execute construction and earthwork, by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas to prevent erosion and sedimentation.
   1. Hold the areas of bare soil exposed at one time to a minimum.
   2. Provide temporary control measures such as berms, dikes and drains.
   3. Provide silt screens as required preventing surface water contamination.

B. Construct fills and waste areas by selective placement to eliminate surface silts or clays, which will erode.

C. Periodically inspect earthwork to detect any evidence of the start of erosion, apply corrective measures as required to control erosion.

D. All erosion control procedures must comply with the National Pollutant Discharge Elimination System (NPDES). The DBF shall develop and implement a Stormwater Pollution Prevention Plan as outlined by NPDES.

**PART 2 PRODUCTS (NOT APPLICABLE)**

**PART 3 EXECUTION (NOT APPLICABLE)**

**END OF SECTION 01560**

.

## PART 1 GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. Provide, operate, and maintain equipment, services and personnel, with traffic control and protective devices, as required to expedite vehicular traffic flow on haul routes, at site entrances, on-site access roads, and parking areas.

B. Remove temporary equipment and facilities when no longer required, restore grounds to original, or specified conditions.

### 1.2 RELATED REQUIREMENTS

A. All applicable sections of the Specifications.

B. Conditions of the Contract.

### 1.3 TRAFFIC SIGNALS AND SIGNS

A. Provide and operate traffic control and directional signals or signs required to direct and maintain an orderly flow of traffic in all areas under DBF's control or affected by DBF's operations.

### 1.4 FLAGPERSON

A. Provide qualified and suitably equipped flag-person when construction operations encroach on traffic lanes, as required for regulation of traffic.

### 1.5 FLARES AND LIGHTS

A. Provide flares and lights during periods of low visibility:

1. To clearly delineate traffic lanes and to guide traffic.
2. For use of flag-person in directing traffic.

B. Provide illumination of critical traffic and parking areas.

1. Maintain free vehicular access to and through parking areas.
2. Prohibit parking on or adjacent to access roads, or in non-designated areas.

### 1.6 HAUL ROUTES

A. Consult with OWNER and governing authorities, establish public thoroughfares which will be used as haul routes and site access.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to expedite traffic flow, to minimize interference with normal public traffic.

### 1.7 EMERGENCY ACCESS

A. In order to provide protection to the workers and residents, the DBF shall maintain emergency access to all adjacent properties at all times during construction. If a road is required to be closed to vehicular traffic and the distance of the closure exceeds 150 feet between stabilized surfaces or prevents access to properties for a distance that exceeds 150 feet, the DBF shall provide a 10-foot-wide stabilized access way on one side of the trench capable of supporting a Fire Truck. DBF shall also provide stabilized access ways across the trench or unstabilized area a

minimum of 6 feet in width at a spacing not to exceed 100 feet capable of supporting foot traffic. These access ways shall be protected and delineated with lighted barricades, or other such devices as approved by the regulatory agency. Both ends of the emergency access way shall be blocked in accordance with the MOT permit approved by the applicable permitting agency (i.e. City of Fort Lauderdale) with signage indicating that this access way is to be used by emergency vehicles only.

B. No trenches or holes shall be left open after working hours. In the event a trench must be left open after hours, it shall be done so only with the express written permission from the Engineer and CITY, and it shall be the DBF's responsibility to provide proper protection of the open trench or hole as required by the regulatory agency. In addition, the DBF shall provide a security guard at the site whenever the DBF's personnel are not present, 24 hours per day/ 7 days per week. It shall be the Security Guard's responsibility to protect the open trench or hole from trespassers and to direct emergency personnel on site. The Security Guard shall not have any other responsibilities such as operation pumps or equipment but shall be dedicated to protecting the trench or open hole. The Security Guard shall be equipped with a wireless telephone capable of calling 911 to report an emergency and shall keep that telephone on their person at all times. In addition to this provision the DBF shall maintain trench safety and comply with current OSHA regulations and the Trench Safety Act. The DBF shall maintain and keep all safety barricades, signage, flashers, and detours, in operation condition. A copy of the approved MOT plans, and details, shall be on site at all times.

C. Measurement and payment for security guard services shall be included in the utility pipe installation unit price. Measurement for temporary emergency access ways will be paid for under the specified line item at the unit price described in the Bid Schedule.

**PART 2 PRODUCTS (NOT APPLICABLE)**

**PART 3 EXECUTION (NOT APPLICABLE)**

**END OF SECTION 01570**

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## PART 1 GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. Material and equipment incorporated into the work:
   1. Conform to applicable specifications and standards.
   2. Comply with size, make, type and quality specified, or as specifically approved in writing by the OWNER's Representative.
   3. Manufactured and fabricated products:
      a. Design, fabricate and assemble in accord with the best engineering and shop practices.
      b. Manufacture like parts of duplicate units to standard sizes and gauges to be interchangeable.
      c. Two or more items of the same kind shall be identical, by the same manufacturer.
      d. Products shall be suitable for service conditions.
      e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
   4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

### 1.2 RELATED REQUIREMENTS

A. All applicable sections of the Specifications.
B. Conditions of the Contract.

### 1.3 MANUFACTURER'S INSTRUCTIONS

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation prior to installation, including two copies to OWNER's Representative. Maintain one set of complete instructions at the job site during installation and until completion.
B. Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements.
   1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with OWNER's Representative for further instructions.
   2. Do not proceed with work without clear instructions.
C. Perform work in accord with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

### 1.4 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the site. Products shall be delivered to the job site on an "as needed" basis.
   1. Pipe and materials shall not be strung out along installation routes for longer than two (2) weeks prior to installation.
B. Provide equipment and personnel to handle products by methods which prevent

soiling or damage to products or packaging.

C. Coordinate deliveries to avoid conflict with Work and conditions at site such as:
   1. Work of other contractors, or OWNER
   2. Limitations of storage space.
   3. Availability of equipment and personnel for handling products.
   4. OWNER's use of premises.

D. Deliver products in undamaged condition in original containers or packaging, with identifying labels intact and legible.

E. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment, to permit easy accumulation of parts and to facilitate assembly.

F. Immediately on delivery, inspect shipment to assure:
   1. Product complies with requirements of Contract Documents and approved submittals.
   2. Quantities are correct.
   3. Containers and packages are intact, labels are legible.
   4. Products are properly protected and undamaged.

G. Provide equipment and personnel necessary to handle products, including those products provided by OWNER, by methods which prevent soiling or damage to products or packaging.

H. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.

I. Handle products by methods to prevent bending or overstressing.

J. Lift heavy components only at designated lifting points.

## 1.5 STORAGE

A. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.
   1. Store products subject to damage by the elements in weather-tight enclosures.
   2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.
   3. Store unpacked products on shelves, in bins or in neat piles, accessible for inspection.

B. Exterior Storage
   1. Provide substantial platforms, blocking or skids to support fabricating products above ground, prevent soiling or staining.
      a. Cover products, subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
   2. Store loose granular materials on solid surface such as paved areas or provide plywood or sheet materials to prevent mixing with foreign matter.
   3. Provide surface drainage to prevent flow or ponding of rainwater.
   4. Prevent mixing of refuse or chemically injurious materials or liquids.

## 1.6 MAINTENANCE OF STORAGE

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A. Maintain periodic system of inspection of stored products on scheduled basis to assure that:
   1. State of storage facilities is adequate to provide required conditions.
   2. Required environmental conditions are maintained on continuing basis.
   3. Surfaces of products exposed to elements are not adversely affected.
      a. Any weathering of products, coatings and finishes is not acceptable under requirements of Contract Documents.

B. Mechanical and electrical equipment which requires servicing during long term storage shall have complete manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on the exterior of packaging.

## 1.7 PROTECTION AFTER INSTALLATION

A. Provide protection of installed products to prevent damage from subsequent operations. Remove when no longer needed, prior to completion of work.

B. Control traffic to prevent damage to equipment and surfaces.

C. Provide coverings to protect finished surfaces from damage.
   1. Cover projections, wall corners, and jambs, sills and soffits of openings, in areas used for traffic and for passage of products in subsequent work.
   2. Protect finished floors and stairs from dirt and damage.
      a. In areas subject to foot traffic, secure heavy paper, sheet goods, or other materials in place.
      b. For movement of heavy products, lay planking or similar materials in place.
      c. Cover wall and floor surfaces in the vicinity of construction personnel activities and all finished surfaces used by construction personnel.

D. Waterproofed surfaces
   1. Prohibit use of surfaces for traffic of any kind, and for storage of any products.
   2. When some activity must take place in order to carry out the Contract, obtain recommendations of installer for protection of surface.
      a. Install recommended protection; remove on completion of that activity.
      b. Restrict use of adjacent unprotected areas.

E. Lawns and landscaping
   1. Prohibit traffic of any kind across planted lawn and landscaped areas.

F. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

## 1.8 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Products List
   1. Within 15 days after Contract Date submit to CITY a complete list of major products proposed to be used, with the name of the manufacturer and the installing Subcontractor.

B. DBF Options
   1. For products specified only by reference standard, select any product

meeting that standard.

2. For products specified by naming several products or manufacturers, select any one of the products or manufacturers named or approved equal, which complies with the Specifications.
3. For products specified by naming one or more products or manufacturers and "or approved equal," DBF must submit a request as for substitutions for any product or manufacturer not specifically named.

C. Substitutions
1. For a period of 15 days after Contract Date, CITY will consider written request from DBF for substitution of products.
2. Identify product by specification Section and Article Numbers. Provide manufacturer's name and address, trade name of product, and model of catalog number. List fabricators and suppliers as appropriate.
3. List similar projects using product, dates of installation, and name of OWNER.
4. List availability of maintenance services and replacement materials.
5. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including:
   a. Comparison of the qualities and performance of the proposed substitution with that specified.
   b. Changes required in other elements of the work because of the substitution.
   c. Effect on the construction schedule.
   d. Cost data comparing the proposed substitution with the product specified.
   e. Any required license fees or royalties.
   f. Availability of maintenance services, and source of replacement materials.
6. The burden of proof as to the type, function, and quality of any such substitute material or equipment shall be upon the DBF.
7. The CITY will be the sole judge as to the type, function, and quality of any such substitute material or equipment and the CITY's decision shall be final.
8. The CITY may require the DBF to furnish at the DBF's expense additional data about the proposed substitute.
9. The OWNER may require the DBF to furnish at the DBF's expense a special performance guarantee or other surety with respect to any substitute.
10. Acceptance by the CITY of a substitute item proposed by the DBF shall not relieve the DBF of the responsibility for full compliance with the Contract Documents and for adequacy of the substitute item.
11. The DBF shall be responsible for resultant changes and all additional costs which the accepted substitution requires in the DBF work, the work of its Subcontractors and of other Contractors, and shall effect such changes without cost to the OWNER.

D. DBF's Representation
1. A request for a substitution constitutes a representation that DBF:
   a. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.

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b. Will provide the same guarantees or bonds for the substitution as for the product specified.
c. Will coordinate the installation of an accepted substitution into the work and make such other changes as may be required to make the work complete in all respects.
d. Waives all claims for additional costs, under DBF'S responsibility, which may subsequently become apparent.

E. Submittal Procedures
1. Submit three (3) copies of request for substitution.
2. CITY will review requests for substitutions with reasonable promptness, and notify DBF, in writing, of the decision to accept or reject the requested substitution

**PART 2 PRODUCTS (NOT APPLICABLE)**

**PART 3 EXECUTION (NOT APPLICABLE)**

**END OF SECTION 01600**

## PART 1 GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. Comply with requirements stated in Conditions of the Contract and in specifications for administrative procedures in closing out the work.

### 1.2 RELATED REQUIREMENTS

A. All applicable sections of the Specifications.
B. Conditions of the Contract.

### 1.3 SUBSTANTIAL COMPLETION

A. When DBF considers the work is substantially complete, DBF shall submit to OWNER's Representative:
   1. A written notice that the work, or designated portion thereof is substantially complete.
   2. A list of items to be completed or corrected.
B. Within a reasonable time after receipt of such notice, OWNER's Representative will make an inspection to determine the status of completion.
C. Should OWNER's Representative determine that the work is not substantially complete:
   1. OWNER's Representative will promptly notify the DBF in writing, giving the reasons, therefore.
   2. DBF shall remedy the deficiencies in the work and send a second written notice of substantial completion to the OWNER's Representative.
   3. OWNER's Representative will re-inspect the work.
D. When OWNER's Representative and ENGINEER concur that the work is substantially complete, OWNER's Representative will:
   1. Prepare a Certificate of Substantial Completion accompanied by DBF's list of items to be completed or corrected, as verified and amended by the OWNER's Representative.
   2. Submit the Certificate to the OWNER and the DBF for their written acceptance of the responsibilities assigned to them in the Certificate.

### 1.4 FINAL INSPECTION

A. When DBF considers the work is complete, DBF shall submit written certification that:
   1. Contract Documents have been reviewed.
   2. Work has been inspected for compliance with Contract Documents.
   3. Work has been completed in accordance with Contract Documents.
   4. Equipment and systems have been tested in the presence of the OWNER's Representative and are operational.
   5. Work is completed and ready for final inspection.
B. OWNER's Representative and ENGINEER will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
C. Should OWNER's Representative and ENGINEER consider that the work is incomplete and defective:

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1. OWNER's Representative will promptly notify the DBF, in writing, listing the incomplete or defective work.
2. DBF shall take immediate steps to remedy the stated deficiencies and send a second written certification to OWNER's Representative that the work is complete.
3. OWNER's Representative and ENGINEER will re-inspect the work.

D. When the OWNER's Representative finds that the work is acceptable under the Contract Documents, OWNER's Representative shall request the DBF to make closeout submittals.

## 1.5 REINSPECTION FEES

A. Should OWNER's Representative perform re-inspections due to failure of the work to comply with the claims of status of completion made by the DBF:
   1. OWNER will compensate OWNER's Representative and ENGINEER for such additional services.
   2. OWNER will deduct the amount of such compensation from the final payment to the DBF.

## 1.6 DBF'S CLOSEOUT SUBMITTALS TO OWNER'S REPRESENTATIVE

A. Evidence of compliance with requirements of governing authorities.
   1. Certificate of Occupancy (as applicable).
   2. Certificates of Inspection (as applicable).
      a. Mechanical.
      b. Electrical.
      c. City of Fort Lauderdale Public Works.
      d. Other, as may be required.

B. Project Record Documents.
      a. As-builts
      b. Approved Shop Drawings
      c. O&M Manuals
      d. Warranties
      e. Construction Photos
      f. Permits

C. Guarantees and Bonds.

D. Evidence of Payment and Release of Liens:To requirements of General and Supplementary General Conditions.

E. Certificate of Insurance for Products and Completed Operations.

F. Permit closeouts and certifications.

## 1.7 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to OWNER's Representative.

B. Statement shall reflect all adjustments to the Contract Sum.
   1. The original Contract Sum.
   2. Additions and deductions resulting from:
      a. Previous change orders.

b. Allowances.
c. Unit Prices.
d. Deductions for uncorrected work.
e. Penalties and Bonuses.
f. Deductions for liquidated damages.
g. Deductions for re-inspection payments.
h. Other adjustments.

3. Total Contract Sum, as required.
4. Previous payments.
5. Sum remaining due.

C. OWNER's Representative will prepare a final Change Order, reflecting approved adjustments to the Contract Sum, which were not previously made by Change Orders.

### 1.8 FINAL APPLICATION FOR PAYMENT

A. DBF shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

**PART 2 PRODUCTS (NOT APPLICABLE)**

**PART 3 EXECUTION (NOT APPLICABLE)**

**END OF SECTION 01700**

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## PART 1 GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. Execute cleaning, during progress of the Work, and at completion of the Work, as required by the General Conditions.

### 1.2 RELATED REQUIREMENTS

A. All applicable sections of the Specifications.
B. Conditions of the Contract.

### 1.3 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

## PART 2 PRODUCTS

### 2.1 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
B. Use only those cleaning materials and methods recommended by cleaning material manufacturer.

## PART 3 EXECUTION

### 3.1 DURING CONSTRUCTION

A. Execute periodic cleaning to keep the work, the site and adjacent properties free from accumulation of waste material, rubbish and windblown debris, resulting from Construction Work.
B. Provide on-site containers for the collection of waste materials, debris and rubbish.
C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.
D. The OWNER's Representative reserves the right to direct the DBF to remove waste materials, after which waste shall be removed within 24 hours.
E. Mechanical Sweeping: DBF shall maintain on site a mechanical sweeping device for removing debris from existing, temporary and permanent pavement.

### 3.2 DUST CONTROL

A. Perform operations so that dust and other contaminants resulting from Construction Work operations will not cause any damages or maintenance problems to adjacent properties.
B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

### 3.3 FINAL CLEANING

A. Employ skilled laborers for final cleaning.
B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.
C. Polish glossy surfaces to a clear shine.

D. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
E. Prior to final completion, or OWNER occupancy, DBF shall conduct an inspection of sight- exposed interior and exterior surfaces, and all work areas, to verify the entire work is clean.
F. All storage and staging areas shall be cleaned and returned to prior conditions or better as per requirements of this section.

## 3.4 MEASURE AND PAYMENT

A. There shall be no special measurement or payment for the work under this section; it shall be included in the price of all other work.

**END OF SECTION 01710**

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## PART 1 GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the sub- surface investigation work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

B. The sub-surface investigation for conditions of the project site is the sole responsibility of the DBF. In preparing the Bid, the DBF shall make all sub-surface or surface investigations necessary to provide proper background and knowledge to determine the nature and extent of work required.

C. OWNER or OWNER's Representative provides limited sub-surface information, and makes no warranties or guarantees concerning the nature of materials to be encountered on the site.

### 1.3 RELATED WORK

A. Section 02110 - Clearing.

B. Section 02200 – Earthwork.

C. All applicable sections under Divisions 1, 2, 3, and 4.

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION (NOT APPLICABLE)

**END OF SECTION 02010**

## PART 1 GENERAL

### 1.1 REQUIREMENTS INCLUDED

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the site demolition work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

### 1.3 RELATED WORK

A. Section 02200 - Earthwork.
B. All applicable Sections under Divisions 1, 2, and 3.

### 1.4 QUALITY ASSURANCE

A. DBF Qualifications: Minimum of five years of experience in demolition of comparable nature.
B. Requirements of All Applicable Regulatory Agencies:
   1. All applicable Building Codes and other Public Agencies having jurisdiction upon the work.

### 1.5 SUBMITTALS

A. Permits and notices authorizing building demolition.
B. Certificates of severance of utility services.
C. Permit for transport and disposal of debris.
D. Demolition procedures and operational sequence for review and acceptance by CITY.

### 1.6 JOB CONDITIONS

A. Existing Conditions
   1. The demolition work shall be done as indicated on the construction plans.
   2. Remove all demolition debris from the site the same day the work is performed. Leave no deposits of demolished material on site overnight.
   3. Structural demolition, excavation, backfill and compaction as indicated in drawings.
B. Protection:
   1. Erect barriers, fences, guardrails, enclosures, and shoring to protect personnel, structures, and utilities remaining intact.
   2. Protect designated trees and plants from damages.
   3. Use all means necessary to protect existing objects and vegetation designated to remain, and, in the event of damage, immediately make all repairs, replacements and dressings to damaged plants necessary, to the approval of the CITY at no additional cost to the OWNER.
C. Maintaining Traffic:
   1. Ensure minimum interference with roads, streets, driveways, sidewalks, and

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adjacent facilities.

2. Do not close or obstruct streets and sidewalks without written approval from the CITY.
3. If required by governing authorities, provide alternate routes around closed or obstructed traffic ways.

D. Dust Control
1. Use all means necessary for preventing dust from demolition operations from being a nuisance to adjacent property owners. Methods used for dust control are subject to approval by the CITY prior to use.

E. Burning
1. On-site burning will not be permitted.

**1.7 GENERAL ITEMS**

A. Scope of work shall comprise the following: Provide all labor, materials, necessary equipment and services to complete the demolition and clearing work, as indicated on the contract plans, and as specified herein.

B. The DBF shall provide references to the OWNER to demonstrate that they are well versed in demolition of a comparable nature. Current occupational licenses held by DBF shall be submitted to OWNER.

C. The DBF shall be responsible for adherence to all applicable codes of all regulatory agencies having jurisdiction upon the works.

**1.8 PRE-DEMOLITION MEETING**

A. A meeting shall be held with the OWNER or OWNER's representative at the jobsite to describe intended demolition and cleaning procedures and schedules. This shall include identifying access routes for bringing necessary equipment in, removing debris from site, and designation of any trees, drives or other items to remain.

**1.9 EXISTING CONDITIONS**

A. The DBF shall become thoroughly familiar with the site, and of existing utilities and their connections, and note all conditions, which may influence the work.

B. By submitting a bid, the DBF affirms that DBF has carefully examined the site and all conditions affecting work. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

C. The OWNER shall be responsible for removal of all hazardous materials such as asbestos, chemicals, etc., from the site prior to DBF mobilizing on site. The OWNER shall be notified immediately should the DBF discover any further hazardous materials during demolition.

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION

**3.1 INSPECTION**

A. DBF shall verify that structures to be demolished are discontinued in use and ready for removal.

B. DBF shall not commence work until all conditions and requirements of all applicable public agencies are complied with.

## 3.2 PREPARATION

A. Arrange for and verify termination of utility services to include removing meters and capping lines.
B. Notification:
   1. Notify the OWNER at least three full working days prior to commencing the work of this Section.
C. The drawings do not purport to show all objects existing on the site; at the pre-demolition meeting before commencement of the work, verify with the OWNER all objects to be removed and all objects to be preserved.

## 3.3 CLARIFICATION

A. The drawings do not purport to show all objects existing on the site.
B. Before commencing the work of this Section, verify with the OWNER all objects to be removed and all objects to be preserved.

## 3.4 SCHEDULING

A. Schedule all work in a careful manner with all necessary consideration for the public and the OWNER.
B. Avoid interference with the use of, and passage to and from, adjacent facilities.

## 3.5 DISCONNECTION OF UTILITIES

A. Before starting site operations, disconnect or arrange for the disconnection of all affected utility service.
   1. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Disconnect and stub off. Notify affected utility company in advance and obtain approval before starting this work.
   2. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction.
   3. Place markers to indicate location of disconnected services.
   4. On-site drainage structures and drain fields shall be removed in their entirety by methods approved by the OWNER's representative.

## 3.6 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. Utility Services: Maintain existing offsite utilities, keep in service, and protect against damage during demolition operations.
B. Prevent movement or settlement of adjacent structures. Provide and place bracing or shoring and be responsible for safety and support of structures. Assume liability for such movement, settlement, damage, or injury.
C. Cease operations and notify OWNER immediately if safety of adjacent structures appears to be endangered. Take precautions to properly support structures. Do not resume operations until safety is restored.
D. Prevent movement, settlement, damage, or collapse of adjacent services,

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sidewalks, driveways and trees. Assume liability for such movement, settlement, or collapse. Promptly repair damage at no cost to the OWNER.

E. Ensure safe passage of persons around areas of demolition.

## 3.7 MAINTAIN TRAFFIC

A. Do not interfere with use of adjacent buildings and facilities. Maintain free and safe passage to and from. Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed travel ways if required by governing authorities.

## 3.8 POLLUTION CONTROLS

A. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

B. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations as directed by the OWNER or their representative or governing authorities. Return adjacent areas to condition existing prior to start of work.

## 3.9 DEMOLITION

A. Pull out any existing utility lines designated for abandonment, irrigation, electrical lines, pull boxes and splice boxes, Maintenance Access Structure (MAS) and catch basins to be removed and all other objects designated to be removed or interfering with the work. Contact the utility company or agency involved for their requirements for performing this work. All removed equipment and materials shall be removed from the work area the same day as removed.

B. Remove all debris from the site and leave the site in a neat, orderly condition to the full acceptance of the OWNER. No debris shall be left on the site overnight.

C. Clear and Grub and dispose of all hedges, shrubs and other organic matter not otherwise addressed on tree removal and relocation plans and specifications.

## 3.10 DEMOLITION OF SITE STRUCTURES

A. Demolish all site structure items designated to be removed or which are required to be removed to perform the work. This item does not include buildings.

## 3.11 REMOVAL OF DEBRIS AND DISPOSAL OF MATERIAL

A. Material resulting from demolition and not scheduled for salvaging shall become the property of the DBF and shall be removed from site and legally disposed of off-site. Disposal shall be timely, performed as promptly as possible and not left until the final cleanup. Material shall not be left on the job site for more than 60 days.

B. Remove from site contaminated, vermin infested, or dangerous materials encountered and disposed of by safe means so as not to endanger health of

workers and public.

C. Burning of removed materials from demolished structures will not be permitted on-site.

## 3.12 COMPLETION OF WORK

A. Leave the site in a neat, orderly condition to the full acceptance of the OWNER.

B. Dirt remaining after demolition shall be graded level and compacted, in preparation for filling operations to follow demolition. Trenches shall be filled in layers of 12-inch maximum thickness and compacted in accordance with the technical specifications applicable to backfilling of trenches.

**END OF SECTION 02050**

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## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the clearing work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

B. Under this section, the DBF shall do all clearing, grubbing, root-raking, and necessary clean-up operations in connection with the construction of the work and its related site work.

C. The work shall consist of the removal and disposal of plants, shrubs, hedges, stumps, roots, limbs, brush, fences, asphalt, etc. from all project areas as designated on the drawings and specified herein, and as directed by the CITY on the site.

D. The DBF shall remove all refuse, asphalt pavement, concrete pavement, glass, metal, stone, plaster, lumber, paper materials, and any and all trash found in clearing project area and in adjacent areas as directed by the CITY.

E. The DBF shall furnish all services, labor, transportation, materials, and equipment necessary for the performance of these operations. All clearing and cleanup operations shall be accomplished to the complete satisfaction of the CITY.

### 1.3 RELATED WORK

A. Section 02010 – Sub-surface Investigation.

**B.** Section 02200 - Earthwork.

## PART 2 PRODUCTS (NOT APPLICABLE)

## PART 3 EXECUTION

### 3.1 TREE REMOVAL AND TREE PRESERVATION

A. No trees shall be removed if located outside of the right-of-way and dedicated easement.

B. Within the rights-of-way and easements, no trees with a trunk diameter of 3 inch or greater at 4-1/2 inch above grade shall be removed without the approval of the CITY with the exception of Australian Pines, Meleleuca or Florida Holly. Trees shall be evaluated on an individual basis in accordance with following:

1. Type and size of tree.
2. Proximity to proposed and/or existing utility lines and/or exfiltration trench.
3. Change in adjacent grades for swale excavation.
4. Proximity to proposed sidewalk.
5. Proximity to proposed edge of roadway.
6. Living condition of the tree.

C. If trees are determined to remain, Biobarrier shall be installed in accordance with the Biobarrier detail as shown on the Landscape Plans.

**END OF SECTION 02110**

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## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the dewatering work, as indicated in the Contract Documents or listed in permit requirements, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

### 1.3 RELATED WORK

A. Section 02200 - Earthwork.
B. Section 02221 - Excavation and Backfilling for Utilities.
C. Section 02601 - Subterranean Structures.
D. Section 02610 - Piping, General Section.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT

A. Dewatering, where required, may include the use of temporary reservoirs and diking, well points, sump pumps, temporary pipelines for water disposal, rock or gravel placement, and other means. Standby pumping equipment must be maintained on the job site and operate within any local noise ordinance limits. All safety requirements, fencing, etc. shall be installed and maintained by the DBF.

## PART 3 EXECUTION

### 3.1 GENERAL REQUIREMENTS

A. The DBF shall provide all equipment necessary for dewatering. It shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition and shall have available, at all times, competent laborers for the operation of the pumping equipment. Adequate standby equipment shall be kept available at all times to insure efficient dewatering and maintenance of dewatering operation during power failure.
B. Dewatering for structures and pipelines shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.
C. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.
D. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
E. If foundation soils are disturbed or loosened by the upward seepage of water or an

uncontrolled flow of water, the affected areas shall be excavated and replaced with pea rock at no additional cost to the CITY.

F. The DBF shall maintain the water level below the bottom of excavation in all work areas where groundwater occurs during excavation construction, backfilling, and up to acceptance.

G. The DBF shall prevent flotation by maintaining positive and continuous removal of water. The DBF shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.

H. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sand-packed and/or other means used to prevent pumping of fine sands or silts from the sub-surface. A continual check by the DBF shall be maintained to ensure that the sub-surface soil is not being removed by the dewatering operation.

I. The DBF shall dispose of water from the WORK in a suitable manner without damage to adjacent property. DBF shall be responsible for obtaining any permits that may be necessary to dispose of water. No water shall be drained into work built or under construction without prior consent of the CITY. Water shall be filtered using a silt box or another approved method to remove sand and fine-sized soil particles before disposal into any drainage system. The dewatering disposal points shall be approved by the CITY prior to being used. Storm drains facilities used by the DBF for dewatering shall be cleaned by a jet vac, or other method approved by the CITY after dewatering is complete.

J. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, pipelines, and sewers.

K. Dewatering of trenches and other excavations shall be considered, as incidental to the construction of the WORK and all costs thereof shall be included in the various contract prices in the Bid Forms, no separate bid item has been established for dewatering.

L. The DBF shall submit a dewatering plan to the CITY for review. The DBF is advised that the Broward County Environmental Protection and Growth Management Department (BCEPD) and/or SFWMD permits are to be obtained and will require that the DBF follow certain dewatering constraints. The dewatering plan shall be prepared by a State of Florida licensed Professional Engineer or Registered Professional Geologist and shall meet dewatering permit requirements. SPECIAL INSTRUCTIONS are noted on approved dewatering permit.

M. The DBF is advised that the BCEPD may have identified contaminated sites within 1/4- mile radius of the project site. The DBF will be required to provide testing and monitoring of the dewatering operations, and to institute dewatering methods and controls, as required by BCEPD, as noted in permit documents.

## 3.2 QUALITY CONTROL

A. It shall be the sole responsibility of the DBF to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.

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B. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the DBF.

C. Where critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement, which may develop. The responsibility for conducting the dewatering operation in a manner, which will protect adjacent structures and facilities, rests solely with the DBF. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the DBF.

## 3.3 DBF SUBMITTALS

A. Prior to commencement of excavation, the DBF shall submit a detailed plan and operation schedule for dewatering of excavations. The DBF may be required to demonstrate the system proposed and to verify that adequate equipment, personnel, and materials are provided to dewater the excavations at all locations and times. The DBF's dewatering plan is subject to review by the CITY and regulatory agencies.

## 3.4 SPECIAL INSTRUCTIONS

A. See permit documents.

**END OF SECTION 02140**

# PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

## 1.2 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the Earthwork, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

B. Including but not necessarily limited to the following:
   1. Excavation, including demucking.
   2. Backfilling,
   3. Filling.
   4. Grading, general site and building pads.
   5. Compaction.

C. There shall be no classification of excavation for measurement of payment regardless of materials encountered.

D. The work of this Section includes all earthwork required for construction of the WORK. Such earthwork shall include, but not be limited to, the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the work specified in the Contract Documents, which shall include, but not be limited to, the furnishing, placing, and removing of sheeting and bracing necessary to safely support the sides of all excavation; all pumping, ditching, draining, and other required measures for the removal or exclusion of water from the excavation; the supporting of structures above and below the ground; all backfilling around structures and all backfilling of trenches and pits; the disposal of excess excavated materials; borrow of materials to makeup deficiencies for fills; and all other incidental earthwork, all in accordance with the requirement of the Contract Documents.

## 1.3 RELATED WORK

A. All applicable sections of Division 1, 2, 3, and 4.

## 1.4 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS.

A. Codes: All codes, as referenced herein, are specified in Section 01090, "Reference Standards".

B. Commercial Standards:

| | |
|---|---|
| ASTM D 1556 | Method for Particle-Size Analysis of Soils |
| ASTM D 698 | Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49-kg) Rammer and 12-in (304.8-mm) Drop. |
| ASTM D 1556 | Test Method for Density of Soil in Place by the Sand Cone Method. |
| ASTM D 1557 | Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in (457-mm) Drop |
| ASTM D 1633 | Test Method for Compressive Strength of Molded Soil-Cement Cylinders |
| ASTM D 2419 | Test Method for Sand Equivalent Value of Soils and Fine Aggregate. |
| ASTM D 2487 | Classification of Soils for Engineering Purposes. |
| ASTM D 2901 | Test Method for Cement Content of Freshly-Mixed Soil-Cement. |
| ASTM D 2922 | Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth). |
| ASTM D 4253 | Test Methods for Maximum Index Density of Soils Using a Vibratory Table. |
| ASTM D 4254 | Test Methods for Minimum Index Density of Soils and Calculation of Relative Density. |

## 1.5 SUBSOIL INFORMATION

A. There are no representations of any type made as to sub-surface conditions.

## 1.6 SITE INSPECTION

A. DBF shall visit the site and acquaint with all existing conditions. DBF shall investigate the site and sub-surface conditions with no cost to the OWNER if DBF chooses to. Such sub- surface investigations shall be performed only under time schedules and arrangements approved in advance by the OWNER's Representative.

## 1.7 TOPOGRAPHIC INFORMATION

A. The existing grades shown on the drawings are approximate only and no representation is made as to their accuracy or consistency. The DBF shall verify all existing grades to the extent necessary to insure completion of the job to the proposed grades indicated on the drawings.

## 1.8 DISPOSAL OF SURPLUS OR UNSUITABLE MATERIAL

A. Unsuitable material encountered during the course of construction shall be removed from the construction site at the expense of the DBF. Unsuitable material shall not be stockpiled on-site. All suitable material shall be stockpiled on-site at areas designated by the CITY.

## 1.9 BENCHMARKS AND MONUMENTS

A. DBF shall employ a registered Professional Surveyor and Mapper per Florida Statute 472.001-472.037 to lay out lines and grades as indicated. The surveyor

shall establish benchmarks. Benchmarks shall be permanent and easily accessible and maintained and replaced if disturbed or destroyed. All benchmarks shall be NAVD 88.

### 1.10 UTILITIES

A. Before starting site operations, disconnect or arrange for the disconnection of all utility services designated to be removed.

B. Locate all existing active utility lines traversing the site and determine the requirements for their protection. Preserve in operating condition all active utilities adjacent to or traversing the site which are designated to remain.

C. Observe rules and regulations governing respective utilities when working under requirements of this section. Adequately protect utilities from damage, remove or replace as indicated, specified or required. Remove, plug or cap inactive or abandoned utilities encountered in excavation. Record the location of all utilities.

### 1.11 QUALITY ASSURANCE

A. The DBF shall re-adjust all work performed that does not meet technical or design requirements but make no deviations from the Contract Documents without specific and written acceptance of the CITY.

B. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with ASTM D 1557. Where cohesionless, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density will be determined in accordance with ASTM D 4253 and D 4254. Field density in-place tests will be performed in accordance with ASTM D 1556, ASTM D 2922, or by such other means acceptable to the CITY.

C. In case the tests of the fill or backfill show non-compliance with the required density, the DBF shall accomplish such remedy as may be required to insure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the OWNER and shall be at the DBF's expense.

D. Particle size analysis of soils and aggregates will be performed using ASTM D 422.

E. Determination of sand equivalent value will be performed using ASTM D 2419.

F. Unified Soil Classification System: References in these specifications to soil classification types and standards are set forth in ASTM D 2487. The DBF shall be bound by all applicable provisions of said ASTM D 2487 in the interpretation of soil classifications.

G. Requirements of all applicable building codes and other public agencies having jurisdiction upon the work.

## PART 2 PRODUCTS

### 2.1 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

A. General: Fill, backfill, and embankment materials shall be suitable selected or processed clean, fine earth, rock, or sand, free from grass, roots, brush, or other vegetation.

B. Fill and backfill materials to be placed within 6 inches of any structure or pipe shall

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be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 3 inches.

C. Suitable Materials: Soils not classified as unsuitable as defined in the Paragraph entitled, "Unsuitable Material" herein, are defined as suitable materials and may be used in fills, backfilling, and embankment construction subject to the specified limitations. In addition, when acceptable to the CITY, some of the material listed as unsuitable may be used when thoroughly mixed with suitable material to form a stable composite.

D. Suitable materials may be obtained from on-site excavations, may be processed on-site materials, or may be imported. If imported materials are required to meet the requirements of this Section or to meet the quantity requirements of the project the DBF shall provide the imported materials at no additional expense to the OWNER, unless a unit price item is included for imported materials in the bidding schedule.

E. The following types of suitable materials are designated and defined as follows:

1. Type A (one inch minus granular backfill): Crushed rock, gravel, or sand with 100 percent passing a 1-inch sieve and a sand equivalent value not less than 50.
2. Type B (one half inch minus granular backfill): Crushed rock, gravel, or sand with 100 percent passing a 1/2-inch sieve and a sand equivalent value not less than 50.
3. Type C (sand backfill): Sand with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a number 4 sieve, and a sand equivalent value not less than 30.
4. Type D (coarse rock backfill): Crushed rock or gravel with 100 percent passing a 1-inch sieve and not more than 10 percent passing a Number 4 sieve.
5. Type E (pea gravel backfill): Crushed rock or gravel with 100 percent passing a 1/2-inch sieve and not more than 10 percent passing a Number 4 sieve.
6. Type F (coarse drainrock): Crushed rock or gravel meeting the following gradation requirements:

| Sieve Size | Percentage Passing |
|---|---|
| 2-inch | 100 |
| 1-1/2-inch | 90-100 |
| 1-inch | 20-55 |
| 3/4-inch | 0-15 |
| No. 200 | 0-3 |

7. Type G (aggregate base): Crushed rock aggregate base material of such nature that it can be compacted readily by watering and rolling to form a firm, stable base for pavements. At the option of the DBF, the grading for either the 1-1/2-inch maximum size or 3/4-inch maximum size shall be used. The sand equivalent value shall be not less than 22, and the material shall meet the following gradation requirements.

| Sieve Size | Percent Passing 1-1/2-inch Max. | 3/4-inch Max. |
|---|---|---|
| 2-inch | 100 | - |
| 1-1/2-inch | 90-100 | - |
| 1-inch | - | 100 |
| 3/4-inch | 50-85 | 90-100 |
| No. 4 | 25-45 | 35-55 |
| No. 30 | 10-25 | 10-30 |
| No. 200 | 2-9 | 2-9 |

8. Type H (graded drainrock): Drainrock shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying. The material shall be uniformly graded and shall meet the following gradation requirements.

| Sieve Size | Percentage Passing |
|---|---|
| 2-inch | 100 |
| 3/4-inch | 90-100 |
| 3/8-inch | 10-100 |
| No. 4 | 25-40 |
| No. 8 | 18-33 |
| No. 30 | 5-15 |
| No. 50 | 0-7 |
| No. 200 | 0-3 |

The drainrock shall have a sand equivalent value not less than 75. The finish-graded surface of the drainrock immediately beneath hydraulic structures shall be stabilized to provide a firm, smooth surface upon which to construct reinforced concrete floor slabs. The DBF shall use, at its option, one of the asphalt types listed below:

| | Type 1 | Type 2 | Type 3 |
|---|---|---|---|
| Designation | SC-70 | SC-250RS-1 | |
| Spray Temperature (□F) | 135-175 | 165-200 | 70-120 |
| Coverage (gal/sq yd) | 0.50 | 0.50 | 0.50 |

9. Type I: Any other suitable material as defined herein.
10. Type J (cement-treated backfill): Material which consists of Type H material, or any mixture of Types B, C, G and H materials which has been cement-treated so that the cement content of the material is not less than 5 percent by weight when tested in accordance with ASTM D 2901. The ultimate compressive strength at 28 days shall be not less than 400 psi when tested in accordance with ASTM D 1633.
11. Type K (topsoil): Stockpiled topsoil materials, which have been obtained at the site by removing soil to a depth not exceeding 2 feet. Removal of the topsoil shall be done after the area has been stripped of vegetation and debris as specified.

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12. Type L (Class I crushed stone): Manufactured angular, granular crushed stone, rock, or slag, with 100 percent passing a 1-inch sieve and less than 5 percent passing a Number 4 sieve.
13. Type M (aggregate subbase): Crushed rock aggregate subbase material that can be compacted readily by watering and rolling to form a firm stable base. The sand equivalent value shall be not less than 18 and shall meet the following gradation requirements.

| Sieve Size | Percentage Passing |
|---|---|
| 3-inch | 100 |
| 2-1/2-inch | 87-100 |
| No. 4 | 35-95 |
| No. 200 | 0-29 |

14. Type N (trench plug): Low permeable fill material, a non-dispersible clay material having a minimum plasticity index of 10.

## 2.2 UNSUITABLE MATERIAL

A. Unsuitable soils for fill material shall include soils which, when classified under ASTM D 2487, fall in the classifications of PT, OH, CH, MH or OL.

B. In addition, any soil, which cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use, shall be classed as unsuitable material.

## 2.3 USE OF FILL, BACKFILL, AND EMBANKMENT MATERIAL TYPES

A. The DBF shall use the types of materials as designated herein for all required fill, backfill, and embankment construction hereunder.

B. Where these Specifications conflict with the requirements of any local agency having jurisdiction, or with the requirements of a material manufacture, the CITY shall be immediately notified. In case of conflict therewith, the DBF shall use the most stringent requirement, as determined by the CITY.

C. Fill and backfill types shall be used in accordance with the following provisions:
   1. Embankment fills shall be constructed of Type I material, as defined herein, or any mixture of Type I and Type A through Type H materials.
   2. Pipe zone backfill, as defined under "Pipe and Utility Trench Backfill" herein, shall consist of the following materials for each pipe material listed below. Where pipelines are installed on grades exceeding 4 percent, and where backfill materials are graded such that there is less than 10 percent passing a Number 4 sieve, trench plugs of Type J or N material shall be provided at maximum intervals of 200 feet or as shown on the Drawings.
      a. Mortar coated pipe, concrete pipe, and uncoated ductile iron pipe shall be provided Type A, B, C, D, E, or L pipe zone backfill material.
      b. Coal tar enamel coated pipe, polyethylene encased pipe, tape wrapped pipe, and other non-mortar coated pipe shall be backfilled with Type C pipe zone backfill material.
      c. Plastic pipe and vitrified clay pipe shall be backfilled with Type L pipe

zone backfill material.

3. Trench zone backfill for pipelines as defined under "Pipe and Utility Trench Backfill" shall be Type I backfill material or any of Types A through H backfill materials or any mixture thereof, except that Type K material may be used for trench zone backfill in agricultural areas unless otherwise shown or specified.
4. Final backfill material for pipelines under paved area, as defined under "Pipe and Utility Trench Backfill" shall be Type G backfill material. Final backfill under areas not paved shall be the same material as that used for trench backfill, except that Type K material shall be used for final backfill in agricultural areas unless otherwise shown or specified.
5. Trench backfill, and final backfill for pipelines under structures shall be the same material as used in the pipe zone, except where concrete encasement is required by the Contract Documents.
6. Aggregate base materials under pavements shall be Type G material constructed to the thickness shown or specified. Where specified or shown, aggregate subbase shall be Type M Material.
7. Backfill around structures shall be Type I material, or Types A through Type H materials, or any mixture thereof.
8. Backfill materials beneath structures shall be as follows:
   a. Drainrock materials under hydraulic structures or other water retaining structure with underdrain systems shall be Type H material.
   b. Under concrete hydraulic structures or other water retaining structures without underdrain systems, Types G or H materials shall be used.
   c. Under structures where groundwater must be removed to allow placement of concrete, Type F material shall be used.
   d. Under all other structures, Type D, E, G, or H material shall be used.
9. Backfill used to replace pipeline trench over-excavation shall be a layer of Type F material with a 6-inch top filter layer of Type E material or filter fabric to prevent migration of fines for wet trench conditions or the same material as used for the pipe zone backfill if the trench conditions are not wet. Filter fabric shall be Mirafi 140 N, Mirafi 700X, or approved equal.
10. The top 6 inches of fill on reservoir roofs, embankment fills around hydraulic structures, and all other embankment fills shall consist of Type K material, topsoil.

## 2.4 EMBANKMENT

A. The maximum sizes of rock, which will be permitted in the completed fill areas, are as follows:

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| Depth Below Finish Grade | Maximum Allowable Diameter |
|---|---|
| Top 4 inches | 1 inch |
| 4 inches to 12inches | 3-1/2-inches |
| 12 inches to 2 feet | 6 inches |
| 2 feet to 4 feet | 12 inches |
| 4 feet to 8 feet | 24 inches |
| Below 8 feet | 36 inches |

B. Embankments shall be constructed of material containing no muck, stumps, roots, brush, vegetable matter, rubbish or other material that will not compact into a suitable and enduring roadbed, and material designated as undesirable shall be removed from the site. Where embankments are constructed adjacent to bridge end bents or abutments, rock larger than 3-1/2 inches in diameter shall not be placed within three feet of the location of any abutment.

C. Fill material containing debris, sod, and biodegradable materials shall not be used as fill in construction areas.

D. Fill material required for the building pads and for pavement subgrade shall be granular fill, free of organic material.

E. Fill material required for pervious and sodded areas shall have a maximum organic component of 10%. DBF shall provide, at DBF'S cost, organic content test results for approval by the CITY.

## PART 3 EXECUTION

### 3.1 JOB CONDITIONS

A. Protection: Use all means necessary to protect existing objects and vegetation. In the event of damage, immediately make all repairs, and replacements necessary to the acceptance of the OWNER's Representative at no cost to the OWNER.

### 3.2 BACKFILL, FILLING, & GRADING

A. Grades:
   1. Cut, backfill, fill and grade to proper grade levels indicated. The existing grades shown on the drawings are to be matched for finished grade over the site.

B. Filling:
   1. Fill material shall be placed in horizontal layers and spread to obtain a uniform thickness.
   2. After compaction, layers of fill are not to exceed twelve (12) inches for cohesive soils or eight (8) inches for non-cohesive soils.

### 3.3 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

A. General: Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grades shown or ordered. Unless otherwise provided, the entire construction site

shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. The DBF shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other measure for the removal or exclusion of water, including taking care of storm water, groundwater, and wastewater reaching the site of the work from any source so as to prevent damage to the work or adjoining property. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

B. Excavation Beneath Structures and Embankments: Except where otherwise specified for a particular structure or ordered by the CITY, excavation shall be carried to the grade of the bottom of the footing or slab. Where shown or ordered, areas beneath structures or fills shall be over-excavated. The subgrade areas beneath embankments shall be excavated to remove not less than the top [6 inches] of native material and where such subgrade is sloped, the native material shall be benched. When such over excavation is shown, the DBF shall perform both over-excavation and subsequent backfill to the required grade. When such over-excavation is not shown but is ordered by the CITY, such over-excavation and any resulting backfill will be paid for under a separate unit price bid item if such bid item has been established; otherwise payment will be made in accordance with a negotiated price. After the required excavation or over-excavation has been completed, the exposed surface shall be scarified to a depth of 6 inches, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain density as specified in Paragraph 3.14.I.

C. Excavation Beneath Paved Areas: Excavation under areas to be paved shall extend to the bottom of the aggregate base or subbase, if such base is called for; otherwise it shall extend to the paving thickness. After the required excavation has been completed, the top 12 inches of exposed surface shall be scarified, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain density as specified in Paragraph
3.14.I. The finished subgrade shall be even, self-draining, and in conformance with the slope of the finished pavement. Areas that could accumulate standing water shall be regraded to provide a self-draining subgrade.

D. Notification: The DBF shall notify the CITY at least 3 days in advance of completion of any structure excavation and shall allow the CITY a review period of at least one day before the exposed foundation is scarified and compacted or is covered with backfill or with any construction materials.

## 3.4 PIPELINE AND UTILITY TRENCH EXCAVATION

A. General: Unless otherwise shown or ordered, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of pipe zone densification selected by the DBF but shall have a minimum width at the bottom of the trench equal to the outside diameter of the pipe plus 24 inches for mechanical compaction methods and 18 inches for water consolidation methods.

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B. Trench Bottom: Except when pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe. The trench bottom shall be given a final trim, using a string line for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Rounding out the trench to form a cradle for the pipe will not be required. Excavations for pipe bells and welding shall be made as required.

C. Open Trench: The maximum amount of open trench permitted in any one location shall be 300 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades and warning lights meeting OSHA requirements shall be provided and maintained.

D. Trench Over-Excavation: Where the Drawings indicate that trenches shall be over-excavated, they shall be excavated to the depth shown, and then backfilled to the grade of the bottom of the pipe.

E. Over-Excavation: When ordered by the CITY, whether indicated on the Drawings or not, trenches shall be over-excavated beyond the depth shown. Such over-excavation shall be to the depth ordered. The trench shall then be backfilled to the grade of the bottom of the pipe. All work specified in this Section shall be performed by the DBF when the over- excavation ordered by the CITY is less than 6 inches below the limits shown. When the over-excavation ordered by the CITY is 6 inches or greater below the limits shown, additional payment will be made to the DBF for that portion of the work which is located below said 6-inch distance. Said additional payment will be made under separate unit price bid items for over-excavation and bedding if such bid items have been established; otherwise payment will be made in accordance with a negotiated price.

F. Where pipelines are to be installed in embankment or structure fills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

## 3.5 OVER-EXCAVATION NOT ORDERED, SPECIFIED, OR SHOWN

A. Any over-excavation carried below the grade ordered, specified, or shown, shall be backfilled to the required grade with the specified material and compaction. The DBF at its own expense shall perform such work.

## 3.6 EXCAVATION IN LAWN AREAS

A. Where excavation occurs in lawn areas, the sod shall be carefully removed, kept damp, and stockpiled to preserve it for replacement. Excavated material may be placed on the lawn, provided that a drop cloth or other suitable method is employed to protect the lawn from damage. The lawn shall not remain covered for more than 72 hours. Immediately after completion of backfilling and testing of the pipeline, the

sod shall be replaced and lightly rolled in a manner so as to restore the lawn as near as possible to its original condition. DBF shall provide new sod if stockpiled sod has not been replaced within 72 hours.

## 3.7 EXCAVATION IN VICINITY OF TREES

A. Except where trees are shown to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without express permission of the CITY. Trees shall be supported during excavation by any means previously reviewed and approved by the CITY.

## 3.8 ROCK EXCAVATION

A. Rock is defined as follows:
   1. Rock shall be classified as material having a blow count in excess of 30 blows per foot from a Standard Penetration Test (ASTM D-1586) and exceeding 1000 psi from an Unconfined Compression Strength Test (ASTM D-2938); and,
   2. General Excavation - Any material that cannot be excavated with a single-toothed ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 71,000 lbs. (Caterpillar D9N or equivalent), and occupying an original volume of at least 2 cubic yards or more; and,
   3. Trench Excavation - Any material that cannot be excavated with a backhoe having a breakout force rated at not less than 44,000 lbs. (Caterpillar 235D or equivalent) and occupying an original volume of at least 2 cubic yards.

B. Rock excavation shall include removal and disposal of the following: (1) all boulders measuring 1/3 of a cubic yard or more in volume; (2) all rock material in ledges, bedding deposits, and unstratified masses which cannot be removed without systematic drilling and blasting; (3) concrete or masonry structures which have been abandoned; and (4) conglomerate deposits which are so firmly cemented that they possess the characteristics of rock as described in Paragraph 3.09(A).

C. Said rock excavation shall be performed by the DBF; provided, that should the quantity of rock excavation be affected by any change in the scope of the work, an appropriate adjustment of the contract price will be made under a separate bid item if such bid item has been established; otherwise, payment will be made in accordance with the negotiated price.

D. Explosives and Blasting: Blasting will not be permitted, except by express permission of the CITY on a case-by-case basis. The use of explosives will be subject to the approval and regulations of all agencies having jurisdiction. If blasting is utilized at the site of the WORK, the DBF shall take all precautions and provide all protective measures necessary to prevent damage to property and structures or injury to person. Prior to blasting, the DBF shall secure all permits required by law for blasting operations and shall provide any additional hazard insurance required by the OWNER. The DBF shall have a fully qualified and experienced blasting construction supervisor in charge of all blasting operations.

E. The DBF will be held responsible for all and shall make good any damage caused by blasting or resulting from its possession or use of explosives on the WORK.

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F. All operations involving the handling, storage, and use of explosives shall be conducted in accordance with the requirements of the OSHA Standards for Construction, and in accordance with all local laws and regulations.

## 3.9 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. The DBF shall remove and dispose of all excess excavated material at a site selected by the DBF and reviewed by the CITY.

## 3.10 DISPOSAL OF UNSUITABLE EXCAVATED MATERIAL

A. The DBF shall remove and dispose of all unsuitable excavated material. This shall include muck, tree roots, rocks, garbage, debris, or any other material designated as unsuitable by Paragraph 2 of this Section. Disposal shall be at a site selected by the DBF that is designated as an approved disposal site for the unsuitable material.

## 3.11 BACKFILL – GENERAL

A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

B. Except for drain rock materials being placed in over-excavated areas or trenches, backfill shall be placed after all water is removed from the excavation.

## 3.12 PLACING AND SPREADING OF BACKFILL MATERIALS

A. Backfill materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment the layers shall be evenly spread so that when compacted each layer shall not exceed 6 inches in thickness.

B. During spreading each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Pipe zone backfill materials shall be manually spread around the pipe so that when compacted the pipe zone backfill will provide uniform bearing and side support.

C. Where the backfill material moisture content is below the optimum moisture content water shall be added before or during spreading until the proper moisture content is achieved.

D. Where the backfill material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is satisfactory.

## 3.13 COMPACTION – GENERAL

A. Compact each layer of fill in designated areas with approved equipment to achieve a maximum density at optimum moisture, AASHTO T 180 - latest edition.

1. Building Pads: compaction shall be to 98% of maximum density, unless otherwise shown on the drawings or specifications. Building pads shall be within plus or minus one-tenth (0.1) of a foot of the elevations shown on the plans.
2. Refer to Sections 02513 Asphaltic Concrete Paving - General for compaction

requirements in the affected areas.

3. Under landscaped area, compaction shall be to density as specified in Paragraph 3.14.I., unless otherwise shown on the Drawings.

B. No backfill shall be placed against any masonry or other exposed building surface until permission has been given by the OWNER's Representative, and in no case until the masonry has been in place seven days.

C. Heavy construction equipment will not be permitted within ten (10) feet of any masonry or other exposed building surface.

D. Compaction in limited areas shall be obtained by the use of mechanical tampers or approved hand tampers. When hand tampers are used, the materials shall be deposited in layers not more than four inches thick. The hand tampers used shall be suitable for this purpose and shall have a face area of not more than 100 square inches. Special precautions shall be taken to prevent any wedging action against masonry, or other exposed building surfaces/

## 3.14 COMPACTION OF FILL, BACKFILL, AND EMBANKMENT MATERIALS

A. Each layer of Types, A, B, C, G, H, I, and K backfill materials as defined herein, where the material is graded such that at least 10 percent passes a No. 4 sieve, shall be mechanically compacted to the specified percentage of maximum density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.

B. Each layer of Type D, E, F, and J backfill materials shall be compacted by means of at least 2 passes from a flat plate vibratory compactor. When such materials are used for pipe zone backfill, vibratory compaction shall be used at the top of the pipe zone or at vertical intervals of 24 inches, whichever is the least distance from the subgrade.

C. Type L material requires mechanical spreading and placement to fill voids but does not require mechanical compaction or vibration.

D. Fill on reservoir and structure roofs shall be deposited at least 30 days after the concrete roof slab has been placed. Equipment weighing more than 10,000 pounds when loaded shall not be used on a roof. A roller weighing not more than 8,000 pounds shall be used to compact fill on a roof.

E. Flooding, ponding, or jetting shall not be used for fill on roofs, backfill around structures, backfill around reservoir walls, for final backfill materials, or aggregate base materials.

F. Pipe zone backfill materials that are granular may be compacted by a combination of flooding and vibration using concrete vibrators or by jetting, when acceptable to the CITY.

G. Pipeline trench zone backfill materials, containing 5 percent or less of material passing a No. 200 sieve, may be compacted using flooding and jetting or vibration if the DBF uses effective procedures that yield the specified compaction test results. Flooding and jetting shall not be done in such a manner that the pipe or nearby utilities are damaged, in areas of poorly draining or expansive soils, or where the use of the procedure is prohibited by any agency having jurisdiction

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over the street or right-of-way. Approved jet pipes or immersible vibrators shall be used so that each backfill layer is saturated and consolidated to its full depth before the next layer is placed. Jet pipes shall be kept at least 6 inches away from the pipe where the backfills being consolidated and 2 feet away from other pipes or utilities.

H. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the fill at that time. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations.

I. Compaction Requirements: The following compaction test requirements shall be in accordance with AASHTO T-180. Where agency or utility company requirements govern, the highest compaction standards shall apply.

| Location or Use of Fill | Percentage of Maximum Density |
|---|---|
| Pipe zones backfill portion above bedding for flexible pipe. | 98 |
| Pipe zones backfill bedding and over-excavated zones under bedding/pipe for flexible pipe, including trench plugs. | 98 |
| Pipe zones backfill potion above bedding for rigid pipe. | 98 |
| Pipe zones backfill bedding and over-excavated zones under bedding/pipe for rigid pipe. | 98 |
| Final backfills, beneath paved areas or structures. | 98 |
| Final backfills, not beneath paved areas or structures. | 95 |
| Trench zones backfill, not beneath paved areas or structures, including trench plugs. | 95 |
| Embankments. | 98 |
| Embankments, beneath paved areas, or Structures. | 98 |
| Backfill beneath structures, hydraulic structures. | 98 |
| Backfill around Structures | 98 |
| Topsoil (Type K material) | 80 |
| Aggregate base or subbase (Type G or M material) | 80 |

J. Trench Backfill Requirements: the pipe has been structurally designed based upon the trench configuration specified herein.

K. The DBF shall maintain the indicated trench cross section up to a horizontal plane lying 6 inches above the top of the pipe.

L. If, at any location under said horizontal plane, the DBF slopes the trench walls or exceeds the maximum trench widths indicated in the Contract Documents, the pipe zone backfill shall be “improved” or the pipe class increased as specified

herein, at no additional cost to the OWNER. “Improved” backfill shall mean sand-cement backfill or other equivalent materials acceptable to the CITY.

M. If the allowable deflection specified for the pipe is exceeded, the DBF shall expose and reground or replace the pipe, repair all damaged lining and coating, and reinstall the pipe zone material and trench backfill as specified at no additional expense to the OWNER.

## 3.15 PIPE AND UTILITY TRENCH BACKFILL

A. Pipe zone Backfill: The pipe zone is defined as that portion of the vertical trench cross- section lying between a plane 6 inches below the bottom surface of the pipe, i.e., the trench subgrade, and a plane at a point 6 inches above the top surface of the pipe. The bedding for flexible pipe is defined as that portion of pipe zone backfill material between the trench subgrade and the bottom of the pipe. The bedding for rigid pipe is defined as that portion of the pipe zone backfill material between the trench subgrade and a level line which varies from the bottom of the pipe to the spring line as shown.

B. Bedding shall be provided for all sewers, drainage pipelines, and other gravity flow pipelines. Unless otherwise specified or shown, for other pipelines the bedding may be omitted if all the following conditions exist.

1. The pipe bears on firm, undisturbed native soil, which contains only particles that will pass a one-inch sieve.
2. The trench excavation is not through rock or stones.
3. The trench subgrade soils are classified as suitable fill and backfill materials per Paragraph 2.01.
4. The trench subgrade soils have, as a maximum, a moisture content that allows compaction.

C. Where bedding is required, after compacting the bedding the DBF shall perform a final trim using a stringline for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Excavation for pipe bells and welding shall be made as required.

D. The pipe zone shall be backfilled with the specified backfill material. The DBF shall exercise care to prevent damage to the pipeline coating, cathodic bonds, or the pipe itself during the installation and backfill operations.

E. Trench Zone Backfill: After the pipe zone backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the trench zone may proceed. The trench zone is defined as that portion of the vertical trench cross- section lying between a plane 6 inches above the top surface of the pipe and a plane at a point 18 inches below the finished surface grade, or if the trench is under pavement, 18 inches below the roadway subgrade. If flooding, ponding, or jetting is used the pipe shall be filled with water to prevent flotation.

F. Final Backfill: Final backfill is all backfill in the trench cross-sectional area within 18 inches of finished grade, or if the trench is under pavement, all backfill within 18 inches of the roadway subgrade.

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## 3.16 EMBANKMENT CONSTRUCTION

A. The area where an embankment is to be constructed shall be cleared of all vegetation, roots and foreign material. Following this, the surface shall be moistened, scarified to a depth of 6 inches, and rolled or otherwise mechanically compacted as specified in Paragraph 3.14.I. Embankment fill material shall be placed and spread evenly in horizontal layers. Each layer shall be moistened or aerated, as necessary. Unless otherwise approved by the CITY, each layer shall not exceed 6 inches of compacted thickness. The embankment fill and the scarified layer of underlying ground shall be compacted to 95 percent of maximum density under structures and paved areas, and 90 percent of maximum density elsewhere.

B. When an embankment fill is to be made and compacted against hillsides or fill slopes steeper than 4:1, the slopes of hillsides or fills shall be horizontally benched to key the embankment fill to the underlying ground. A minimum of 12 inches normal to the slope of the hillside or fill shall be removed and recompacted as the embankment fill is brought up in layers. Material thus cut shall be recompacted along with the new fill material at the DBF's expense. Hillside of fill slopes 4:1 or flatter shall be prepared in accordance with Paragraph A, above.

C. Where embankment or structure fills are constructed over pipelines, the first 4 feet of fill over the pipe shall be constructed using light placement and compaction equipment that does not damage the pipe. Heavy construction equipment shall maintain a minimum distance from the edge of the trench equal to the depth of the trench until at least 4 feet of fill over the pipe has been completed.

## 3.17 CORRECTION OF GRADE

A. Bring to required grade levels areas where settlement, erosion or other grade changes occur.

## 3.18 MAINTENANCE AND PROTECTION OF WORK

A. While construction is in progress adequate drainage for the roadbed shall be maintained at all times.

B. The DBF shall maintain all earthwork construction throughout the life of the contract, unless otherwise provided, and shall take all reasonable precautions to prevent loss of material from the roadway due to the action of wind or water. DBF shall repair at DBF'S expense, except as otherwise provided herein, any slides, washouts, settlement, subsidence, or other mishap which may occur prior to final acceptance of the work.

C. All channels excavated as a part of the contract work shall be maintained against natural shoaling or other encroachments to the lines, grades, and cross sections shown on the plans, until final acceptance of the project.

## 3.19 AS-BUILT SURVEY

A. At the completion of the work and prior to final inspection of the area, the DBF shall provide the CITY with an as-built topographic survey made by a Professional Surveyor and Mapper per Florida Statute 472.001-472.037.

B. The surveyor is to certify on the survey whether or not the as-built conditions conform to the elevations shown on the Drawings to within plus or minus two-hundredth (0.02) of a foot.

**END OF SECTION 02200**

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# PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

## 1.2 WORK INCLUDED

A. Remove existing asphalt concrete pavement by milling to improve the rideability and cross slope of the finished pavement, to lower the finished grade adjacent to existing curb prior to resurfacing, or to completely remove existing pavement.
B. When milling to improve rideability, the plans will specify an average depth of cut.
C. DBF to take ownership of milled material.

# PART 2 PRODUCT

## 2.1 EQUIPMENT

A. Provide a milling machine capable of maintaining a depth of cut and cross slope that will achieve the results specified in the Contract Documents. Use a machine with a minimum overall length (out to out measurement excluding the conveyor) of 18 feet and a minimum cutting width of 6 feet.
B. Equip the milling machine with a built-in automatic grade control system that can control the transverse slope and the longitudinal profile to produce the specified results.
C. To start the project, the CITY will approve any commercially manufactured milling machine that meets the above requirements. If it becomes evident after starting milling that the milling machine cannot consistently produce the specified results, the CITY will reject the milling machine for further use.
D. The DBF may use a smaller milling machine when milling to lower the grade adjacent to existing curb or other areas where it is impractical to use the above described equipment.
E. Equip the milling machine with means to effectively limit the amount of dust escaping during the removal operation.

# PART 3 EXECUTION

## 3.1 MILLING

A. Protection: Use all means necessary to protect existing objects and vegetation. In the event of damage, immediately make all repairs, and replacements necessary to the acceptance of the OWNER's Representative at no cost to the OWNER.

## 3.2 BACKFILL, FILLING, & GRADING

A. Remove the existing raised reflective pavement markers prior to milling. Include the cost of removing existing pavement markers in the price for milling.
B. When milling to improve rideability or cross slope, remove the existing pavement to the average depth specified in the plans, in a manner that will restore the pavement surface to a uniform cross-section and longitudinal profile. The CITY may require the use of a stringline to ensure maintaining the proper alignment.
C. Establish the longitudinal profile of the milled surface in accordance with the milling

plans. Ensure that the final cross slope of the milled surface parallels the surface cross slope shown on the plans or as directed by the CITY. Establish the cross slope of the milled surface by a second sensing device near the outside edge of the cut or by an automatic cross slope control mechanism. The plans may waive the requirement of automatic grade or cross slope controls where the situation warrants such action.

D. Multiple cuts may be made to achieve the required pavement configuration or depth of cut. Include in the Quality Control Plan a system to control the cross slope of the milling surface with a minimum frequency of one cross slope measurement every 250 feet during milling operations in order to ensure that the slopes are uniform and in compliance with the designed milling slope. When the difference between the measured cross slope and the designed cross slope exceeds ±0.2% for travel lanes (including turn lanes) and ±0.5% for shoulders, make all corrections immediately to bring the cross slope into an acceptable range. The CITY will periodically verify the DBF's measurements at the job site.

E. The CITY can randomly take ten measurements of the cross slope per day for the first two days of milling operation. If the average cross slope of the ten random measurements per day varies more than the required tolerance (0.2% for travel lanes including turn lanes and 0.5% for shoulders), the milling operation shall be stopped until appropriate corrective actions are made to bring the cross slope into an acceptable range. Approval by the CITY will be required prior to resuming the milling operation.

F. A recheck of ten random measurements will be made after corrective actions are taken. If the recheck indicates that the cross slope is out of control, the deficient section(s) shall be corrected to bring the cross slope into an acceptable range. During milling operations, the CITY reserves the right to take ten cross slope measurements per day. If the average cross slope of the ten measurements varies more than the permissible tolerance, the milling operation will be stopped until appropriate corrective actions are made to bring the cross slope into an acceptable range and the deficient sections shall be corrected accordingly.

G. The CITY may waive the corrections specified above if an engineering determination indicates that the deficiencies are sufficiently separated so as not to significantly affect the final cross slope.

H. For intersections, tapers, crossovers, transitions at the beginning and end of the project and in other similar areas, the cross slope will be adjusted as directed by the CITY to match the actual site conditions.

I. Operate the milling machine to minimize the amount of dust being emitted. The CITY may require pre-wetting of the pavement.

J. Provide positive drainage of the milled surface and the adjacent pavement. Perform this operation on the same day as milling. Repave all milled surfaces no later than the day after the surface was milled unless otherwise stated in the plans.

K. If traffic is to be maintained on the milled surface prior to the placement of the new asphalt concrete, provide suitable transitions between areas of varying thickness to create a smooth longitudinal riding surface. Produce a pattern of striations that will provide an acceptable riding surface.

L. Prior to opening an area which has been milled to traffic, sweep the pavement with

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a power broom or other approved equipment to remove, to the greatest extent practicable, fine material which will create dust under traffic. Sweep in a manner that will minimize the potential for creation of a traffic hazard and to minimize air pollution.

M. Sweep the milled surface with a power broom prior to placing asphalt concrete

N. In urban and other sensitive areas, use a street sweeper or other equipment capable of removing excess milled materials and controlling dust.

O. Perform the sweeping operation immediately after the milling operations or as directed by the CITY.

### 3.3 MILLED SURFACE

A. Provide a milled surface with a reasonably uniform texture, within 1/4 inch of a true profile grade, and with no deviation in excess of 1/4 inch from a straightedge applied to the pavement perpendicular to the centerline.

B. Ensure that the variation of the longitudinal joint between multiple cut areas does not exceed 1/4 inch. The CITY may accept areas varying from a true surface in excess of the above stated tolerance without correction if the CITY determines that they were caused by a pre-existing condition which could not have reasonably been corrected by the milling operations.

C. Correct any unsuitable texture or profile, as determined by the CITY, at no additional expense to the OWNER.

D. The CITY may require remilling of any area where a surface lamination causes a non- uniform texture to occur.

E. Refer to Section 02513 for specifications on resurfacing of asphaltic pavement.

**END OF SECTION 02212**

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. The work shall consist of furnishing all materials, labor and equipment for excavation, trenching and backfilling for utilities. "Utilities" shall include storm water drains, culverts, water mains, gravity sewers, sewage force mains and appurtenant structures.

### 1.3 RELATED WORK

A. 02200 – Earthwork.

## PART 2 PRODUCT (NOT APPLICABLE)

## PART 3 EXECUTION

### 3.1 EXCAVATION

A. General: This work shall consist of the excavation of whatever substances shall be encountered to the depths as shown on the plans. Excavated materials not required for fill or backfill shall be removed from the work site as directed by the CITY and shall be considered to be a part of the bid price of the utility pipe for which excavation and backfill is required.

B. Excavation for structures and other accessories shall have a minimum clearance of twelve inches and a maximum clearance of twenty-four inches on all sides.

C. Excavation shall not be carried below the required depths as indicated by the plans. Excess excavation below the required level shall be backfilled at the DBF's expense with sharp sand, gravel or other suitable material thoroughly compacted and approved by the CITY.

D. Any unstable soil shall be removed and shall be replaced by material acceptable to the CITY. The removal and replacement of such unstable soil shall be considered to be part of the bid price of the pipe for which excavation and backfill is required.

E. Water shall not be permitted to accumulate in the excavated area. It shall be removed by pumping or other means as approved by the CITY. The removal of water shall be considered to be a part of the bid price of the pipe for which excavation and backfill is required.

F. Well points, pumps or other approved means shall be used to keep the ground water sufficiently low in the opinion of the CITY to permit the placing of concrete, masonry, or pipe in first class condition, and sufficiently long thereafter to protect the concrete, masonry or joints against washing or damage.

G. The DBF shall also use such other means as may be necessary to keep the excavation in satisfactory condition for the construction of the work, and the use of well points, or other approved method, will not relieve the DBF of DBF'S responsibility to make structures watertight.

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H. Banks and trenches shall be vertical unless shown otherwise on plans. The width of the trench shall be no less than 24 inch plus the diameter of the pipe, or as approved by the CITY. Bell holes shall be accurately excavated by hand.

I. If the bottom of the trench is rock, the excavation shall be carried eight inches below the invert of the pipe and backfilled with thoroughly compacted sharp sand, gravel or other suitable material approved by the CITY.

J. See Section 02200 Part 3.08 for specifications on Rock Excavation.

K. Whenever it is necessary, in the interest of safety, to brace or shore the sides of the trench, such bracing or shoring shall be considered to be part of the bid price of the pipe for which excavation and backfill is required.

L. The DBF shall furnish, put in place, and maintain such sheeting, bracing, as may be required to support the side of the excavation, and to prevent any movement which can in any way damage the work or endanger adjacent structures. If the CITY is of the opinion that supports are insufficient, the CITY may order additional supports. The compliance with such order shall not release the DBF from DBF'S responsibility for the sufficiency of the sheeting. The DBF shall leave all sheeting in place. The CITY may require sheeting to be cut off at any specified elevation, but in no case will any sheeting be left closer than two (2) feet below the natural surface, nor cut off below the elevation of the top of the pipe.

## 3.2 BACKFILLING

A. After pipes, structures and other appurtenances have been installed, the trench or opening shall be backfilled with material free from large stones or clods of a quality acceptable to the CITY.

B. Backfill around the pipe and to a point twelve inches above the top of the pipe shall be placed in six-inch layers compacted with 20 pound hand tampers or mechanical tampers suitable for this purpose. Backfilling shall follow lying closely and shall not be more than one hundred (100) feet behind completed lying. Backfill over pipe shall be carefully placed by experienced labor and thoroughly consolidated without shock to the pipe and carried up uniformly on both sides of the pipe. No backfilling with bulldozers will be permitted adjacent to pipeline.

C. Within roadway rights-of-way, or within areas where pavements are to be constructed over the pipe, the remainder of the trench shall be placed in six-inch layers (compacted thickness) and shall be compacted to that as noted in Section 02200. DBF will be responsible for correcting settlement in all backfilled areas whether under the pavement or otherwise.

D. In areas where no pavement is to be constructed, the backfill above the twelve-inch line above the pipe shall be compacted to firmness approximately equal to that of the soil adjacent to the pipe trench or to that as noted in Section 02200. Backfill below the 12-inch line shall be compacted in 6-inch layers (compacted thickness) and shall be compacted to 98% of maximum density as determined by AASHTO T-180.

## 3.3 EXPLOSIVES

A. The use of explosives will not be permitted. See Section 02200 Part 3.08

Paragraph D through F for further instruction.

**END OF SECTION 02221**

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# PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

## 1.2 WORK INCLUDED

A. The DBF shall furnish all labor, materials, equipment and incidentals required to install pipe by the technique of inserting the pipe directly into a directional drilled opening; at the locations shown on the Drawings and as specified herein.

B. All directional drill operations shall be performed in accordance with all requirements of the permitting agency and other agencies having jurisdiction over the work area.

## 1.3 RELATED WORK

A. Division 2 as applicable.

B. Section 02200 – Earthwork.

C. Section 02221 Excavation and Backfilling for Utilities.

D. Section 02510 Piping, General.

E. Section 02641 Valves, General.

F. Exhibit D Permit Conditions.

G. Commercial Standards:

| | |
|---|---|
| ASTM F 1962 | Maxi-Horizontal Directional Drilling |
| ASTM F 2620 | Heat Fusion Joining of Polyethylene Pipe and Fittings |

## 1.4 GENERAL REQUIREMENTS

A. Directional drilling and pipe installation shall be done only by an experienced, licensed contractor specializing in directional drilling technique and whose key personnel have at least five (5) years of experience in this work. Furthermore, the said contractor shall have had experience in directional drilling under Florida waterways and major roadways.

B. The DBF shall visit the site and determine the proximity of structures on either side of the crossings. The DBF shall provide the OWNER with a drilling plan outlining procedures to prevent drilling fluid or the drilling process from adversely affecting these structures.

C. Prior to pre-construction meeting DBF is to submit “Frac-Out Plan” (see Exhibit A) per State Water Quality Standards, pursuant to Rule 62-302, with details of the non-toxic florescent tracking dyes that the DBF will be using with the drilling lubricant as a monitoring method with the bentonite.

D. Prior to the start of work, the DBF shall engage a Professional Engineer registered in the State of Florida to design a detailed plan of boring and receiving pits, including excavation, together with an outline of the methods to be used and a time schedule for directional drill operations. In addition, DBF shall identify an environmental scientist/biologist with experience in water quality monitoring and habitat protection to be used in the event of a frac-out near protected areas.

E. Three workdays written notice prior to start of the actual work shall be given to the

OWNER.

F. The DBF shall install, maintain, and leave in place any sheeting, underpinning, cribbing, and other related items (other than that required for the boring and receiving pits) to support any structure or facility affected by the boring operations. The CITY, depending upon existing conditions, may require that additional sheeting for the excavation be left in place.

G. The DBF shall maintain traffic whenever possible during fusing and installation operations. Fusing and staging areas shall be carefully planned, and locations shall be approved b the CITY.

H. The DBF shall assume all responsibility for the methods and means of construction, the stability and accuracy of the drilled and reamed hole and constructed pits, and all cost responsible for the safety of the pits and related structures, and personnel engaged in construction throughout the duration of work.

I. All work under this specification affecting the right-of-way, or municipal facilities shall be carried out to the full satisfaction of the authorized representative. It is the DBF's responsibility to be fully informed of all requirements, and permit conditions as it pertains to the specific project and shall conduct all work accordingly.

J. All equipment used by the DBF on OWNER's property and rights-of-way may be inspected by the OWNER or the OWNER's Representatives.

K. The DBF shall be fully responsible for all damages arising from the failure of the DBF or Subcontractors to comply with the regulations and the requirements of these Specifications.

L. The DBF's methods and schedule shall comply with the overall project requirements. The DBF shall be familiar with the work within the local subsurface conditions. The DBF's selection of inadequate, inappropriate, or inefficient equipment and methods will not be cause for adjustments to the Contract price or Contract time.

M. The DBF shall be responsible for all clean-up of project site, debris, materials and equipment and shall clear the site of and dispose of them in accordance with Contract Documents.

## 1.5 SUBMITTALS

A. The DBF shall submit for the OWNER's approval the qualifications of the directional drilling specialty provider indicating compliance with the following minimum experience criteria:

1. Descriptions of successfully completed similar projects using the guided directional drill technique, which shall include a listing of the following information.
    a. Project name and location
    b. Year of Project
    c. Owner/Client
    d. Client contact information
    e. Diameter and material of pipe
    f. Length of direction drilling installation
    g. Other information relevant to the successful completion of the project

2. Documentation of compliance with the following minimum standards:
    a. The directional drilling specialty provider shall be an experienced, licensed contractor specializing in guided directional drilling and whose key personnel assigned to this work shall have a minimum of five (5) years of related directional drilling experience.
    b. The directional drilling specialty provider shall have installed utilities under major roadways and waterways via directional drill technique.

B. Two (2) weeks prior to the start of the directional drilling work, the DBF shall submit the directional drilling work plan for the OWNER's review. The work plan shall include the following information.
    1. A plan showing details of the proposed method of construction, sequence of operations to be performed, number and size of construction crew, hours to be worked, pilot hole drilling procedure, reaming procedure, pullback procedure, method of monitoring the drilling head and method of verifying pipe location for as-built drawings.
    2. A drilling fluid plan which details types of drilling fluids, including the of non-toxic fluorescent tracking dyes, cleaning and recycling equipment, estimated flow rates, and procedures for minimizing drilling fluid escape.
    3. A plan in the event of drilling fluid escape including, but not limited to, stoppage of work, notification of applicable permitting authorities whose right-of-way is impacted by the escape of drilling fluid, procedure to confine drilling fluids/muds, and procedure for repair/plugging of fissures. See Dewatering Permit for requirements that will need to be met, at no additional cost to the OWNER, should fluid escape.
    4. A plan and profile drawing showing the DBF's proposed pilot bore hole routing and location of other underground utilities. The plan drawing shall be at a 1 inch = 20-foot scale and the profile drawing at a 1 inch = 20 foot scale horizontal and 1 inch = 2 foot scale vertical.
    5. A 1 inch = 20-foot scale drawing of the proposed setup of major equipment at the entry point and the proposed layout at the exit point.

C. The DBF shall furnish shop drawings showing all fabrication and construction details for the directional drilled crossings.

D. The DBF shall use dataloggers to record and monitor fusing of HDPE pipe. Upon completion of the fusing and prior to pulling the pipe, the DBF must provide the datalogger information to the Engineer for review.

E. The DBF will be responsible for maintaining drilling logs that provide drill bit locations at least 30 feet along the drill path. In addition, logs will be kept that record the following on an hourly basis throughout each drill pass, back ream pass or pipe installation pass:
    1. Drill fluid pressure
    2. Drilling fluid flow rate
    3. Drill thrust pressure
    4. Drill pullback pressure
    5. Drill head torque
    6. Horizontal distance of drill head from entry point

F. Upon completion of the pilot hole phase of the operation, a complete set of as-built records showing the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 30 feet shall be submitted in duplicate to the CITY along with one electronic AutoCAD as-built drawing file. Contractor shall provide as-builts (mapping) of the installed pipe based on the tracking data generated by the guidance system used during installation. These records shall include copies of the plan drawing at a 1 inch = 20-foot scale, and a profile drawing at a 1 inch = 20 foot scale horizontal and a 1 inch = 2 foot scale vertical, as well as directional survey reports as recorded during the drilling operation.

### 1.6 SAFETY

A. The DBF shall, at all times, conform to all applicable State and Federal regulations.

B. DBF is to adhere to requirements of all permits. See Permit Conditions for permit requirements.

C. Guided Directional Drilling Equipment machine safety requirements will include a common grounding system to prevent electrical shock in the event of high voltage underground cable strike. The grounding system will connect all pieces of interconnecting machinery: the drill, mud mixing system, drill power unit, drill rod trailer, operator's booth, worker grounding mats and any other interconnected equipment to a common ground. The drill will be equipped with an "electrical strike" audible and visual warning system that will notify the system operators of an electrical strike.

D. Operators of the drill will wear electrical shock protection equipment and operate from common grounded mats as required.

## PART 2 PRODUCT

### 2.1 MATERIALS

A. The carrier pipe shall conform to Section 02610; Piping, General.

B. Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by DBF and maintained at all sites for use in the event of inadvertent leaks, seeps or spills.

C. Technical criteria for bentonite shall be as given in API Spec. 13A, Specification for Oil Well Drilling Fluids Material for freshwater drilling fluids. Any modification to the basis drilling fluid involving additives must describe the type of material to be used and be included in DBF's drilling plan presented to OWNER. The OWNER retains the right to sample and monitor the waste drilling mud, cuttings and water.

### 2.2 HDPE PIPELINE IDENTIFICATION

A. All polyethylene pipe shall be black, and shall contain a continuous colored stripe, 2 inches wide, at three separate locations along the length of the pipe. Stripe color shall be:

1. Potable Water Mains - blue stripe
2. Reclaimed Water Mains - purple stripe
3. Force Mains - green stripe
4. Sanitary Sewer - green stripe

5. Storm Sewer - no stripes required

## PART 3 EXECUTION

### 3.1 DIRECTIONAL DRILLING OPERATION

A. The DBF shall provide all material, equipment, and facilities required for directional drilling. Proper alignment and elevation of the opening shall be consistently maintained throughout the directional drilling operation. Entrance and exit angles for the drill are at the DBF's discretion such that the elevation profile maintains adequate ground cover to reasonably precaution against hydraulic fractures with the drilling fluid and maintain the minimum cover shown in the Drawings and specified herein.

B. DBF shall carefully plan the drill path and ensure all existing utilities are identified. Accuracy of the drill path is a priority. DBF shall only use a wireline locating system or a gyro-based locating system for the tracking, steering and guidance of the directional bore. DBF shall monitor and record the bore location during installation to ensure accuracy of the drill path. The position of the drill string shall be monitored by the DBF and recorded every 30 feet. Information of the bore path may be requested by the OWNER and ENGINEER at any time. The profile and alignment defined on the construction drawings for the bores define the minimum depth and radius of curvature. At no point in the drilled profile shall the radius of curvature of the bore be less than the minimum defined by the pipe manufacturer with a 10% factor of safety. The DBF shall maintain and provide to the OWNER, upon request, the data generated by the downhole survey tools in a form suitable for independent calculation of the pilot hole profile.

C. Boring pits shall be shored with sheeting, or such other materials as required. Sheeting shall be driven to a sufficient depth below the invert of the carrier pipe to resist any pressure developed by the soil outside the boring pit. Sheeting when used shall terminate not less than 3 feet 6 inches above existing grade.

D. At the completion of the direction drilling operations, the DBF will be required to remove all sheeting in place. If steel sheeting is used, it may be removed after installation of the carrier pipe in the bore hole, but prior to installation of the joining carrier pipe. However, should damage to the roadway, pipeline or any other adjacent structure occur, the DBF shall leave all remaining sheeting in place and redrive and leave in place any sheeting which is required to stabilize the site and prevent additional damage from occurring. The top of all sheeting left in place shall be cut off 36 inches below finished grade.

E. Bentonite or other stabilizing gels shall be used to prevent calving of the unsupported bore hole.

### 3.2 DRILLING FLUIDS AND CUTTINGS

A. To the extent practical, the DBF shall maintain a closed loop drilling fluid system and utilize drilling tools and procedures which will minimize the discharge of any drilling fluids.

B. DBF shall have divers present during the drilling operations in order to respond to potential frac-out release.

C. The Guided Horizontal Direction Drilling operation is to be operated in a manner to

eliminate the discharge of water, drilling mud and cuttings to the canal or land areas involved during the construction process. The DBF shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. All excavated pits used in the drilling operation shall be lined by DBF with heavy duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or groundwater.

D. Pits constructed at the entry or exit point area shall be so constructed to completely contain the drill fluid and prevent its escape to the surrounding land or canal.

E. Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of stumps, pumps, tanks, distiller/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the cleaning/separating operation without interference with the drilling program. The cuttings and excess drilling fluids shall be dewatered and dried by DBF to the extent necessary for disposal, and disposal in offsite landfills at the DBF's expense. Water from the dewatering process shall be treated by DBF to meet permit requirements and disposed of locally. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of unplanned leaks or seeps.

F. All drilling mud shall be removed from the entry and exit area soils such that water will percolate. All disturbed areas shall be restored to original conditions.

## 3.3 INSTALLING PIPE

A. The pipe installed within the boring shall be in full conformity with these Specifications and as shown on the Drawings. The pipe shall be installed, as to a reasonable directional drilling ability, to the exact lines grades required after having been satisfactorily approved by the CITY from the directional drillers expected drill path plan and profile sheets provided in Section 1.5.

B. The type and size of the pilot string cutting head shall be at the DBF's discretion. The type and outside diameter of the drill pipe to be used in the pilot string shall also be at the DBF's discretion.

C. A minimum depth requirement of 10 feet below the existing crossing bottoms shall be maintained, depths deeper than 10 feet shall be acceptable. Lateral positioning at exit shall be no further than 5 feet left or right of planned centerline, and horizontal positioning shall be no further than 5 feet short or long of proposed exit location. Entry and exit locations, as well as intermediate centerline stationing, shall be staked by the DBF.

D. Upon approval of the pilot hole location by the CITY, the hole opening or enlarging phase of the installation shall begin. The type of hole opener or back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation. The reamer type shall be at the DBF's discretion.

E. The open borehole may be stabilized by means of bentonite drilling slurry being pumped through the inside diameter of the drill pipe and through opening in the reamer. The slurry will also serve as an agent to carry the loose cutting to the surface through the annulus of the borehole. These cuttings and bentonite slurry are to be contained at the exit or entry side of the directional bore in pits or holding

tanks. The slurry may be recycled at this time for reuse in the hole opening operation, or it shall be hauled by the DBF to an approved dump site and properly disposed.

F. Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately prior to joining.

G. A complete list of all drilling fluid additives and mixtures to be used in the directional operation will be submitted to the CITY, along with their respective Material Safety Data Sheets. All drilling fluids and loose cuttings shall be contained in pits or holding tanks for recycling or disposal, no fluids shall be allowed to enter any unapproved areas or natural waterways. Upon completion of the directional drill project, drilling fluid shall be disposed of by the DBF at an approved dump site.

H. A "weak-link or breakaway device shall be used at the leading end of the pipe to protect the pipe from excessive pulling loads. The breakaway strength of this device shall be set at or below the allowable tensile load of the pipe.

I. High Density Polyethene (HDPE) pipe shall not be placed in direct sunlight immediately prior to installation.

J. HDPE pipe shall have the beads removed from the interior of the fused joints.

K. A sufficient length of HDPE pipe shall be pulled past the exit point and left before the entry point to allow for relaxation.

L. HDPE pipe shall have mechanical joint adapters to connect to the pipe on either side of the directional drills. Mechanical joint adapter used is to match HDPE pipe manufacturer requirements for connection to ductile iron pipe.

M. HDPE shall have sufficient time for relaxation before connecting to the pipe on either side of the direction drill.

## 3.4 FUSING OF HDPE PIPE

A. Standard practice for HDPE fusion shall follow the recommendations from the latest revision of ASTM 2620, ISO 21307 or industry standard international practices.

B. DBF to handle pipe and fusing operations with care. Fuse joints must be protected from rain, water and dust during fusing operations until the joint has cooled down.

C. DBF must use data loggers to monitor fusing and provide fusing data results to ENGINEER prior to pulling or installation of the pipe.

D. Fusing beads must be inspected and shall show a clean fuse and be visually acceptable as required by ASTM 2620.

## 3.5 EXISTING UTILITIES

A. The Drawings show existing buried utilities that are believed to be near the directional drill alignment. There is no guarantee that these utilities are located as shown or that other utilities may be present. It is the DBF's responsibility to locate all utilities or other subsurface obstructions that may interfere with the work.

B. Utility lines and structures indicated on the Drawings which are to remain in service shall be protected by the DBF from any damage as a result of the operations. Where utility lines or structures not shown on the drawings are encountered, the DBF shall report them to the OWNER before proceeding with the Work. The DBF shall bear the cost of repair or replacement of any utility lines or structures which

are broken or damaged by the DBF's operations.

C. All utilities in close proximity to the drill pilot bore, back ream or carrier pipe installation must be exposed through a "pot-hole" or other opening, in accordance with state utility locate laws and regulations, to ensure, through visual inspection, that the drill, reamer or pipe has caused no damage to the utility and maintains adequate clearance.

## 3.6 TESTING

A. DBF is required to perform a pressure test prior to installation of pipe. A leakage test in accordance with Contract Documents shall also be performed post pulling. All leakage tests shall be completed and approved prior to placing of permanent resurfacing. When leakage exceeds the amount allowed by the Specifications, the DBF, at its expense, shall locate the leaks and make the necessary repairs or replacements in accordance with the Specifications to reduce the leakage to the specified limits. Any individually detectable leaks shall be repaired, regardless of the results of the tests.

B. Leakage Tests: The leakage testing shall be as follows:

1. All PVC and DIP pressure test (force mains and water mains): pressure mains shall be hydrostatically pressure tested for a period of not less than 2 hours at 150 PSI with an allowable leakage not to exceed the formula:

$$L = \frac{SD(P)^{1/2}}{148{,}000}$$

L = Allowable leakage in gallons per hour
S = Length of pipe in feet
D = Nominal diameter of pipe inches
P = average test pressure during test in pounds per square inch
All testing is to be in accordance with AWWA C605.

C. HDPE pressure test shall be comprised of two phases as follows:

1. Pre-pressure Testing Phase
   a. Safety precautions shall follow ASTM F2164.
   b. Fill the test section slowly. Purge all air. Take all appropriate precaution to ensure that no air is trapped in the test section. Use air release valves or corporation stops to allow bleeding of trapped air, prior to beginning the test. Allow the test section and the test liquid to equalize to a common temperature.
2. Initial Expansion Phase (4 hours)
   a. When the test section is completely filled and purged of air, gradually increase pressure in the test section to the required maximum pressure as determined by ENGINEER.
   b. Add make-up water as necessary to maintain maximum test pressure for a minimum of 4 hours.
   c. If test pressure cannot be attained, or if it takes an unreasonable long time to reach test pressure, there may be faults such as excessive leakage, entrapped air, or open valves, or the pressurizing equipment

may be inadequate for the size of the test section. If such faults, exist, discontinue pressurizing, and correct them before continuing.

3. Test Phase (1 hour)
   a. Reduce the pressure by 10 psi and monitor pressure for 1 hour. Do not increase pressure or add make-up water.
   b. If no visual leakage is observed and pressure during the test phase remains steady, within +/- 5 psi, for the 1-hour test period, a passing test is indicated.
   c. If retesting is necessary, depressurize the test section and correct any faults or leaks in the test section. Do not attempt to correct faults or Dix leaks while the test section is under pressure.
   d. The rime required to pressurize, stabilize, hold test pressure, and depressurize should not exceed 8 hours. If re-testing is necessary: the test section should be depressurized for 8 hours prior to retesting.

## 3.7 COMPLETION OF DIRECTIONAL DRILLING

A. Completion and successful testing of the approved pipe will entitle the DBF to full payment of the applicable amounts in the Contract.

In the event of failure to install the directional drilled pipelines, the DBF shall retain possession of any DBF-supplied pipe and remove it from the site. The bore holes shall be completely filled with grout to prevent future problems. If the pipe cannot be removed from the bore hole, it shall be cut off five feet below ground and the pipe and annular space shall be grouted.

**END OF SECTION 02410**

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. The work specified in this Section consists of the construction of concrete sidewalk in accordance with these Specifications and in conformity with the lines, grades, dimensions and notes shown on the plans.

### 1.3 RELATED WORK

A. Section 02200 – Earthwork.
B. Section 02110 - Clearing.
C. Section 03010 - Concrete.
D. Section 03300 - Cast-In-Place Concrete.
E. Section 03370 - Concrete Curing.

## PART 2 PRODUCTS

### 2.1 CONCRETE

A. Concrete shall be Class I Concrete, with a minimum compressive strength of 3,000 psi in accordance with Section 345, Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

### 2.2 FORMS

A. Forms for this work shall be made of either wood or metal and shall have a depth equal to the plan dimensions for the depth of concrete being deposited against them. They shall be straight, free from warp or bends, and of sufficient strength when staked, to resist the lateral pressure of the concrete without displacement from lines and grade. Forms shall be cleaned each time they are used and shall be oiled prior to placing the concrete.

### 2.3 SUBGRADE AND GRADING

A. Excavation shall be made to the required depth, and the foundation material upon which the sidewalk is to be set shall be compacted to a firm, even surface, true to grade and cross-section, and shall be moist at the time that the concrete is placed. Subgrade shall be compacted to an LBR of 40.

### 2.4 JOINTS

A. Contraction joints may be of the open type or may be sawed. Staking a metal bulkhead in place and depositing the concrete on both sides shall form open type contraction joints. After the concrete has set sufficiently to preserve the width and shape of the joint, tbulkhead shall be removed. After the sidewalk has been finished over the joint, the slot shall be edged with a tool having a 1/2-inch radius.
B. If the DBF elects to saw the contraction joints, a slot approximately 1/8-inch-wide

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and not less than 1-1/2 inches deep shall be cut with a concrete saw after the concrete has set, and within the following periods of time:

C. Contraction joints shall be constructed at not more than 20-foot intervals and shall be in place within 12 hours after finishing.

## PART 3 EXECUTION

### 3.1 PLACING

A. The concrete shall be placed in the forms to the required depth and shall be vibrated and spaded until mortar entirely covers its surface.

### 3.2 FINISHING

A. Screeding: The concrete shall be struck-off by means of a wood screed, used perpendicular to the forms, and floated in order to obtain the required grade and remove surplus water and laitance.

B. Surface requirements: The concrete shall be given a broom finish. The surface variations shall not be more than 1/4 inch under a ten-foot straightedge, nor more than 1/8 inch on a five-foot transverse section. The exposed edge of the slab shall be carefully finished with an edging tool having a radius of 1-1/2 inch.

### 3.3 CURING

A. The concrete shall be continuously cured for a period of at least 72 hours. Curing shall be commenced after finishing has been completed and as soon as the concrete has hardened sufficiently, to permit application of the curing material without marring the surface.

B. Wet burlap, white-pigmented curing compound, waterproof paper or polyethylene sheets may be used for the curing of grey concrete only.

### 3.4 COLORED CONCRETE (NOT USED)

A. Colored – Conditioned Concrete shall be placed, finished, and cured in strict accordance with applicable requirements of this Section and Sections 03010, 03370, and the requirements of the chosen manufacturer.

**END OF SECTION 02510**

# PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

## 1.2 WORK INCLUDED

A. This section of the specifications covers the control and general conduct of asphalt paving construction for roads, parking, walks and court areas.

B. All work within the right-of-way shall be constructed using materials and methods in accordance with the drawings, City of Fort Lauderdale Public Works Standard Details.

C. Provide all labor, materials, necessary equipment, and services to complete the Asphaltic Concrete Paving work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

D. Including, but not necessarily limited to the following:

1. Preparation of subgrade.
2. Installation and compaction of base course.
3. Spreading of asphalt surface course.

## 1.3 RELATED WORK

A. Section 02200 – Earthwork.

## 1.4 TRAFFIC CONTROL

A. The DBF shall provide and maintain access to and from all properties along the line of DBF'S work. The DBF shall also provide temporary bypasses and maintain them in a safe and usable condition whenever the public cannot do detouring of traffic to parallel routes without hardship or excessive increases in travel.

## 1.5 SPECIAL SUBGRADE CONDITIONS

A. When special subgrade conditions are encountered for which these "Asphaltic Concrete Paving Specifications" are not applicable, portions of these specifications shall be deleted or revised to provide a properly finished paved surface. A requested revision or deletion of the specifications shall be accompanied with reports and laboratory tests on existing field conditions. Any change from these "Asphaltic Concrete Paving Specifications" shall be approved by the CITY and shall be in effect only for a specified area or paving project.

## 1.6 QUALITY ASSURANCE

A. D.O.T. Standard Specifications.

1. Work and materials shall conform to all applicable requirements of Florida Department of Transportation "Standard Specifications for Road and Bridge Construction – Latest Edition" (referred to herein as D.O.T.).

B. American Society for Testing and Materials.

1. ASTM 3515-80 "Standard Specification for Hot-Mixed, Job Laid, Bituminous Paving mixtures."

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### 1.7 SUBMITTALS

A. Provide copies of materials, notarized certificates of compliance signed by material producer and DBF, certifying that each material item complies with, or exceeds, specified requirements.

### 1.8 JOB CONDITIONS

A. Apply prime and tack coats when ambient temperature is above 50 degrees, and when temperature has not been below 35 degrees for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

B. Construct asphalt concrete surface course only when atmospheric temperature is above 40 degrees, and when base is dry. Base course may be placed when air temperature is above 30 degrees and rising.

### 1.9 LOCATIONS, LAYOUT AND GRADES

A. Locate and layout paved areas and right-of-ways with reference to benchmarks, property lines or buildings according to the drawings and as accepted by the CITY.

B. Determine locations of paved edges and right-of-way line from surveyor's permanent reference monuments and information on the drawings.

C. Where permanent reference monuments are not available, obtain proper line locations from authorities having jurisdiction.

D. Establish and maintain required lines and elevations.

## PART 2 PRODUCTS

### 2.1 FILL

A. All fill shall be clean rock and sand (maximum rock size = 1 inch).

B. Fill shall be compacted thoroughly as per Section 02200 - Earthwork.

### 2.2 LIMEROCK

A. Limerock shall be obtained from pits for which all overburden has been removed previous to blasting and shall show no tendency to air slake and must undergo the following chemical requirements.

| | Percent |
|---|---|
| Carbonates of Calcium | Min. 70.0 (Miami Limerock) and Magnesium 95.0 (Ocala Limerock) |
| Oxides of Iron and Aluminum | Max. 2.0 |
| Organic Matter | Max. 0.5 |

1. Any constituents of other than those listed above shall be silica or inert material.
2. The material shall be crushed to such size that not less than 97% shall pass a 3-1/2 inch sieve and it shall be graded uniformly down to dust. All fine material shall consist entirely of dust of fracture.
3. Limerock from on-site may be used if the material meets the requirements of this section of the specifications.

B. All limerock shall comply with requirements set forth under D.O.T. Section 911.

C. Equipment: The equipment for constructing the rock base shall be in first class working condition and shall include:
   1. Three-wheel roller weighing not less than ten tons.
   2. Self-propelled blade grader weighing not less than three tons. The wheelbase shall be not less than fifteen feet and blade length not less than ten feet.
   3. Scarifiers shall have teeth space not to exceed 4-1/2 inches.
      a. Provision for furnishing water at the construction site by tank or hose at a rate not less than 50 gallons per minute.

## 2.3 PRIME COAT

A. Prime coat shall be Grade RC-70, cut-back asphalt, D.O.T. Section 916-2.
B. Prime coat shall have full compatibility with surface treatment asphalt.
C. The bituminous material shall conform to the requirements of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Section 300- 2.
D. The sand for cover shall be clean dry sand.

## 2.4 TANK COAT

A. The bituminous material to be used for the tack coat shall conform to the requirements of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Section 300-2.

## 2.5 ASPHALT

A. The asphaltic concrete surface course shall be in accordance with the City of Fort Lauderdale, Florida Department of Transportation Standard Specifications for Friction Course, Superpave, Type S-1 and Type S-3, Asphaltic Concrete Surface Course.
B. Pavement within public road right-of-way, which has been disturbed by this construction, shall be replaced with the same type and thickness to match the existing pavement section.
C. General composition of mixtures:
   1. The aggregate in the asphaltic concrete shall be crushed stone and manufactured sand screening of natural sand or combination of both when necessary to meet requirements of composition of mix. All aggregate shall have a Los Angeles abrasion loss of less than 40%.
   2. The mineral aggregate shall be so graded, and the prescribed constituents, prepared as hereinafter set out, shall be combined in such proportions as to produce a mixture conforming to the following general composition limits by weight:

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| Constituent | Passing Sieve | S-1 Percent by Weight | S-3 Percent by Weight |
|---|---|---|---|
| Coarse Aggregate | 3/4"<br>1/2"<br>3/8" No.4 | 100<br>80-100<br>75-93<br>47-75 | 100<br>100<br>88-100<br>60-90 |
| Total Coarse Aggregate | No.10 | 31-53 | 40-70 |
| Fine Aggregate | No.40<br>No.80 | 19-35<br>7-21 | 20-45<br>10-30 |
| Filler | No.200 | 2-6 | 2-6 |
| Constituent | | Percent by Weight | Percent by Weight |
| Total Fine Aggregate and Filler | No. 10 | 100 | 100 |
| Total Mineral Aggregate | | 100 | 100 |
| Total Mix | | 100 | 100 |
| Asphalt Cement | | 5-9* | |
| (Bitumen) Total Mix | | 100 | |

*For highly absorptive aggregates the upper limit may be raised.

### 2.6 SEAL COATING

**A.** Homogeneous mixture of emulsified coal tar pitch, asbestos, sand and other inert fillers. It shall be easily remixed if settlement occurs in storage (except in the case of freezing). It shall be capable of application and complete coverage by rubber squeegee, brush, or approved mechanical method, to the surface of bituminous pavements at the spreading rate of point two (.2) to point three (.3) gallons per square yard in two (2) coats.

B. Approved product: "TARFEX" manufactured by Bitucote Products Co. or approved equal.

## PART 3 EXECUTION

### 3.1 BARRICADES

A. Provide substantial temporary barricades around all areas of operation and maintain until work under this section is completed and approved.

B. Install temporary traffic markers, signals, and signs as per the City of Fort Lauderdale requirements for:

1. Eliminate potentially hazardous conditions.
2. Maintain adequate traffic patterns free of conflict with work under this Contract.

### 3.2 PREPARATION OF SUBGRADE

A. This work consists of bringing the bottom of excavations and top of embankments of the roadway between the outer limits of the shoulders or base course to a surface conforming to the grades, lines, and cross sections shown on the plans. The subgrade shall be of uniform density ready to receive the rock base of the paving course.

B. All soft and yielding material and other portions of the subgrade which will not compact readily shall be removed and replaced with suitable material and the entire subgrade brought to line and grade to provide a foundation of uniform compaction and supporting power.

C. Stumps, roots, and other deleterious organic matter encountered in the preparation of the subgrade shall be removed.

D. Where fills are required on areas covered or partly covered by existing paving, the entire area of such existing paving shall be scarified to a depth of at least six inches, and the scarified material spread evenly over the area to be filled to a width not less than that of the proposed paving.

E. Material for fills shall consist of sand or other suitable material approved by the CITY free from stumps, roots, brushes, and other deleterious organic matter.

F. Where fill is more than one foot (1 foot) in depth, the backfill material above the ground water table shall be compacted on one (8 inch) depth lift. Each individual layer of fill under the rock base shall have a density as specified in Section 02200, Paragraph 3.14.I. unless shown otherwise on the plans. Each individual layer of fill under the shoulder area shall have a density as specified in Section 02200, Paragraph 3.14.I., unless shown otherwise on the plans.

G. The bottom of all excavated areas and the top of all fills where rock base is to be constructed shall be thoroughly compacted by rolling. Water shall be used to insure thorough compaction. The stability of the top 12 inch thickness of the subgrade
immediately under the base, for the full base width plus six (6) inches on each side, shall be at least LBR 40 as determined by AASHTO T-180.

H. Bring subgrade, which has been properly filled and shaped to a firm unyielding surface, by rolling an entire area with an approved vibratory power roller weighing a minimum of 10 tons.
   1. Thoroughly compact area inaccessible to the roller with approved hand tamper.
   2. Apply water sufficiently to compact the subgrade where the subgrade is of a dry, sandy nature and cannot be rolled.

I. The subgrade shall be maintained free from ruts, depressions or other irregularities until rock base material is spread.

J. For all roads and streets other than state highways, the stabilized subgrade shall have a minimum Limerock Bearing Ratio (LBR) of 40, unless otherwise noted on the plans.

K. Where the bearing value of the existing subgrade is adequate without addition of stabilizing material, the subgrade shall be scarified and disked, harrowed, bladed or tilled for removal of boulders, roots, etc. to assure uniformity and thorough mixing of material to the full width and depth of required stabilization. The compacted subgrade shall conform to the lines, grades and cross-section shown

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on the plans.

L. Test subgrade for crown and elevation after preparation and immediately before base of paving course is laid.
   1. Remove or add material and compact to bring to a correct elevation and uniform bearing if the subgrade is found not to be at the specified elevation at all points.
   2. Adjust the MAS rims, catch basin frames and valve boxes where necessary to match proposed finish grade.

## 3.3 CONSTRUCTION OF BASE COURSE

A. This work consists of construction of lime rock base course for the asphaltic concrete wearing surface. The base course shall be constructed on the prepared subgrade with eight (8) inch thick limerock bases constructed in two four-inch lifts as shown on the drawings. Twelve (12) inch thick limerock bases shall be constructed in two six-inch lifts. The limerock base shall be a minimum LBR of 100 and shall extend six (6) inches beyond the edge of the asphaltic concrete on each side.

B. Spreading Rock: The rock shall be transported to the points where it is to be used over rock previously placed, and dumped on the end of the preceding spread. It shall then be spread uniformly with hand tools, or mechanical equipment. In no case shall rock be dumped directly on the subgrade. No hauling shall be done over the subgrade.

C. Compacting Rock
   1. Following spreading, the rock shall be rolled with a three-wheel roller weighing not less than ten tons, water being added as required, until the entire depth of base is compacted into a dense unyielding mass.
   2. No greater area of rock base shall be placed during any one day than that which can be rolled and compacted on the same day.

D. Finishing Base
   1. After watering and rolling, the entire surface shall be thoroughly scarified to a depth not less than four inches (4") and shaped to exact crown and cross section, re-watered and again thoroughly rolled. Rolling shall continue until the entire depth of base is bonded and compacted into a dense, unyielding mass, true to grade and cross section.
      a. Any irregularities, which may develop in the surface during such finishing, shall be corrected by the removal or addition of rock as the case may be.
      b. If at any time the subgrade material becomes churned up and mixed with the base rock, the DBF shall dig out and remove the mixture, reshape and compact the subgrade and replace the materials removed with clean rock which shall be watered and rolled until satisfactorily compacted.
      c. Where cracks or checks appear in the base either before or after priming, which in the opinion of the CITY would impair the structural efficiency of the base course, the DBF shall remove such cracks or checks by re-

scarifying, reshaping, watering, rolling and adding rock where necessary.

d. During final compacting operations, if grading of any areas is necessary to obtain the true grade and cross section, the compacting operations for such areas shall be completed prior to making the density tests on the finished base.

E. Inferior Rock: If in the opinion of the CITY at any time during the progress of the work, rock of inferior quality is being delivered to the construction site, a laboratory analysis of the rock shall be made. Should the results of such tests indicate that the rock does not conform to specifications, the DBF shall, at DBF's own expense, remove such inferior material from the area indicated and deliver and spread satisfactory rock on said area.

F. Testing Surface: The finished surface of the rock base shall be true to the required cross section. Any irregularities in the grade greater than 1/4 inch, as determined by placing a ten-foot straight edge parallel with the centerline, shall be corrected by scarifying to a depth of three inches (3"), removing or adding rock as may be required and again watering, rolling, and compacting the scarified area. In testing the surface for irregularities, the measurements under the straight edge shall not be taken in small holes caused by individual pieces of rock having been pulled out by the road grader.

G. Thickness Determination: Thickness of the base shall be measured by intervals as required by the CITY. Measurements shall be taken at various points on the cross section. The measurements shall be taken in holes through the base of not less than three inches (3") in diameter. Where the base is more than 1/2 inch less than the required compacted thickness, the DBF shall correct such areas by scarifying and adding rock. The affected areas shall then be watered, rolled and brought to a satisfactory state of completion, and of required thickness and cross section.

H. Density: An average required density shall be as specified in Section 02200, Paragraph
3.14.I at intervals acceptable to the OWNER. No section of base shall be accepted when
more than 10% of tests fall below 98% of maximum density and in no case shall a density of less than 96% of maximum be accepted.

I. Testing: The DBF shall coordinate with CITY for all testing. All tests shall be made in accordance with AASHTO, T-180 for each class of material in the subgrade and base.

1. In place density tests in accordance with AASHTO T-147 shall be made in the locations shown on the plans. Two copies of the test reports will be sent directly to the CITY for evaluation.
2. Any material, which fails to meet these specifications, shall be removed, replaced, and retested, all at the DBF's expense.
3. Tests shall be taken at least every 1,000 square yards and taken at locations and lifts as directed by the CITY.

## 3.4 PRIME COAT FOR BASE COURSE

A. Cleaning the prepared base:

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1. Before any bituminous material is applied, all loose material: dust, dirt, caked clay and foreign matter which might prevent proper bond with the existing surface shall be moved to the shoulders, to the full width of the treatment, by means of revolving brooms or approved mechanical sweepers and by mechanical blowers, of approved types, supplemented by hand sweeping. Dust and other loose materials not removed by mechanical means shall be removed with hand brooms. Particular care shall be taken to clean the outer edges of the strip to be treated in order to ensure that the prime coat will adhere. Sweeping and blowing shall be continued until all the loose dust and dirt is removed from the surfaces.
2. Application of bituminous material shall be made during the same day surface has been swept and as soon as practical thereafter.

B. Application for prime coat:
1. The bituminous material shall be applied to the clean dry surface of the rock base at such temperature as will insure uniform distribution. The amount applied will be at the rate of approximately 0.10 to 0.20 gallons per square yard of base area. The application shall be made by means of self-propelled pressure distributor operating under a pressure not less than 20 pounds per square inch. Application of bituminous material shall be made on only one-half of the width of base at one time.
2. The primed base shall then be covered with a uniform layer of clean sand and kept thoroughly and uniformly covered by additional sand or sweeping until it shows no signs of picking up under traffic. For a period of one week after priming, the DBF shall again broom any area where insufficient cover sand or excess of bituminous material causes "bleeding" and, if necessary, spread additional sand on such area.

C. Prime coat finish: After prime has cured or sat and been sanded, the shoulder shall be shaped to conform to all grade lines and cross sections and the entire area shall be rolled and compacted with a rubber-tired roller or a power roller before asphalt surface is laid on the finished base.

## 3.5 BITUMINOUS TACK COAT

A. Before applying any bituminous material, all loose material: dust, dirt and foreign material, which might prevent proper bond with the existing surface, shall be removed for the full width of the application.

B. Application for tack coat:
1. The surface to receive the tack coat shall be clean and dry. The tack coat shall be clean and dry. The tack coat shall be applied with a pressure distributor except that on small jobs, if approved by the CITY, the application may be made by other approved mechanical methods or by hand methods. The pressure distributor shall operate at a pressure not less than 20 pounds per square inch and at a consistency such that it can be properly pumped and sprayed uniformly over the surface.
2. The bituminous material shall be applied in a thin uniform layer. The rate of application shall be between 0.02 and 0.10 gallon per square yard. The tack coat shall be applied sufficiently in advance of the laying of the wearing

surface to permit drying but shall not be applied so far in advance that it might lose adhesiveness as a result of being covered with dust or other foreign material. The tack coat surface shall be kept free from traffic until the wearing surface is laid.

## 3.6 ASPHALTIC CONCRETE WEARING SURFACE COURSE

A. Cleaning and preparing base:
   1. Prior to the laying of the asphaltic concrete, the base of pavement to be covered shall be cleaned of all loose deleterious material by the use of power brooms or blowers. A tack coat shall be applied on all pavements. The tack coat shall not be applied so far in advance of laying operations as to allow shifting and sand or weather conditions to nullify its effectiveness.
   2. After the surface has been thoroughly cleaned, all holes shall be filled with asphaltic concrete, if necessary, and thoroughly compacted to conform to the existing surface and to form a smooth surface.

B. Placing asphaltic concrete: The asphaltic concrete surface course shall be applied after the tack coat after a reasonable permitted time for drying but not to an extent that the tack coat is allowed to lose its adhesiveness.
   1. Machine spreading: Upon arrival the mixture shall be dumped into the approved mechanical spreader and immediately spread and struck off to the full width required and to the appropriate loose depth for each successive course that when the work is completed the required weight of the mixture per square yard or the specified thickness will be secured. An excessive amount of mixture shall be carried ahead of the screen at all times. Hand raking shall be done behind the machine as required.
   2. Hand spreading: In limited areas, where, on account of irregularities or unavoidable obstacles, the use of mechanical spreading and finishing equipment is impractical, the mixture may be spread by hand, when so authorized by the CITY.
   3. The mixture shall be laid only when the surface to be covered is dry and only when weather conditions are suitable.
   4. All structures which will be in actual contact with asphaltic mixture, including the face or surface of curbs or gutters and the vertical faces of existing pavements, shall be painted with a uniform coating of asphalt material to provide a closely bonded, watertight joint.
   5. Where necessary, due to the traffic requirements, the mixture shall be laid in strips in such manner as to provide for the passage of traffic.
   6. Any mixtures caught in transit by a sudden rain may be laid at the DBF's risk. In no case shall the mixture be laid while rain is falling or when there is water on the surface to be covered.
   7. The depth of the layer being spread shall be gauged as directed, and where the thickness fails to average the specified thickness, immediate steps shall be taken to correct the depth.
   8. Before any rolling is started, the course surface shall be checked, any inequalities adjusted, and all drippings, fat sand accumulations from the

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screed and fat spots from any source shall be removed and replaced with satisfactory material.

9. Straight-edging and back patching shall be done after initial completion has been obtained and while the material is still hot. Any irregularity greater than 1/4 inch either longitudinally or transversely shall be corrected at this time.
10. No skin patching shall be done. When a depression is to be corrected while the mixture is hot, the surface shall be well scarified before the addition of fresh mixture. If irregularities occur and are not corrected while the mixture is still hot, the irregularities shall be cut out the full depth of the layer and replaced with fresh mixture.

C. Compacting mixture: After the spreading, the mixture shall be rolled when it has set sufficiently or come to the proper condition to be rolled, and when the rolling does not cause undue displacement or shoving.

1. The motion of the roller shall at all times be slow enough to avoid displacement and shall at once be corrected by the use of rakes and fresh mixture where required. The rolling shall include all transverse, longitudinal, and diagonal rolling, as may be necessary to obtain the maximum density.
2. The seal rolling with tandem steel rollers weighing from five to eight tons shall follow as close behind the spreader as is possible without picking up or displacing or blistering the material.
3. Rolling with the self-propelled pneumatic-tired rollers shall follow as soon as possible and as close behind the seal rolling as the heat of the mixture will permit. The rolling shall be done while pavement temperature is between 175o and 240oF, and to such an extent that the self-propelled traffic roller shall cover every area of the surface with at least ten passes. Final rolling with tandem steel rollers shall be done after the rolling with self-propelled pneumatic tired rollers is completed. This final rolling shall be done before the pavement temperature is lower than 175oF and shall be continued until all roller marks or tire marks are eliminated.
4. Self-propelled pneumatic rollers shall be used for the rolling of patching and leveling courses. At the option of the DBF, a steel-wheeled roller may be used to supplement the self-propelled pneumatic-tired rollers but not more than one steel-wheeled roller may be used in conjunction with the necessary number of self-propelled pneumatic- tired rollers. After final completion, the finished pavement shall at no point have a density less than 95% of the laboratory compacted density.
5. Rolling with the self-propelled pneumatic-tired roller shall proceed at a speed from six to twelve miles per hour and the rate of rolling shall not exceed 3,000 square yards per hour per roller. A sufficient number of self-propelled pneumatic-tired rollers shall be used so that the rolling of the surface for the required number of 10 passes within this maximum rolling rate shall not delay any other phase of the placing operation and not result in excessive cooling of the mixture before the rolling is complete. In the event that the rolling is not properly maintained to schedule as outlined above, the laying operation shall be discontinued until the rolling operations are sufficiently caught up.
6. In all places inaccessible to a roller, such as adjacent to curbs, headers,

gutters, bridges, MAS, etc., the required compaction shall be secured with tamps. Depressions, which may develop before the completion of the rolling, shall be remedied by loosening the mixture laid and adding new material to bring such depressions to a true surface.

7. Should any depressions remain after final compaction has been obtained, the mixture shall be removed sufficiently, and new material added to form a true and even surface. All high spots, high joints and honeycombs shall be adjusted as directed by the CITY.
8. The mixture, after compaction, shall be of the thickness shown on the plans. After compactions, at no place on the surface shall an excess of asphalt be shown and any area showing such excess or other defect, shall be cut out and replaced with fresh mixture and immediately compacted to conform with the surrounding area. Any mixture which becomes loose or broken, mixed with dirt in the wearing course shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with surrounding areas.
9. Gasoline or oil from rollers shall not be allowed to deposit on the pavement and any pavement damaged by such deposits shall be removed and replaced as directed by the CITY.
10. Any mixture remaining unbonded after rolling shall be removed and replaced.

D. Protection of pavement: After the completion of the pavement, no vehicular traffic of any kind shall be permitted on the pavement until it has set sufficiently as approved by the CITY.

## 3.7 ABUTTING EXISTING PAVING

A. Meet elevation of existing paving and structures, facilities and utilities where applicable by sawcutting and removing no less than two (2) feet from abutment. Milling of asphalt for a width of two (2) feet is an alternative if approved by CITY. Do not cover access covers, MAS tops, water meters or other similar devices.

## 3.8 PAVEMENT EDGES

A. Make edges of paved area conform to details and sections as shown on drawings.

## 3.9 SEAL COATING

A. Preparation of surface: Pavement to be sealed must be sound and free of loose dust, dirt, stones, or other foreign matter:
   1. Repair any breaks or holes.
   2. Scrape off accumulations of oil or fuel drippings and scrub with detergent and water. Remove all traces of detergent.
   3. Soft or damaged spots must be repaired.
   4. Flush entire area with clean water.
   5. Pavement should be damp (no puddles or excess water) when seal coating is applied.

B. MIXING: Stir seal coating to a uniform consistency, use no solvents for thinning. Dilute seal coating with ten (10) percent to twenty (20) percent clean water, stirring

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to uniform consistency.

C. Application:
   1. Seal coat may be applied to dampened surface with a rubber squeegee, soft bristled push broom, or approved mechanized equipment.
   2. Seal coating may be poured directly onto pavement in a ribbon or window. Squeegee is placed on pavement at a slight angle to edge line of pavement and pulled in a window along pavement in parallel lines, always working excess material toward bottom edge of squeegee.
   3. Seal coating should be applied in two (2) thin coats. After first coat is completely dry to touch, a second coat may be applied at right angles to the first. Rate of application will depend on porosity of surface.
   4. Allow to cure for twenty-four (24) hours before opening to traffic.
   5. Do not apply seal coating when temperature is below fifty (50) degrees Fahrenheit, or falling, before sealer is dry, or rain appears imminent or forecast.
   6. Apply in strict accord with manufacturers published instructions.

## 3.10 FIELD QUALITY CONTROL

A. Test in place asphalt concrete course for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by OWNER's Representative.
   1. In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:
      a. Base Course: Not greater than 1/2 inch of specified thickness.
      b. Surface Course: Not greater than 1/4 inch of specified thickness.
   2. Test finished surface of each asphalt concrete course for smoothness, using 10-foot straight edge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness.
      a. Base Course Surface: 1/4 inch.
      b. Wearing Course Surface: 1/8 inch.

B. Check surface area at intervals as directed by the CITY.

C. Finish grade shall be within ±0.01 feet of the grades indicated on the plans or ± 0.05 feet as long as no ponding of water is observed after final paving.

## 3.11 CLEAN UP

A. Remove all debris and excess material immediately from project site.

B. Take down all barricades and temporary traffic markers, signals and signs only after all work included in this section is finished and inspected, and only after so directed by the CITY

C. Leave project area clean, orderly and free of any hazardous conditions.

## 3.12 CONSTRUCTION OF SWALES

A. This work consists of regrading existing swales and construction of new swales adequate for conveying storm water along the right-of-way to catch basins. The

swale shall be shaped according to the cross section shown on the plan. In areas adjacent to existing roadways all swales shall be regraded to meet the City of Fort Lauderdale standards, unless otherwise noted.

B. Requirements: All soft and yielding material and other portions of the swale which will not compact readily shall be removed and replaced with suitable material and the entire swale area brought to the proper grade. Stumps, roots, and other deleterious organic matter encountered during the shaping for the swale shall be removed.

C. The bottom of all excavated areas and the top of all fills of swale areas shall be thoroughly compacted by rolling. Water shall be used as necessary to insure thorough compaction. The stability of the top 12-inch thickness of swale area shall be at least LBR 40. Sufficient stabilizing material shall be added to swale area soil as required to provide the specified stability.

D. The DBF shall place sod over existing areas damaged by construction. The sod shall match the existing sod type in the affected areas.

**END OF SECTION 02513**

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# PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1-General Requirements shall govern the WORK under this section.

## 1.2 WORK INCLUDED

A. The work covered by this section shall include the furnishing of all labor, equipment, services, materials, products, and tests to perform all operations in connection with the construction of all new structures or modifications or abandonment of existing structures as shown on the plans, defined in these specifications and subject to the terms and conditions of this contract, including, but not limited to, maintenance access structures (MAS), conflict structures, catch basins, and inlets.

## 1.3 RELATED WORK

A. Section 02200 – Earthwork
B. Section 02221 - Excavation and Backfilling for Utilities

## 1.4 SUBMITTALS

A. The DBF shall furnish the CITY shop drawings of the precast drainage structures and MAS for approval. Shop drawings should illustrate all dimensions, reinforcements and specifications.

# PART 2 PRODUCTS

## 2.1 MORTAR

A. Mortar for use in constructing and plastering sewer structures shall conform to ASTM C-270, "Specifications for Mortar for Unit Masonry". A Portland cement-hydrated lime mixture or a masonry cement may be used provided that the same materials are used throughout the project.
B. Mortar materials shall be proportioned by volume and shall consist of one-part Type II Portland Cement to two parts aggregate (sand). Portland Cement shall conform to ASTM C- 150, "Specifications for Portland Cement". Aggregate shall conform to ASTM C-144, "Specifications for Aggregate for Masonry Units."

## 2.2 PRECAST CONCRETE MAS

A. Precast MAS sections shall conform to ASTM C-478, Specifications for Precast Reinforce Concrete MAS Sections as modified thereto. Concrete shall attain a minimum compressive strength of 4,000 pounds per square inch at 28 days. Minimum wall thickness shall be 8 inches.
B. Unless otherwise specified on the plans, all joints shall be made with neoprene or rubber "O" ring compression joints; mastic joint sealing compound, or approved equal. After assembly, all joints shall be filled with mortar and painted to provide a smooth surface without joint voids.
C. The base and walls that compose the bottom section of precast MAS shall be of monolithic construction, minimum 8 inches thick, and the edge of the base slab shall project a minimum 4 inches beyond the outside diameter of the wall.

D. Holes for piping shall be 6 inches larger than the outside diameter of the respective pipe. After the pipe is set, the void space between the pipe and the hole perimeter shall be completely filled with non-shrinking, quick-setting, waterproof cement mortar and struck smooth.

E. The minimum height of precast base section shall be 36 inches from the bottom of the base slab; however, no holes for piping shall be cast less than 8 inches from the top of the base section or less than 2 inches from the top of the base slab.

F. The maintenance access structure walls shall be coated inside and outside with 2 coats of coal tar epoxy. The first coat shall be red and the second coat shall be black. Each coat shall have a thickness of 8 mil for a total thickness of 16 mil outside and 16 mil inside.

## 2.3 ENDWALLS, CATCH BASINS, INLETS, JUNCTION BOXES AND VALVE VAULTS

A. Endwalls, valve vaults, catch basins, inlets and junction boxes shall be constructed at the locations shown and to the dimensions indicated on site plans. Unless otherwise specified on the plans, inlets, junction boxes, catch basins, valve vaults and similar structures may be constructed of brick, concrete block, poured concrete or precast concrete. Precast catch basins shall conform to latest Portland Cement Association specifications. Concrete shall have not less than 4,000-pounds per square inch compressive strength at 28 days.

B. Unless otherwise specified on the plans, all concrete for these structures shall be Class I concrete as specified in the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction", latest revision, Section 345. Mortar for use in constructing and plastering shall be as previously set forth in this section.

C. Brick shall be solid hard-burned clay conforming to ASTM Serial C-32-73, Grade MA. Concrete brick shall conform to ASTM Serial C-55-75, Grade P-I. Concrete block shall conform to ASTM Serial C-90-78, Grade PI.

D. All brick or concrete block structures covered in this Section shall be plastered inside and outside with 1/2 inch of cement mortar. Inside surfaces shall be smooth and even.

E. Base slabs and walls of concrete structures shall be constructed in a continuous pour between expansion joints.

F. For each grate type inlet, two layers of Mirafi 140 fabric of "Poly Filter X" polypropylene material or approved equal, shall be sandwiched between 2 x 2 x 10/10 welded wire fabric cut to the grate size and attached to the underside of the grate. The sandwiched filter material shall be wired to the cross members of the grate each way on 4-inch centers. After inlet construction and the roadway construction is completed and the project site work (including landscaping) has been established, the filter material and fabric shall be removed with any retained silt or sand.

## 2.4 CASTINGS (INCLUDING FRAMES, COVERS AND GRATINGS)

A. Iron castings shall conform to ASTM A-48, "Specifications for Gray Iron Castings", and shall be Class 30. Frames and grates may be Class 20.

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B. All castings shall be made of clean, even grain, tough grey cast iron. The castings shall be smooth, true to pattern and free from projections, san holes, warp and other defects. The horizontal surface of the frame cover seats and the under surface of the frame cover seat which rests upon the cover seat shall be machined. After machining, it shall not be possible to rock any cover that has been seated in any position in its associated frame. Machining shall be required only on those frames and covers intended for vehicular traffic.

C. Bearing surfaces between cast frames, covers and grates shall be machined and fitted together to assure a true and even fit. Within areas of vehicular traffic, the frames, covers and gratings shall be machined-ground so that irregularity of contact will be reduced to a minimum and will be rattle-proof.

D. All MAS covers shall be provided with concealed pick holes. Manufacturer's name and catalog number shall be cast on all frames, covers, grates, etc. Covers shall be lettered "Storm Sewer" or "Sanitary Sewer" as applicable and shall be plainly visible as shown on the plans. The MAS frames and covers shall be flush with finished grade.

E. Grates and covers for inlets shall be as shown on the plans, set to the grades indicated and conforming with the requirements of the castings described above. Grates shall be furnished complete with frames specifically constructed to provide full bearing at all points of contract.

## PART 3 EXECUTION

### 3.1 CHANNELS

A. Channels shall be accurately and smoothly formed in accordance with the plans. Channels shall be constructed of concrete with trowel-finished surfaces. The upper surface of the MAS shall be sloped toward the channels as shown.

B. Drop pipe at sanitary sewer MAS shall be installed when the difference in elevation between the pipe invert and the invert at the center of the MAS exceeds two feet (2'), or where directed by the CITY. The drop MAS structure shall be built according to the plans and specifications.

C. After channels are formed and section joints are pointed, the interior of the sanitary sewer MAS shall be painted with two coats of Koppers Bitumastic 300-M (7 mils per coat) or approved equal. The exterior shall be painted in a similar manner, if required by local regulations.

D. Storm drainage structures are not required to be painted inside or outside. Provide finish and water proofing as specified in 3.02 and 3.03 below.

### 3.2 BRICKS

A. All bricks shall be thoroughly wetted before being laid. Brick shall be laid by the above shove joint method so as to bond them thoroughly into the mortar. Headers and stretcher courses shall be so arranged as to bond and mass thoroughly. Joints shall be finished smooth and shall be not less than 1/4 inch or more than 1/2 inch in thickness.

### 3.3 MANHOLES AND OTHER STRUCTURES

A. All joints shall be finished watertight; all openings for sewers, frames, etc., in precast MAS and catch basins shall be cast at time of manufacture. Spaces around all piping entering or leaving MAS shall be completely filled with Embeco mortar or approved equal.
B. All MAS shall be set plumb to line and grade and shall rest on a firm carefully graded subgrade which shall provide uniform bearing under base.
C. Grout for MAS bottoms shall consist of broken block, brick and 2:1 cement mortar.

## 3.4 CLEANING AND MAINTENANCE

A. All structures shall be cleaned and maintained in workable condition until accepted by the CITY.

## 3.5 ABANDONMENT OF EXISTING STRUCTURES IN PLACE

A. All structures shown on the drawings to be abandoned in place shall be removed to a minimum of 3 feet below existing grade and properly filled with material as in section 02200 paragraph 3.14. Excavation, backfill, and restoration shall be executed in accordance with requirements for removing existing and installing new structures.

**END OF SECTION 02601**

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## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. The DBF shall install and place in operation submersible sewage pumps and control panel as indicated on the drawings and specified herein. Pump shoes, guide rails (or bars), brackets and all other equipment shall be supplied and installed by the DBF.

B. To assure unity of responsibility, pumps, motors, driving mechanisms and base plate shall be supplied and coordinated by the pump manufacturer. The DBF shall assume responsibility for the satisfactory installation and operation of the entire pumping system

C. The work covered by this section consists of furnishing all labor, equipment, services, materials, products, and tests to perform all operations in connection with the construction/installation of forcemain as shown in the design criteria package and defined in the specifications and subject to the terms and conditions of this Contract, including but not limited to the following:
   1. Excavation and Backfill
   2. Wet Well and Valve Vault
   3. Pumps
   4. Electrical
   5. Force Main (and Tap)
   6. Dewatering

D. Concrete Protective Liner System for Precast Structures
   1. Furnish and install all labor, materials, equipment, and incidentals required to supply polypropylene, random copolymer (PP-R) concrete protective liner in the precast wet wells and valve vault as required and as shown on the plans. The liner system shall be AGRU “Sure-Grip” PP-R Concrete Protective Liner or approved equal polypropylene lining.
   2. PP-R concrete protective liner shall be designed and installed to protect the precast structure’s interior surfaces from chemical attack and microbial corrosion, and to facilitate the prevention of ground water infiltration. A watertight seal between the ring and cover, or access hatch, and the liner, must be incorporated into the design. Additionally, the liner must be sealed at the bottom of the concrete structure’s wall with a water stop assembly thermo-welded to the wall liner, or with continuous liner coverage over the top of the base slab. All construction joints must be sealed by extrusion welding the liner seams together to form a continuous and flexible seal between structure sections (Option I), or through the use of a 90-degree liner turnback into the inside horizontal plane of the upper and lower construction joint, and sealed with a butyl, or equal, sealant (Option II). Option II is not recommended for underground structures subjected to high levels of hydraulic backpressure or exposed to a severe corrosive environment.

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## 1.3 RELATED WORK

A. Section 02200 – Earthwork
B. Section 02221 - Excavation and Backfilling for Utilities
C. Section 02601 – Subterranean Structures
D. Section 02610 - Piping – General
E. Section 02641 - Valve – General
F. Section 02722 - Sanitary Sewerage System
G. Section 16010 – Basic Electrical Requirements
H. Section 16015 – Electrical Systems Analyses
I. Section 16050 – Electrical General Provisions
J. Section 16110 – Raceways
K. Section 16120 – Wires and Cables
L. Section 16405 – Electric Motors
M. Section 16452 – Grounding
N. Section 16485 – Variable Frequency Drives
O. Section 16810 – Control Panels
P. Section 16950 – Miscellaneous Equipment

## 1.4 SUBMITTALS

A. The DBF shall submit to the CITY for preliminary approval of the construction materials selected and shall furnish to the CITY shop drawings for review. Shop drawings shall illustrate all dimensions, reinforcements, joint details, materials, and material specifications.
B. The DBF shall submit a certificate from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of each unit.
C. DBF shall submit a complete wiring schematic for the pump station package.
D. Concrete Protection:
    1. The DBF shall submit for review a detailed CAD drawing for each type of structure to be used on the project. These drawings shall detail the precast structure, per the design specified for the project, and shall show the concrete protective liner's placement on the structure's interior wall surfaces, at the construction joints, at pipe and other conduit connections, and at the adjustment area between the precast structure and the ring and cover.
    2. The DBF shall provide, upon request, detailed thermo-welding and weld testing procedures, and supply to the CITY, upon request, a copy of the liner manufacturer's certification of training for those personnel performing the welding.

# PART 2 PRODUCTS

## 2.1 WET WELL, VAULT, AND FORCE MAIN

A. Wet well shall be constructed at the location shown and to the dimensions and depths indicated on the plans. DBF to determine final sizing, depth and capacity of wet well. No additional compensation will be provided for larger wet well or vaults

if required.

B. The wet well shall be precast concrete. The base and three (3) feet of the wall shall be cast monolithically. The remaining wall sections shall be cast with wall sleeves for appurtenances located as shown. The top shall be precast with vent and access hatch required.

C. Holes for sewer and force main piping shall be 4 inches larger than the outside diameter of the respective pipe. Holes for power cables and control wiring shall be one inch larger than the outside diameter of respective rigid conduit. After pipe is set the void space shall be completely filled with cement mortar and struck smooth. The waterproof hydraulic cement mortar shall be used to provide a leakproof seal around the pipe.

D. Wetwell Interior shall be coated with one of the following options:
   1. 2 coats of 15 MILS (DFT) each, of a Bitumastic coating (30 MILS DFT, Total). Bitumastic Coating shall be Carboline (Koppers) or approved Equal
   2. Sprayed with high build, moisture tolerant, chemical resistant epoxy coating designed to be applied on dry or damp concrete surfaces and yielding a hard durable chemical resistant finish to a pH of 1.0. Epoxy Coating shall be BASF Sewer Guard HBS 100, or other approved material on the BCWWS approved materials list.
      a. Apply material using a 30:0 or 45:1 airless sprayer to a minimum dry thickness of 60 MILS in two (2) 30 MILS coats.

E. Wetwell and Valve Vault exterior shall be coated with two (2), 10MILS (DFT) each coat of a Bitumastic coating (20 MILS Total DFT). Bitumastic coating shall be Carboline (Koppers) 300M or approved equal.

F. The valve vault shall be precast. The top shall be the hatch as indicated in the standard details. The walls shall be constructed subsequent to completion of the piping installation.

G. Valve Vault interior surfaces shall be coated with 100% solids polyamine epoxy specifically designed for wastewater immersion and low permeation to H2S gas. Material shall be TNEMEC PERMA-GLAZE, Series 435, or approved equal, applied to two (2) coats, 15.0 MILS (DFT) each, (30.0 MILS DFT, Total). Final color is to be beige. Surface preparation, priming and application shall be in accordance with the more stringent of the manufacturer's recommendations or BCWWS specifications.

H. Ductile iron shall conform to AWWA C 151. Ductile Iron Pipes and Fittings exterior surfaces shall be coated with a 100% polyamine epoxy specifically design for wastewater immersion and low permeation to H2S gas. Material shall be TNEMEC PERMA-GLAZE, Series 435, or approved equal. It shall be applied in two (2) coats of 20 MILS (DFT) each (40 MILS Total DFT). Valves shall receive only the final 20 MILS (DFT) coat. Final color is to be beige. Surface preparation, priming and application shall be in accordance with the more stringent of the manufacturer's recommendations or BCWWS specifications.

I. Ductile Iron Pipes and Fittings interior shall be coated with 40 MILS (DFT) of Protecto 401 or approved equal. Surface preparations and application shall be in accordance with the manufacturer's recommendations. Certification of the manufacturer shall be provided.

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## 2.2 PUMPS

A. The pumps shall be submersible type. Operational characteristics shall be as shown on the plans. The pumps shall alternate in service and operate in accordance with the sequence outlined on the plans. Sealed mercury switches shall be used for actuation. Furnish and install three submersibles non-clog wastewater pumps for each lift station.

B. Each pump shall have a capacity of at least 90 hp and run with a 480 volts configuration. DBF responsible for verifying ultimate pump size and capacity at no additional cost. The power cable shall be sized according to NEC and ICEA standards. An adequate length of multiconductor submersible cable (SUBCAB) will be used to convey pump monitoring device signals between control panel and submersible pumps. The pump shall be supplied with a mating discharge connection and be capable of delivering flow per the operating points defined within the plans. Pump shut off head shall be no less than 52 feet. Each pump shall be fitted with adequate length of lifting chain or stainless-steel cable. The working load of the lifting system shall be 50% greater than the pump unit weigh.

C. Pump Design

1. The DBF shall design the pump intake in accordance with Hydraulic Institute standard 9.8, Rotodynamic Pumps for Pump Intake Design.
    a. Operating range shall be 40% to 120% of the flow at the best operating point for each scenario.
    b. Pumps shall operate within the allowable operating range for all conditions and operate within the preferred operating range for design conditions.
    c. Single pump operation shall be able to meet minimum flow requirements with no more than 50% turndown on VFDs
    d. NPSH available shall be a minimum of 1.5 greater than NPSHA required at design points
2. The pump should be no less than 90 hp, using two pumps at the same time to handle the flow that ranges between 555 and 1950 gpm with a pressure value at the connection point that ranges from 15 to 45 psi. Values provided are preliminary. DBF shall verify flows and calculate current and future flows to determine the most efficient pump motor for the project at no additional cost.
3. The pump(s) shall be capable of handling raw, unscreened sewage. The design shall be such that the pump unit will be automatically and firmly connected to the discharge piping when lowered into place on its mating discharge connection, permanently installed in the wet well. The pump shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be disconnected. For this purpose, there shall be no need for personnel to enter the wet well. Each shall be fitted with a stainless-steel chain of adequate strength and length to permit raising and lowering the pump for inspection or removal. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 165 feet.

4. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. The entire weight of the pump/motor unit shall be borne by the pump discharge elbow. No portion of the pump/motor unit shall bear on the sump floor directly or on a sump floor mounted stand. Power and pilot cable supports shall be provided and consist of a wire braid sleeve with attachment loops or tails to connection to the underside of the access frame.

D. Pump Construction

1. All major parts, such as the stator casing, oil casing, and impeller shall be of gray iron. A coating of rubber asphalt paint resistant to sewage shall protect all surfaces coming into contact with sewage. All exposed bolts and nuts shall be of stainless steel.
2. A wear ring system shall be bronze and installed to provide efficient sealing between the volute and impeller. The impeller shall be gray cast iron of non-clogging design, capable of handling solids, fibrous material, heavy sludge, and other matter found in normal sewage applications. The impeller shall be constructed with a long throughlet without acute turns. The impeller shall be dynamically balanced. Static and dynamic balancing operations shall not deform or weaken it. The impeller shall be a slip fit to the shaft and key driven. Non-corroding fasteners shall be used.
3. Each pump shall be provided with a mechanical rotating shaft seal system running in an oil reservoir having separate, constantly hydro-dynamically lubricated lapped seal faces. The (lower) seal unit between the pump and oil chamber shall contain one stationary and one positively driven rotating tungsten-carbide ring. The (upper) seal unit between the oil sump and motor housing shall contain one stationary tungsten-carbide ring and one positively driven rotating tungsten carbide ring. Each interface shall be held in contact by its own spring system supplemented by external liquid pressures. The seals shall require neither maintenance nor adjustment but shall be easily inspected and replaceable. Shaft seals without positively driven rotating members or conventional double mechanical seals with a common single or double spring acting between the upper and lower units, requiring a pressure differential to offset external pressure and effect sealing shall not be considered acceptable nor equal to the dual independent seal system specified. The shaft sealing system shall be capable of operating submerged to depths of, or pressures equivalent to 165 feet. No seal damage shall result from operating the pumping unit out of its liquid environment. The seal system shall not rely upon the pump media for lubrication.
4. A sliding guide bracket shall be an integral part of the pump unit. The volute casing shall have a machined discharge flange to automatically and firmly connect with the cast iron discharge connection, which when bolted to the floor of the sump and discharge line, will receive the pump discharge connecting flange without the need of adjustment, fasteners, clamps or similar devices.

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5. Installation of each pump unit to the discharge connection shall be the result of a simple linear downward motion of the pump unit guide by no less than two 2 inch stainless steel guide bars.
6. No other motion of the pump unit, such as tilting or rotating, shall be required. Sealing of the discharge interface by means of a diaphragm, O-ring or other devices will not be considered acceptable nor equal to a metal-to-metal contact of the pump discharge flange and mating discharge connection specified and required. No portion of the pump unit shall bear directly on the floor of the wet well. There shall be no more than one 90o bend allowed between the volute discharge flange and station piping.
7. The pump motor shall be housed in a water-tight casing and shall have moisture resistant Class F 155o insulation. The motor shall be NEMA Design B and designed for continuous duty.
8. The cable entry water seal design shall be such that precludes specific torque requirements to insure a watertight and submersible seal. Epoxies, silicones or other secondary sealing systems shall not be required or used. The cable entry junction box and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign materials gaining access through the pump top.
9. Pump motor cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors and shall be of adequate size to allow motor voltage conversion without replacing the cable. Motor electrical cables shall be of sufficient length to extend from the motor to the above ground disconnect switch unspliced.
10. All mating surfaces of major parts shall be machined and fitted with nitrile O-rings where watertight sealing is required. Machining and fitting shall be such that sealing is accomplished by automatic compression in 2 planes and O-ring contact made on four surfaces, without the requirement of specific torque limits to affect this. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered adequate nor equal.
11. Tolerances of all parts shall be such that allows replacement of any part without additional machining required to ensure sealing as described above. No secondary sealing compounds, greases or other devices shall be used.
12. Each unit shall be provided with an adequately designed cooling system. Thermal radiators integral to the stator housing, cast in one unit, are acceptable. Where water jackets alone or in conjunction with radiators are used, separate circulation shall be provided. Cooling media channels and ports shall be non-clogging by virtue of their dimensions. Provision for external cooling and flushing shall be provided.
13. Integral thermal sensors shall not be a requirement on any unit without a water jacket. Thermal sensors shall be used to monitor stator temperatures on any unit with a water jacket. There shall be one for each phase group in the motor. These shall be used in conjunction with and supplemental to external motor over current protection and available at the control panel.

14. All units of 100 HP or more shall have thermal sensors monitoring bearing temperatures in addition to the motor thermal sensors described above. Bearing thermal monitors shall be independent of the motor sensors and available at the control panel circuitry to effect alarm and/or shut down functions.

E. Pump Test
   1. The pump manufacturer shall perform the following inspections and tests on each pump before shipment from factory.
      a. Impeller, motor rating and electrical connections shall first be checked for compliance to the customer's purchase order.
      b. A motor and cable insulation test for moisture content or insulation defects.
      c. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.
      d. The pump shall be run for 30 minutes submerged, a minimum of 6 feet under water.
      e. After operational test (item d), the insulation test (item b) is to be performed again.
      f. Test shall consist of checking the unit at its noted speeds for head capacity, efficiency, and brake horsepower at a number of points to properly establish the performance curve.
   2. A certified written test report and performance curve stating the foregoing have been done shall be supplied with each pump at the time of shipment.
   3. The pump cable end will then be fitted with a shrink fit rubber boot to protect it prior to electrical installation.

F. Pump Warranty
   1. The pump manufacturer shall fully warrant the units being supplied to the CITY against defects in workmanship and materials. Full replacement within 5-years (not a prorated warranty) under normal use, operation, and service. The warranty shall be in printed form, include a warranty schedule, and apply to all similar units.

G. Documentation
   1. Standard drawings supplied shall include pump outlines, controls, access frames and typical installation guides. Each station shall be supplied with installation and maintenance manuals and pump parts lists for the pumps installed. Electrical control wiring diagrams shall accompany each control.

H. Spare Parts
   1. DBF shall furnish one pump complete with parts necessary for its installation. The pump shall be delivered to CITY still in crates.

## 2.3 ELECTRICAL

A. All work shall be in conformance with the National Electric Code, National Electrical Manufacturers Association, National Fire Protection Association, Institute of Electrical and Electronics Engineers, American National Standards Institute,

Occupational Safety & Health Administration, South Florida Building Code, and CITY Standards.

B. Pump Motors:
   1. Electrical Service Specifications
      a. Voltage Tolerance: +10%, - 14%
      b. Frequency Tolerance: +5%
      c. Voltage Balance (Phase to Phase): ±1%
   2. Cable Specifications
      a. All wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper conductors.
      b. All conductors No. 8 AWG and larger shall be stranded.
      c. Type XHHW shall be 600-volt cross-linked polyethylene (XLP) and type THHN/THWN shall be 600 volts as manufactured by the Hi-Tech Company, Rome Cable Corporation, The Okonite Company or approved equal.
      d. Process instrumentation wire shall be 600 volt, PVC or polyethylene insulated, aluminum/polyester tape shielded, polyvinyl chloride jacketed, type “TC” as manufactured by the American Insulated Wire Company, Belden Corporation, “Beldfoil” 9342, or approved equal.
   3. Motor Protection
      a. Motor and power line protection for overload and short circuit conditions must conform to N.E.C. standards, ref. NATIONAL ELECTRIC CODE, 1984 edition, Article 430.
   4. Thermal Protection
      a. The stator is protected by three thermal switches (one per phase) imbedded in the windings. These switches are wired in series and two leads are brought up to the pump terminal board for connection to the control panel. The switches must be connected so that the pump is turned off if the stator overheats.

C. Control Panel
   1. The control panel shall be supplied by the DBF completely factory wired with all necessary motor starters, circuit breakers, etc. for complete operation of the pumps. It shall be of the safety type and components shall bear the label of approval of Underwriters Labs; as well as meeting all applicable requirement of NEMA. The top of the cabinet shall be mounted 6'-0" above the floor, properly aligned and adequately supported independently of the connecting raceways. Each device in the control circuit shall be mounted on a frame with plastic cover mounted on the inside of the door.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

B. Pipe handling. All loading or unloading of pipe, fittings, valves, and accessories shall be done in such a manner so as to avoid damage. The pipe shall not be skidded or rolled against pipe already unloaded.

C. Force mains shall be constructed of ductile iron pipe or PVC plastic pipe as specified on the Plans. Fittings 4 inches and over shall be properly anchored and braced with restrained joints conforming to the details shown in the plans.

D. The interior of all pipes, fittings and other appurtenances shall be kept free of dirt and foreign matter at all times. Pipe shall be flushed clean before valves and other appurtenances are installed.

E. Pipe laying. All pipes shall be laid to line and grade with valves stems plumb. All pipes shall have a minimum cover of 30 inches for DIP pipe and 36 inches for HDPE and PVC pipe.

F. All fittings, encasement and appurtenances shall be incidental to the cost of furnishing and installing the force mains.

G. Concrete Protective Liner

1. The installation of the protective liner into precast wet wells and maintenance access structures shall be accomplished only by a precast concrete manufacturer certified by the liner manufacture, with a minimum of five years of manufacturing experience, and a minimum of five years of experience in the installation of corrosion resistant thermo-plastic sheet liners in concrete structures. Upon request, the liner installer shall provide written certification that the installation is in accordance with the liner manufacturer's installation specifications. Part 2, Paragraph 2.01 of this Section includes further information as it pertains to the lining of the wetwell.
2. Placement of the liner on forms shall conform to the liner manufacturer's written instructions. Only thermo-plastic extrusion welders certified by the liner manufacturer shall perform all shop and field welding. All field thermo-welding shall additionally be performed only by confined space trained, and certified, personnel. A copy of the thermo-welder's certifications shall accompany the submittal.

## 3.2 SHOP PAINTING

A. Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter.

B. All pumps and motors shall be shop primed, with primer compatible with the field painting.

C. All nameplates shall be properly protected during painting.

D. Gears, bearing surfaces and other similar surfaces, which are not to be painted, shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the CITY up to the time of the final acceptance test.

## 3.3 FIELD PAINTING

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A. The primer and paint used in the field shall be products of the same manufacturer as the shop paint to assure compatibility.

## 3.4 INSPECTION AND TESTING

A. The CITY shall have the right to inspect, test or witness tests of all materials or equipment to be furnished under these Specifications, prior to the shipment from the point of manufacture.

B. The CITY shall be notified in writing prior to initial shipment, in ample time so that the CITY can make arrangements for inspection.

C. The CITY or CITY'S representative shall be furnished all facilities, including labor, and shall be allowed proper time for inspection and testing of material and equipment.

D. Materials and equipment shall be tested or inspected as required by the CITY, and the cost of such work shall be included in the cost of the equipment. The DBF shall anticipate that delays may be caused because of the necessity of inspection, testing, and accepting materials and equipment before their use is approved.

E. The services of a factory representative shall be furnished for one (1) day and shall have complete knowledge of proper operation and maintenance to inspect the final installation and supervise a test run of the equipment.

F. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.

## 3.5 PUMP TESTING

A. After all pumps have been completely installed, and working under the direction of the manufacturer, conduct in the presence of the CITY such tests that are necessary to indicate that pump efficiency and discharge conform to the Specifications. Field tests shall include all power, water or wastewater, labor, equipment, and incidentals required to complete the field tests.

B. If the pump performance does not meet the Specifications, corrective measures shall be taken or pumps shall be removed and replaced with pumps, which satisfy the conditions, specified.

## 3.6 MOTOR TESTING

A. The DBF shall check all motors for correct lubrication in accordance with manufacturer's instructions. The DBF shall check direction of rotation of all motors and reverse connections, if necessary.

## 3.7 ELECTRICAL

A. All electrical wiring shall comply with the latest edition of the minimum requirements of the Florida Building Code, National Electric Code, and Underwriters Laboratories. Electrical wiring will also need to meet the requirements listed in Division 16 of the specifications and the drawings.

**END OF SECTION 02603**

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. The DBF shall furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.

B. The piping shown is intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. It is the DBF's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, etc., for a complete and functional system.

### 1.3 RELATED WORK

A. Division 2 as applicable.
B. Section 02200 - Earthwork.
C. Section 02221 - Excavation and Backfilling Utilities
D. Section 02641 – Valves, General

### 1.4 REFERENCE STANDARDS

A. Codes: All codes, as referenced herein are specified in Section 01090, "Reference Standards".

B. Commercial Standards:

| | |
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| ANSI/ASME B1.20.1 | Pipe Threads, General Purpose (inch). |
| ANSI B16.5 | Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys. |
| ANSI/AWWA | C100 Ductile Iron Pipe |
| ANSI/AWWA | C900 Plastic Pipe |
| ANSI/AWWA | C207 Steel Pipe Flanges for Water Works Service, Sizes 4 inch through 144 inch. |
| ANSI/AWWA | C606 Grooved and Shouldered Joints. |
| ANSI/AWS D1.1 | Structural Welding Code. |
| ASTM A 307 | Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile. |
| ASTM A 325 | Specification for High-Strength Bolts for Structural Steel Joints. |
| ASTM D 792 | Test Methods for Specific Gravity and Density of Plastics by Displacement. |

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| ASTM D 2000 | Classification System for Rubber Products in Automotive Applications. |

## 1.5 SUBMITTALS

A. The DBF shall submit complete shop drawings and certificates, test reports, affidavits of compliance, of all piping systems, in accordance with the requirements in Section 01340, "Shop Drawings, Product Data and Samples", and as specified in the individual sections. The shop drawings shall include all necessary dimensions and details on pipe joints, fittings, fitting specials, valves, appurtenances, design calculations, and material lists. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, and pipe supports necessary to accommodate the equipment and valves provided in a complete and functional system.

B. All expenses incurred in making samples for certification of tests shall be borne by the DBF.

C. The DBF shall submit as part of the shop drawings a certification from the pipe fabricator stating that all pipes that are fabricated are subject to a recognized Quality Control Program. An outline of the program shall be submitted to the CITY for review prior to the fabrication of any pipe.

## 1.6 QUALITY ASSURANCE

A. Inspection: All pipes shall be subject to inspection at the place of manufacture. During the manufacture of the pipe, the CITY shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

B. Tests: Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards.

## 1.7 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Where the assistance of a manufacturer's service representative is advisable, in order to obtain perfect pipe joints, supports, or special connections, the DBF shall furnish such assistance at no additional cost to the OWNER.

## 1.8 MATERIAL DELIVERY, STORAGE, AND HANDLING

A. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground, to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

## 1.9 CLEANUP

A. After completion of the work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site. The entire piping system shall be handed over in a clean and functional condition.

**PART 2** PRODUCTS

## 2.1 GENERAL

A. All pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the applicable Sections of Division 2 and as specified herein.

B. Lining: All requirements pertaining to thickness, application, and curing of pipe lining, are in accordance with the requirements of the applicable Sections of Division 2, unless otherwise specified.

C. Coating: All requirements pertaining to thickness, application, and curing of pipe coating, are in accordance with the requirements of the applicable Sections of Division 2, unless otherwise specified. Pipes above ground or in structures shall be field-painted as directed by the CITY.

D. Grooved Piping Systems: Piping systems with grooved joints and fittings may be provided in lieu of screwed, flanged, welded, or mechanical joint systems for ductile iron yard piping. (All piping above and below ground within the property limits of treatment plants, pump stations, and similar installations). All grooved couplings on buried piping must be bonded. To assure uniform and compatible piping components, all grooved fittings, couplings, and valves shall be from the same manufacturer. The DBF shall make the coupling manufacturer responsible for the selection of the correct style of coupling and gasket for each individual location.

## 2.2 PIPE FLANGES

A. Flanges: Where the design pressure is 150 psi or less, flanges shall conform to either ANSI/AWWA C207 Class D or ANSI B16.5 150-lb class. Where the design pressure is greater than 150 psi, up to a maximum of 275 psi, flanges shall conform to ANSI/AWWA C207 Class E, Class F, or ANSI B16.5 150-lb class. However, AWWA flanges shall not be exposed to test pressure greater than 125 percent of rated capacity. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected. Where the design pressure is greater than 275 psi up to a maximum of 700 psi, flanges shall conform to ANSI B16.5 300-lb class. Flanges shall have flat faces and shall be attached with boltholes straddling the vertical axis of the pipe unless otherwise shown. Attachment of the flanges to the pipe shall conform to the applicable requirements of ANSI/AWWA C207. Flanges for miscellaneous small pipes shall be in accordance with the standards specified for these pipes.

B. Blind Flanges: Blind flanges shall be in accordance with ANSI/AWWA C207, or with the standards for miscellaneous small pipes. All blind flanges for pipe sizes 12 inches and over shall be provided with lifting eyes in form of welded or screwed eyebolts.

C. Flange Coating: All machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

D. Flange Bolts: All bolts and nuts shall conform to pipe manufacturers recommendations. Studs and bolts shall extend through the nuts a minimum of 1/4-inch. All-thread studs shall be used on all valve flange connections, where space restrictions preclude the use of regular bolts.

E. Insulating Flanges: Insulated flanges shall have boltholes 1/4-inch diameter

greater than the bolt diameter.

F. Insulating Flange Sets: Insulating flange sets shall be provided where shown. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers and a steel washer. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2-inch or smaller and shall be made of acetal resin. For bolt diameters larger than 1-1/2-inch, insulating sleeves and washers shall be 2-piece and shall be made of polyethylene or phenolic. Steel washers shall be in accordance with ASTM A 325. Insulating gaskets shall be full-face.

G. Insulating Flange Manufacturers, or approved equal:
   1. JM Red Devil, Type E;
   2. Maloney Pipeline Products Co., Houston;
   3. PSI Products, Inc., Burbank, California.

H. Flange Gaskets: Gaskets for flanged joints shall be full-faced, 1/16-inch thick compressed sheets of aramid fiber base, with nitrile binder and non-stick coating, suitable for temperatures to 700 degrees F, a pH of one to eleven, and pressures to 1000 psi. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange. Ring gaskets shall not be permitted.

I. Flange Gasket Manufacturers, or approved equal:
   1. John Crane, style 2160;
   2. Garlock, style 3000.

## 2.3 THREADED INSULATING CONNECTIONS

A. General: Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. Materials: Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

## 2.4 MECHANICAL-TYPE COUPLINGS (GROOVED OR BANDED PIPE)

A. General: Cast mechanical-type couplings shall be provided where shown. The couplings shall conform to the requirements of ANSI/AWWA C606. All gaskets for mechanical-type couplings shall be compatible with the piping service and fluid utilized, in accordance with the coupling manufacturer's recommendations. The wall thickness of all grooved piping shall conform with the coupling manufacturer's recommendations to suit the highest expected pressure. To avoid stress on equipment, all equipment connections shall have rigid-grooved couplings, or harness sets in sizes where rigid couplings are not available, unless thrust restraint is provided by other means. The DBF shall have the coupling Manufacturer's service representative verify the correct choice and application of all couplings and gaskets, and the quality of work, to assure a correct installation.

B. Couplings for Steel Pipe, Manufacturers, or approved equal:
   1. Gustin-Bacon (banded or grooved);
   2. Victaulic Style 41 or 44 (banded, flexible);
   3. Victaulic Style 77 or 07 (grooved).

C. Ductile Iron Pipe Couplings, Manufacturers, or approved equal:
   1. EBAA Iron
   2. Romac.
   3. Sigma
   Note: Ductile iron pipe couplings shall be furnished with flush seal gaskets.

## 2.5 SLEEVE-TYPE COUPLINGS

A. Construction: Sleeve-type couplings shall be provided where shown, in accordance with ANSI/AWWA C219 unless otherwise specified, and shall be of steel with steel bolts, without pipe stop, and shall be of sizes to fit the pipe and fittings shown. The middle ring shall be not less than 1/4-inch in thickness and shall be either 5 or 7 inches long for sizes up to and including 30 inches and 10 inches long for sizes greater than 30 inches, for standard steel couplings, and 16 inches long for long-sleeve couplings. The followers shall be single-piece contoured mill section welded and cold expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Buried sleeve-type couplings shall be epoxy-coated at the factory as specified.

B. Pipe Preparation: The ends of the pipe, where specified or shown, shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

C. Gaskets: Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," grade 60, or equivalent suitable elastomer. The rubber in the gasket shall meet the following specifications:
   1. Color - Jet Black
   2. Surface - Non-blooming
   3. Durometer Hardness - 74 ± 5
   4. Tensile Strength - 1000 psi Minimum
   5. Elongation - 175 percent Minimum

D. The gaskets shall be immune to attack by impurities normally found in water or wastewater. All gaskets shall meet the requirements of ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as noted above. All gaskets shall be compatible with the piping service and fluid utilized.

E. Insulating Couplings: Where insulating couplings are required, both ends of the coupling shall have a wedge-shaped gasket which assembles over a rubber sleeve of an insulating compound in order to obtain insulation of all coupling metal parts from the pipe.

F. Restrained Joints: All sleeve-type couplings on pressure lines shall be harnessed

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unless thrust restraint is provided by other means. Harnesses shall be in accordance with the requirements of the appropriate reference standard, or as shown.

G. Manufacturers or Equal:
   1. JCM Industries
   2. Hymax
   3. Smith-Blait

## 2.6 FLEXIBLE CONNECTORS

A. Flexible connectors shall be installed in all piping connections to engines, blowers, compressors, and other vibrating equipment, and where shown. Flexible connectors for
service temperatures up to 180 degrees F shall be flanged, reinforced Neoprene or Butyl spools, rated for a working pressure of 40 to 150 psi, or reinforced, flanged duck and rubber, as best suited for the application. Flexible connectors for service temperatures above 180 degrees F shall be flanged braided stainless-steel spools with inner, annular, corrugated stainless steel hose, rated for minimum 150 psi working pressure, unless otherwise shown. The connectors shall be 9 inches long, face-to-face flanges, unless otherwise shown. The manufacturer shall approve the final material selection. The DBF shall submit manufacturer's shop drawings and calculations.

## 2.7 EXPANSION JOINTS

A. All piping subject to expansion and contraction shall be provided with sufficient means to compensate for such movement, without exertion of undue forces to equipment or structures. This may be accomplished with expansion loops, bellow-type expansion joints, or sliding-type expansion joints. Expansion joints shall be of stainless steel, monel, rubber, or other materials, best suited for each individual service. The DBF shall submit detailed calculations and manufacturer's shop drawings, guaranteeing satisfactory performance of all proposed expansion joints, piping layouts showing all anchors and guides, and information on materials, temperature and pressure ratings.

## 2.8 PIPE THREADS

A. All pipe threads shall be in accordance with ANSI/ASME B1.20.

# PART 3 EXECUTION

## 3.1 GENERAL

A. All pipes, fittings, and appurtenances shall be installed in accordance with the requirements of the applicable Section of Divisions 2. The lining manufacturer shall take full responsibility for the complete, final product and its application. All pipe ends and joints at screwed flanges shall be epoxy-coated, to assure continuous protection.

B. Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction to avoid damage to embedded raceways and rebars.

C. All exposed piping shall be painted. All piping to be painted shall be color coded in

accordance with OWNER's standard color code. Color samples shall be submitted to CITY for final color selection.

**END OF SECTION 02610**

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# PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

A. Provide all labor, materials, necessary equipment and services to complete the water distribution and wastewater transmission system work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

## 1.2 WORK INCLUDED

A. The DBF shall provide all tools, supplies, materials, equipment, and labor necessary for furnishing, epoxy coating, installing, adjusting, and testing of all valves and appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents. Where buried valves are shown, the DBF shall furnish and install valve boxes to grade, with covers, extensions, and position indicators.

B. The provisions of this Section shall apply to all valves and valve operators specified in the various Sections and Division 2 of these Specifications except where otherwise specified in the Contract Documents. Valves and operators in particular locations may require a combination of units, sensors, limit switches, and controls specified in other Sections of these Specifications.

## 1.3 RELATED WORK

A. Section 02221 - Excavation and Backfilling for Utilities

B. Section 02610 - Piping, General

## 1.4 REFERENCE STANDARDS

A. Codes: All codes, as referenced herein, are specified in Section 01090, "Reference Standards".

B. Commercial Standards:

| | |
|---|---|
| ANSI B16.1 | Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800. |
| ANSI B16.5 | Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys. |
| ANSI/ASME B31.1 | Power Piping. |
| ASTM A 36 | Specification for Structural Steel. |
| ASTM A 48 | Specification for Gray Iron Castings. |
| ASTM A 126 | Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings. |
| ASTM A 536 | Specification for Ductile Iron Castings. |
| ASTM B 61 | Specification for Steam or Valve Bronze Castings. |
| ASTM B 62 | Specification for Composition Bronze or Ounce Metal Castings. |
| ASTM B 148 | Specification for Aluminum-Bronze Castings. |
| ASTM B 584 | Specification for Copper Alloy Sand Castings for General Applications. |
| ANSI/AWWA C500 | Gate Valves for Water and Sewerage Systems. |
| ANSI/AWWA C502 | Dry-Barrel Fire Hydrants. |

| | |
|---|---|
| ANSI/AWWA C503 | Wet-Barrel Fire Hydrants. |
| ANSI/AWWA C504 | Rubber-Seated Butterfly Valves. |
| ANSI/AWWA C507 | Ball Valves 6 Inches Through 48 Inches. |
| ANSI/AWWA C508 | Swing-Check Valves for Waterwork Service, 2 Inches Through 24 Inches NPS. |
| ANSI/AWWA C509 | Resilient-Seated Gate Valves for Water and Sewage Systems. |
| ANSI/AWWA C511 | Reduced-Pressure Principle Backflow-Prevention Assembly. |
| ANSI/AWWA C550 | Protective Interior Coatings for Valves and Hydrants. |
| SSPC-SP-2 | Hand Tool Cleaning. |
| SSPC-SP-5 | White Metal Blast Cleaning. |

### 1.5 SUBMITTALS

A. Shop Drawings: Shop drawings of all valves and operators including associated wiring diagrams and electrical data, shall be furnished as specified in Section 01340, "Shop Drawings, Product Data and Samples".

B. Valve Labeling: The DBF shall submit a schedule of valves to be labeled indicating in each case the valve location and the proposed wording for the label.

### 1.6 QUALITY ASSURANCE

A. Valve Testing: Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

B. Bronze Parts: Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62, or where not subject to dezincification, to ASTM B 584.

C. Certification**:** Prior to shipment, the DBF shall submit for all valves over 12 inches in size, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, ASTM, etc.

## PART 2 PRODUCTS

### 2.1 VALVES, GENERAL

A. General: The DBF shall furnish all valves, gates, valve-operating units, stem extensions, and other accessories as shown or specified. All valves and gates shall be new and of current manufacture. All shut-off valves, 6-inch and larger, shall have operators with position indicators. Where buried, these valves shall be provided with valve boxes and covers containing position indicators, and valve extensions. Shut-off valves mounted higher than 5 feet-6 inches above working level shall be provided with chain operators.

B. Valve Flanges: The flanges of valves shall be in accordance with Section 02610, "Piping, General".

C. Gate Valve Stems: Where subject to dezincification, gate valve stems shall be of bronze conforming to ASTM B 62, containing not more than 5 percent of zinc nor more than 2 percent aluminum. Gate valve stems shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 40,000 psi, and an elongation

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of at least 10 percent in 2 inches, as determined by a test coupon poured from the same ladle from which the valve stems to be furnished are poured. Where dezincification is not a problem, bronze conforming to ASTM B 584 may be used.

D. Protective Coating: Except where otherwise specified, ferrous surfaces, exclusive of stainless steel surfaces, in the water passages of all valves 4-inch and larger, as well as the exterior surfaces of all submerged valves, shall be coated with 2 part thermal setting epoxy coatings. Flange faces of valves shall not be epoxy coated. The valve manufacturer shall certify in writing that such coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with these Specifications.

E. Valve Operators: Where shown, certain valves and gates shall be furnished with electric operators, provided by the valve or gate manufacturer. The same manufacturer shall furnish all operators of a given type. Where different manufacturers supply these operators, the DBF shall coordinate their selection to provide uniformity of each type of electric operator. All valve operators, regardless of type, shall be installed, adjusted, and tested by the valve manufacturer at the manufacturing plant.

F. Valve Labeling: Except when such requirement is waived by the ENGINEER in writing, a label shall be provided on all shut-off valves exclusive of hose bibbs and chlorine cylinder valves. The label shall be of 1/16-inch plastic or stainless steel, minimum 2 inches by 4 inches in size, and shall be permanently attached to the valve or on the wall adjacent to the valve as directed by the ENGINEER. Valve labels shall be photographed and marked on the As-Built Drawings. Valves are also required to have an Identification Marker in accordance with the Contract Documents.

G. Nuts and Bolts: All nuts and bolts on valve flanges and supports shall be in accordance with manufacturers recommendations. Where submerged or buried, all nuts and bolts on valve flanges and valve bodies shall be stainless steel.

## 2.2 GATE VALVES

A. All buried gate valves shall be of the inside screw, non-rising stem type. Valves shall be capable of being repacked under line pressure. Valves 14-inch and larger installed on vertical pipes with their stems horizontal shall be fitted with bronze slides, tracks, rollers, and scrapers to assist the travel of the gate assembly. Quick opening valves shall have quick opening levers and cams in lieu of handwheel operators.

B. Knife Gate Valves.

1. Knife gate valves shall be provided with raised face and resilient seats for positive seating. Wetted parts shall be constructed of Type 316 stainless steel. Gates shall be finish-ground on both sides to prevent packing or seat damage. Valves 2 to 4 inches in size shall be furnished with cast stainless steel bodies; valves 6 to 24 inches in size shall be furnished with cast semi-steel bodies with stainless steel linings. Valve ends shall be of the flanged or wafer design, as shown. Gate guides and jams shall be steel. Actuator shall be handwheel. Port design shall be full-round.
2. Manufacturers or approved equal:
   a. Red Valve Company Inc.;

b. DeZurik Corporation
c. Fabri-Valves;
d. Rovang, Inc.

C. Resilient-Seated Gate Valves

3. Resilient-seated gate valves conforming to ANSI/AWWA C509 shall be provided. Resilient-seated gate valves shall have cast iron bodies with flanged, bell, or mechanical joint ends, rubber-coated cast iron disc, flanged bonnet, bronze stem, O-ring seals, and operators with handwheel or square nut, unless otherwise shown. Rubber and rubber composition materials (EPDM) shall be suitable for use in water chlorine or chloramines and in sanitary sewage.

**4.** Manufacturers or approved equal:

a. Clow Valve Co.;
b. Kennedy Valve;
c. Mueller Company;
d. M&H Valve

## 2.3 ECCENTRIC PLUG VALVES

A. Equipment Requirements: Plug valves shall be of the non-lubricated, eccentric type with resilient faced plugs, port areas shall be 100% of full pipe area regardless of the size. The body shall be of semi-steel (ASTM A-126 C1.B) and shall have bolted bonnet, which gives access to the intervals of the valve. Seats shall be welded overlay of high nickel content, or a stainless-steel plate locked in the body cavity. If a plate is used, it shall be replaceable through the bonnet access. Bearings shall be permanently lubricated of stainless steel, bronze or teflon lined, fiberglass backed duralon. Bearing areas shall be isolated from the flow with grit seals. Valves shall have packing bonnets where the shaft protrudes from the grit seals. Valves shall have packing bonnets where the shaft protruded from the valve and the packing shall be self-adjusting chevron type, which can be replaced without removing the bonnet. All nuts, bolts, springs and washers shall be stainless steel.

B. Valves shall be designed for a working pressure of 150 PSI. The valve and actuator shall be capable of satisfactory operation in either direction of flow against pressure drops up to and including 100 PSI (for plug valves over 12 inches in diameter). Valves shall be bubble tight in both directions at 100-psi differential.

C. Plug valves over 12 inches in diameter shall have worm gear operators. The operating mechanism shall be for buried service with a 2-inch square-operating nut.

D. Plug valves are to be installed with the sear pointed towards the upstream flow, when specified.

E. Manufacturers or approved equal:

1. Val-Matic.
2. DeZurik Corporation.
3. Clow Valve Co.
4. American

## 2.4 BALL VALVES (4-INCH AND SMALLER)

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A. General Requirements: Unless otherwise specified or shown, general purpose ball valves in sizes up to 4-inch shall have manual operators with lever or handwheel. Ferrous surface of 4-inch valves, which will be in contact with water, shall be epoxy-coated. All ball valves shall be of best commercial quality, heavy-duty construction.
B. Body: All ball valves up to 1-1/2 inch (incl.) in size shall have bronze or forged brass 2- or 3-piece bodies with screwed ends for a pressure rating of not less than 300 psi WOG (water-oil-gas). Valves 2-inch to 4-inch in size shall have bronze forged brass or steel 2- or 3-piece bodies with flanged ends for a pressure rating of 125 psi or 150 psi.
C. Balls: The balls shall be solid brass or chrome plated bronze, or stainless steel, with large or full openings.
D. Stems: The valves seats shall be of Polytetrafluoroethylene (PTFE) or Buna N, for bi-directional service and easy replacement.
E. Manufacturers or approved equal:
    1. Jamesbury Corporation;
    2. Jenkins Bros.;
    3. Lunkenheimer Flow Control;
    4. Wm. Powell Company;
    5. Worcester Controls;
    6. Valve Primer Corporation.

## 2.5 SWING CHECK VALVES (3-INCH AND LARGER)

A. General: Swing check valves for water, sewage, sludge, and general service shall be of the outside lever and spring or weight type, in accordance with ANSI/AWWA C 508 - Swing-Check Valves for Waterworks Service, 2-inch through 24-inch NPS, unless otherwise indicated, with full-opening passages, designed for a water-working pressure of 150 psi. They shall have a flanged cover piece to provide access to the disc.
B. Body: The valve body and cover shall be of cast iron conforming to ASTM A 126, with flanged ends conforming to ANSI B 16.1, or mechanical joint ends, as shown.
C. Disc: The valve disc shall be of cast iron, ductile iron, or bronze conforming to ASTM B 62.
D. Seat and Rings: The valve seat and rings shall be of bronze conforming to ASTM B 62 or B 148, or of Buna-N.
E. Hinge Pin: The hinge pin shall be of bronze or stainless steel.
F. Manufacturers or approved equal:
    1. American
    2. Clow

## 2.6 AIR-VACUUM AND AIR-RELEASE VALVES

A. Air and Vacuum Valves: Air and vacuum valves shall be capable of venting large quantities of air while pipelines are being filled and allowing air to re-enter while pipelines are being drained. They shall be of the size shown, with flanged or screwed ends to match piping. Bodies shall be of high-strength cast iron. The float, seat, and all moving parts shall be constructed of Type 316 stainless steel.

Seat washers and gaskets shall be of a material insuring water tightness with a minimum of maintenance. Valves shall be designed for minimum 150-psi water-working pressure, unless otherwise shown.

B. Air-Release Valves: Air-release valves shall vent accumulating air while system is in service and under pressure and be of the size shown and shall meet the same general requirements as specified for air and vacuum valves except that the vacuum feature will not be required. They shall be designed for a minimum water-working pressure of 150 psi, unless otherwise shown.

C. Combination Air Valves: Combination air valves shall combine the characteristics of air and vacuum valves and air release valves by exhausting accumulated air in systems under pressure and releasing or re-admitting large quantities of air while a system is being filled or drained, respectively. They shall have the same general requirements as specified for air and vacuum valves.

D. Manufacturers or approved equal:
   **1.** ARI

## 2.7 CORPORATION STOPS (Ball Valve Type)

A. Unless otherwise shown, corporation stops shall be made of brass alloy for key operation, with screwed ends with corporation thread or iron pipe thread, as required. AWWA taper thread for inlet thread and compression type fittings for outlet.

B. Manufacturer or approved equal:
   1. Ford Meter Box Company;
   2. Cambridge Brass;
   **3.** Mueller Company.

C. Electric Motor Operators
   1. All motorized valves shall be furnished by the DBF through the valve manufacturers as a complete package. Motor driven valve operators shall be furnished and installed in accordance with the applicable requirements shown on the process and instrumentation diagrams and electrical elementary diagrams. Operators shall comply with AWWA requirements for electrical operators.
   2. Electric operators including the motor, all required gearing, integral continuous duty rated reversing starter, AC line surge suppressors, controls and switches shall be as manufactured by Rotork, Limitorque, EIM; or approved equal.
   3. The motorized operators for modulating service shall be furnished with an integral position indicator/transmitter/controller. The above unit shall be internally powered, factory calibrated and furnished with adjustable zero, span, gain and deadband controls.
   4. The position indicator/transmitter shall provide a linear, isolated, 4-20 mA, 24 VDC output to remote instrumentation and controls proportional to 0-100 percent travel span. An external DC power source shall not be required.
   5. The position controller shall accept a linear 4-20 mA, 24 VDC input signal proportional to 0-100 percent travel span and shall generate appropriate outputs to the reversing starter to open/close the valve until the desired

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portion has been reached as determined by the position feedback signal to the position controller. Input signal isolation shall be provided.

6. The controller shall be furnished with circuitry to "lock in the last position" upon loss of control signal. DBF shall be responsible for proper transmitter/controller calibration in accordance with the manufacturer's recommendations.
7. Operator capacity shall be adequate to continuously operate the valve under all operating conditions. Unless otherwise indicated, or specified, motor operators shall be furnished complete with motors, limit switch operating mechanisms, travel limit switches, torque switches, transmitters, controllers, starters, lightening and surge suppression, terminal blocks, gear reducers, handwheel, gearing, necessary components, and incidental accessories as follows:
    a. All phases of the power supply shall be monitored. The DBF shall de-energize the motor upon detection of single phasing.
    - Logic circuits shall be protected against spurious voltage spikes, using opto-isolators in circuits connected to any remote input or output signals.
8. 8. Enclosure: The starter for 240 volt single phase motor operators and all local devices shall be mounted on a common NEMA 4 and PVC coated cast aluminum enclosure. The enclosure shall be permanently affixed to the valve operator housing.
9. Valve Stops: Valve stops for the operators shall be positive in action. Closing shall be complete, and opening full. Stops shall be field adjustable to the required settings. The torque switches shall prevent any excessive mechanical stress or electrical overloading any direction of travel.
10. Limit switches and gearing shall be an integral part of the motorized valve operator. The limit switch gearing shall be of the intermittent type, totally enclosed in its own gear case, grease lubricated to prevent direct and foreign matter from entering the gear train and shall be made of bronze or stainless steel. Limit switches shall be of the adjustable type capable of being adjusted to trip at any point between the normal position (full open, or full closed) and 75 percent of the travel to the opposite position.
11. Local (Motor) Devices: Local devices shall include, but not be limited to the following:
    a. Torque Switches: Torque switches, responsive to high torque encountered in either direction of travel. A torque switch, which has tripped due to mechanical load, shall not reset when the operator motor has come to a halt.
    - Limit Switches: Travel limit switches, for opening and closing direction of travel. Contract operations shall be as indicated on the Drawings. If not shown on the Drawings, the operator shall be furnished with a minimum of two DPDT switches. All switches shall be furnished with 5-ampere contacts. Switches shall be connected such that when the valve is fully open, or fully closed, the "open" or "close" light shall be illuminated. All limit switch contacts shall be wired out to a terminal strip so that the electrician in the field does not have to connect to the

switches.

- Local/remote selector switch with phase motor relay and auxiliary to provide dry contacts for collective indication of placement in the "remote" operating mode, the unit is powered, and that all safety/overload interlocks are satisfied to provide the above signal. For further requirements refer to electrical elementary control schematic.
- Open/close push-button for local manual operation (modulating service).
- Position indicator calibrated to 0-100 percent travel span.
- Terminals for remote indication of full open, full closed and overload (torque).

12. Operating Unit Gearing: The actuator shall be double reaction unit with the capability of quickly changing the output speed with a gear change. The power gearing shall consist of generated spur or helical gears of heat-treated steel, and worm gearing where required by the type of operator. Quarter turn or traveling unit operators do not specifically require worm gearing. The worm shall be of hardened alloy steel and the worm gear shall be of alloy bronze. All power gearing shall be grease-lubricated. Ball or roller bearings shall be used throughout for all motor operators. A mechanical dial position indicator to display valve position in percent of valve opening shall be provided. The gearing shall comply with AWWA requirements.
13. Stem Nuts: The actuator for other than quarter turn valves shall have a stem nut of high tensile bronze or other material compatible with the valve stem and suited to the application. The nut arrangement, where possible, shall be of the two-piece type to simplify field replacement. The stem nut for rising stem valves must be capable of being removed from the top of the actuator without removing the actuator from the valve, disconnecting the electrical wiring, or disassembling any of the gearing within the actuator.
14. Manual Operation: A handwheel shall be provided for manual operation. The handwheel shall not relocate during hand operation nor shall a fused motor prevent manual operation.
15. When in manual operating position, the volt motor driven unit will remain in this position until motor is energized at which time the valve operator will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. This movement from motor operation to handwheel operation shall be accomplished by a positive declutching knob or lever, which will disengage the motor and motor gearing mechanically not electrically. Hand operation must be reasonably fast and require no more than 100 lbs. of rim effort at the maximum required torque. It shall not be possible for the unit to be simultaneously in manual and motor operation.
16. 240 Volt Single Phase Motors: All motors on valves shall be designed for 240 volts 1-phase 60 Hz power. The motor shall be specifically designed for valve actuator service and shall be of high torque, squirrel cage reversible, totally enclosed, non-ventilated construction, with motor leads brought into the limit switch compartment without having external piping or conduit box. Motor insulation shall be NEMA Class B with maximum continuous temperature rating of 120˚ C (rise + ambient). Motors shall be sized to have

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a rated running time at the rated running torque of 15 minutes without exceeding the temperature rating of the insulation system. Running load torque shall be not more than 20 percent of the rated seating/unseating torque.

17. Speed-torque curves for the motors and torque calculations for seating, unseating, and running conditions shall be submitted. The maximum valve torque (seating/unseating) shall be less than 50 percent of stall torque or starting torque potential of the motor whichever is greater.
18. Operator Type:
    Type A: Remote set point using a 4-20 mA analog signal
    a. Local Operation
        (1) LOCAL/REMOTE selector
        (2) OPEN/CLOSE push buttons
        (3) Position set-point potentiometer/indicator
        (4) LOCAL accepts local position set point
        (5) OPEN/CLOSE indication
        (6) Fault (torque) indication
    b. Remote operation
        (1) REMOTE - accept a remote 4-20 mA position set-point
        (2) Position transmitter 4-20mA signal to RTU
        (3) Available Ready of Auto to RTU
        (4) Fault torque status to RTU
19. Valve Closure Time: Valve closure time shall be 1 minute.
20. Spare Parts:
    a. DBF shall furnish loose, one unit valve operator, complete with all the devices specified herein and with all the features and characteristics similar to the equipment supplied in this Contract. The spare operator shall be delivered to the OWNER still in crates.

## 2.8 BUTTERFLY VALVES

A. General: Butterfly valves used for 12 inch diameter and larger ONLY. All valves shall meet or exceed ANSI/NSF 61, latest revision. All valves shall meet or exceed AWWA C-504, Class 150B, latest revision. Valves shall open left, or counterclockwise. Buried service valves shall have a 2-inch operating nut.

1. Body: Body and disc material shall be cast or ductile iron meeting or exceeding ASTM A126 (latest revision) or A536, latest revision. Seat and all rubber material shall be chloramine resistant.
2. Shaft: Shaft, nuts, screws, and hardware material shall be stainless steel (Type 304 minimum). Valve disc shall be rigidly attached to the shaft to eliminate any relative motion. Shaft shall be offset from the disc and body seats so that they do not intersect. Shafts of 3-inch diameter and smaller shall be one piece through the valve with factory set thruster(s) to center the disc in the seat. Shafts larger than 3 inches diameter shall be stub-shafts rigidly keyed to the disc. Stub-shafts shall be provided with an adjustable thruster(s) to move the disc and shaft assembly positively in either direction to center the disc in the seat

3. Coating: Except where otherwise specified, interior and exterior ferrous surfaces, exclusive of stainless-steel surfaces, in all valves shall be coated with two-part thermosetting epoxy coating or fusion bonded epoxy coating. Flange faces of valves shall not be epoxy coated. The epoxy shall be suitable for use in potable water, reclaimed water, and wastewater.
4. Manufacturers or approved equal:
   a. Mueller
   - Val-Matic
   - Pratt
   - Clow

## PART 3 EXECUTION

### 3.1 VALVE INSTALLATION

A. General: All valves, gates, operating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as shown and specified. All gates shall be adequately braced to prevent warpage and bending under the intended use. Valves shall be firmly supported to avoid undue stresses on the pipe.

B. Access: All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and structural members or handrails.

C. Valve Accessories: Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the DBF to properly assemble and install these various items so that all systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

D. Butterfly Valves: All exposed butterfly valves shall be installed with a means of removing the complete valve assembly without dismantling the valve or operator.

**END OF SECTION 02641**

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# PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 (General Requirements) shall govern the WORK under this section.

## 1.2 WORK INCLUDED

A. The work under this Section shall consist of furnishing and installing sewer pipes and service connections and/or abandonment of pipelines in place as indicated on the plans and in accordance with these Specifications.

## 1.3 RELATED WORK

A. Section 02221 - Excavation and Backfilling for Utilities
B. Section 02601 - Subterranean Structures
C. Section 02610 - Piping – General
D. Section 02641 - Valves – General

# PART 2 PRODUCTS

## 2.1 PIPE

A. PVC plastic pipe and fittings for gravity sanitary sewers shall be un-plasticized, PVC Plastic Gravity Sewer Pipe conforming to ASTM D 3034 with SDR 26 (minimum pipe stiffness of 115 lbs/in/in) and integral wall bell and spigot joints for conveyance of domestic sewage that shall meet or exceed the requirements of ASTM D3212, latest revision. Sewer pipe, including laterals and fittings shall be of the same material composed of PVC plastic having a cell classification of 12454B or 12454C as defined in ASTM D 1784. Gaskets shall meet the requirements of ASTM F477, latest revision. No solvent welded pipe will be permitted.
   1. In addition to the above requirements, pipe shall also conform to the following tests:
      a. Drop Impact Test in accordance with ASTM D 2444.
      b. Pipe Stiffness Test in accordance with ASTM D2412.
      c. Acetone Immersion Test in accordance with ASTM D 2152.

B. PVC plastic gravity sewer pipe shall be as manufactured by JM Eagle or approved equal. Prior to delivery of PVC plastic pipe to the jobsite, DBF shall furnish the ENGINEER complete data from the manufacturer of the type of PVC pipe and fittings DBF proposes to install.

C. C900 plastic gravity sewer pipe (or SDR 18) shall conform to ANSI/AWWA standard for pipes 4 inch through 12 inch made from class 12454-A or class 12454-B material. C-900 or C-905 plastic gravity sewer pipe will be required to be installed where the depth of installation is 12 foot or deeper. C-900 or C-905 plastic gravity sewer pipe (SDR 18) shall
conform to ANSI/AWWA for pipe 14 inch through 48 inch made from class 12454-B material.

D. Ductile iron pipe shall be epoxy lined and conform to ANSI/AWWA standard C151/A21.51 and C150/A21.50.

E. DIP pipe shall conform with pressure class 350 for 4 inch through 24 inch.

## 2.2 SUBMITTALS

A. Shop Drawings: Shop drawings of all sanitary sewerage system products and materials shall be furnished as specified in Section 01340, "Shop Drawings, Product Data and Samples"

## 2.3 FORCE MAIN

A. Pipe Material

1. Force main shall be Protecto 401 (or approved equal) epoxy lined ductile iron pipe as specified on the plans. All pipes material shall be in accordance with material specified in Section 02610 “Piping General”.

# PART 3 EXECUTION

## 3.1 GRAVITY SEWER INSTALLATION

A. All sewer pipes shall be true to line and grade with bells up grade. The sections of the pipe shall be so laid and fitted together that when complete, the sewer shall have a smooth and uniform invert. The pipe shall be maintained clean. All pipe shall be free from defects. Trenches shall be kept dry while the pipe is being laid.

B. Bedding of the pipe shall consist of well graded ASTM C33 #67 rock or better, requiring the bottom of the trench to be shaped to fit the bottom of the pipe for distance equal to one-half of the outside diameter of the pipe. Bell holes shall be deep enough to ensure proper bearing of the pipe barrel on the bedding.

C. All joints shall be carefully fitted so as to ensure a tight waterproof joint. Joints shall not be covered until approved by the CITY. The exposed end of all pipes shall be protected so as to prevent dirt or other debris from entering the pipe. Pipes shall be thoroughly flushed at the completion of the work.

D. SDR 26 shall be per ASTM D2321 with Class I embedment material.

E. A minimum cover of thirty (30) inches is required for DIP and thirty-six (36) inches for PVC pipe unless otherwise shown on the plan and approved by the CITY.

## 3.2 SERVICE LATERAL CONNECTIONS

A. All connections, which are for future use, shall be properly capped. No pipe shall be cut for connections unless approved by the CITY. Wyes for service connections shall be installed as shown on the plans. The upper end of service connections shall be laid at a depth not less than 36 inches nor more than 48 inches below finish grade elevation, unless specifically noted otherwise on plans. All private property connections shall have a minimum slope of 1%. Additional cleanouts are required on all lateral connections over 75 feet in length. DBF is to take all necessary measures to ensure that all private property connections to existing main are switched over the new sanitary sewer facilities prior to abandonment of existing main.

## 3.3 ABANDONMENT OF PIPELINE IN PLACE

A. All sanitary sewer gravity or force mains shown on the drawings to be abandoned in place shall be properly cut and plugged after new mains or services are installed

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and service is properly restored to the homeowner. The pipeline shall be filled with concrete one foot from end of pipe as specified in Division 3 - Concrete, and Section 03010. Excavation, backfill, and restoration shall be executed in accordance with requirements for removing existing and installing new pipelines.

## 3.4 TESTS

A. After the joints have been inspected and approved, backfilling may be done until backfilled to one foot over the pipes. Backfilling shall be in accordance with Section 02221 of these Specifications.

B. After backfilling gravity sewers to the pavement rock base, the ENGINEER will "lamp" the lines between MAS. If this alignment is true and no pipes are broken or misaligned, the backfilling shall be completed. After the Engineer has determined that the pipe has been properly backfilled and sufficient time has passed to allow any settlement but not more than 30 days after backfill, a deflection test is to be performed on all sections of gravity pipeline between MAS. Refer to SECTION 02723 for details on sanitary sewer pipe video requirements.

C. Tests for water tightness of gravity sewers shall be made by the DBF in the presence of the ENGINEER. The sewer and connections shall not leak under the normal exterior ground water pressure at a rate in excess of 100 gallons per inch of diameter per mile per 24 hours for any section of line up to 15 inches in diameter. Special consideration shall be given to leakage allowance for sizes larger than 15 inches in diameter. Exfiltration from individual MAS shall not exceed 4 gallons in 24 hours. A maximum run of 3 MAS may be used per test.

D. Where the crown of the pipe is below the natural ground water table at the time and place of testing, the pipe shall be tested for infiltration. Suitable watertight plugs shall be installed and sections of pipe to be tested shall be pumped dry before start of the test. Where the crown of the pipe is above the natural water table, the pipe shall be tested for exfiltration by installing necessary plugs and filling pipes and MAS with water and maintaining a static head of water of two feet above the crown of the pipe during the test. Exfiltration tests shall be conducted on gravity lines, building and house lateral lines, unless waived by the ENGINEER. With sanitary sewers, the water level or internal pressure to be used for exfiltration tests shall be determined by the ENGINEER.

E. All visible leaks, regardless of results of infiltration tests, shall be repaired. All repairs shown necessary by the tests are to be made, broken or cracked pipe replaced, all deposits removed, the sewer left true to line and grade and entirely clean, free from lumps of cement, protruding gaskets, bulkheads, etc., and ready for use before final acceptance is made.

F. Repair of any defects found in the system are to be completed at the expense of the DBF.

G. On sanitary sewers, final infiltration and exfiltration tests shall be made by the DBF at their expense after all limerock base installations are completed and the sewers are cleaned and ready for use.

H. The ENGINEER shall maintain a record showing date and time of inspection, calculation of allowable exfiltration or infiltration and amount of measured

exfiltration or infiltration.

I. DBF will provide video of the sanitary sewer pipe installed. Video review of gravity sanitary sewer pipe will be performed by the ENGINEER and reviewed for compliance with the CITY Sewer Standard Details. First lift of rock must be installed before the gravity sewer pipe is videoed and available for review and approval by the ENGINEER.

## 3.5 WARRANTY

A. Repair and replacement. Any repairs or replacement necessitated by mechanical failure due to faulty materials, improper installation or poor quality of work shall be completed within five (5) days after notification by the ENGINEER. At the expiration of this time, the OWNER shall be entitled to have work done by others at the expense of the DBF. Such repair work done by others shall not void the warranty nor the responsibility of the DBF for the balance of the installation by the DBF.

**END OF SECTION 02722**

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## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. The work included in this section consists of furnishing all labor, supplies equipment and materials necessary to complete the installation of all landscaping as shown on the Plans as base bid including the installation of sod and seeding as shown, as well as all other related responsibilities as described in these Specifications and accompanying plans.

B. Installation: All plant materials included shall be of the specific size and quality indicated on the plans and in these specifications and shall be installed in strict accordance with sound nursery practices and shall include maintenance and watering for all work outlined on the plans and specifications until final acceptance.

C. Quantities and Locations: The CITY reserves the right to adjust the number and locations of the designated types and species to be used at any of the locations shown in order to provide for any modifications which might become necessary.

### 1.3 RELATED WORK

A. Section 02910 – Sodding

### 1.4 QUALITY ASSURANCE

A. Responsibility for Assuring Quality Work: The DBF'S Superintendent shall be well versed in Florida plant material, planting operations, blueprint reading, and coordination with other performing contracts or services in the job area.

B. All employees shall be competent and highly skilled in their particular job in order to properly perform the work assigned to them. The DBF shall be responsible for maintaining the quality of the material on the job throughout the duration of the CONTRACT.

C. Correct Grade of Plants: In the event that it becomes apparent that any nursery supplying plants for this work has knowingly and consistently represented the grade of plants as being higher than their actual grades as determined under these provisions, all plants already delivered from such sources shall be removed from the job at the DBF'S expense, and no further plants will be accepted from such nursery until written evidence is submitted and confirmed that all material for delivery has been inspected and approved by inspectors of the State Plant Board as being of the grade as represented.

D. Authority for Nomenclature, Species, Etc.: All plant material shall conform to the names given in Hortus Third, 1976 edition. Names of varieties not included therein conform generally with names accepted in the nursery trade.

E. Grade Standards: All plant materials shall be nursery grown except where specified as collected material, and shall comply with all required inspections, grading standards and plant regulations as set forth by the Florida Department of Agriculture's "Grades and Standards for Nursery Plants" revised 1973, or with any

superseding specifications that may be called for on the Plans or in the Specifications. ALL PLANTS NOT LISTED IN THE GRADES AND STANDARDS FOR NURSERY PLANTS, shall conform to a Florida No. 1 as to: (1) Health and Vitality, (2) Condition of Foliage, (3) Root System, (4) Freedom from Pest or Mechanical Damage, (5) Heavily Branched and Densely Foliated according to the accepted normal shape of the species, or sport, (6) Form and branching habit.

F. Balled and Burlapped (B&B) and Wire Balled and Burlapped (WB&B) Plants: These plants shall be properly protected until they are planted. The plant shall be handled only by the earth ball and not be the plant itself.

G. Any (B&B) or (WB&B) plant which shows evidence of having handled by a method other than the method outlined above and resulting in a cracked or broken ball or of the roots being loosened within the ball shall be rejected.

H. For plants grown in soil of loose texture, which does not readily adhere to the root system, (especially in the case of large plant material), WB&B plants may be specified. For WB&B plants, before plant is removed from the hole, sound hog wire shall be placed around the burlapped ball and looped and tensioned until the burlapped ball is substantially packaged by the tightened wire netting, such as to prevent disturbing of the loose soil around the roots during handling. Any wire, synthetic material or chemically treated material will be removed from the rootball at planting time, all ties shall be removed from the rootball and around the trunk at planting.

I. Container Grown Plants (CG): Any Container Grown (CG) plants, which have become "pot bound" or for which the top system is out of proportion (larger) to the size of the container, will not be acceptable.

J. With metal containers, unless the root-ball system slips easily and unbroken from the can, a nursery can-cutter shall be used to slit the can in such a way that the can may be opened fully.

K. CG plants shall not be removed from the can until immediately before planting, and with all due care to prevent damage to the root system.

L. Submit to the CITY the names and locations of nurseries proposed as sources of acceptable plant material. The CITY reserves the right to visit the nursery to inspect and/or select the specified material.

M. The CITY will be included in the hand selecting of all Live Oaks for the project.

## 1.5 DELIVERY, STORAGE AND HANDLING

A. Inspection and Transporting: Movement of nursery stock shall comply with all Federal, State, and local laws and regulations. Therefore, required inspection certificates shall accompany each shipment, and shall be filed with the CITY.

B. Wrap root balls with burlap. Wire wraps burlap if root ball is not sufficiently compacted. Palms will not require burlap wrapping if the following requirements are met:

1. Dug from marl or heavy soil that adheres to roots and retains shape without shattering.
2. Moistened material used to cover ball and roots not exposed to wind and sun.
3. Transport material on vehicles large enough to allow plants not to be crowded. Plants shall be covered to prevent wind damage during transit and

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shall be kept moist, fresh and protected at all times. Such protection shall encompass the entire period, which the plants are in transit, being handled, or are in temporary storage.

C. All plant material shall not remain on the work site longer than two (2) days prior to being installed.

**1.6 SUBSTITUTIONS**

A. Substitutions of plant types or change in the size of plant material will only be permitted upon submission of documented proof that the particular plant type and size specified is not obtainable.

B. Where B&B or WB&B plants are specified, CG plants of the same species, etc., will not be accepted. Where a B&B or WB&B is not specified on a particular plant material, B&B, WB&B or CG plants may be used provided they meet all specifications.

**1.7 GUARANTEE**

A. All plant material shall be guaranteed for a minimum of one (1) calendar year from the time of final acceptance.

**1.8 REPLACEMENT**

A. The guaranteeing of plant material shall be construed to mean the complete and immediate replacement of plant material if it is:
   1. Not in a healthy growing condition.
   2. There is a question to its survival ability at the end of the guarantee period.
   3. It is dead.

**1.9 SIZE, QUALITY AND GRADE OF REPLACEMENT**

A. Replacement plant material shall be of the same species, quality and grade as that of the plant to be replaced. The size of the replacement shall not necessarily be the same size as the original specified plant at its initial planting but shall closely match specimens of the same species. Replacements shall be guaranteed for a period equal to the originally specified guarantee. This guarantee period shall begin at time of plant replacement.

**1.10 GUARANTEE NULL AND VOID**

A. The guarantee shall be null and void for plant material which is damaged or dies as a result of "Act of God" limited to hail, freeze, lightening, winds which exceed hurricane force, and lethal yellowing, providing the plant was in a healthy growing condition prior to these "Acts of God".

**PART 2 MATERIALS**

**2.1 PLANT MATERIAL**

A. Florida No. 1: Except where another grade is specifically called for in the Plans, all plant material shall be no less than Florida No. 1 at the time of final inspection immediately prior to the acceptance by the OWNER.

B. Habit of Growth: All plant material shall have a habit of growth that is normal for that species and shall be sound, healthy, vigorous and free from insects, plant diseases, injuries, and dead limbs.

C. Branching, Leafing, Measurements and Ball Sizes:
   1. Trees and Shrubs: Requirements for the measurement, branching character, ball diameter, depth and other standards shall follow the Code of Standards recommended by the American Association of Nursery Stock, Bulletin Z-60.1-1973 and as revised.
   2. Palms: Requirements for the measurement of clear trunk, clear wood and graywood ball diameter and depth shall comply with requirements as set forth by the Florida department of Agriculture's "Grades and Standards for Nursery Plants, Part II for Palms and Trees".

D. Die-Back and Leaf-Drop: Plant material showing signs of die-back or leaf-drop will not be accepted and must be removed from the job immediately if so directed by the CITY. Therefore, any plant material with tendencies toward leaf-drop or dieback must be root pruned early enough to provide a sound network of hair roots prior to relocation to the job site.

E. Mechanical Destruction of Foliage: Mechanical destruction of foliage resulting from root pruning shall not effect more than 10% of the total foliage prior to planting on the job site. Loss of foliage caused by seasonal change will be accepted.

F. Spanish Moss: If Spanish Moss (Tillandsia usneoides) exists on plant material, it shall be completely removed prior to planting on the job site.

G. Palms: Before transporting, see Delivery, Storage and Handling; for requirements related to wrapping of root balls.

   1. Remove a minimum of fronds from the crown of the palms to facilitate transporting and handling.
   2. Palms with burn marks, nail holes, and frond boots on trunk shall not be accepted.
   3. Using untreated burlap strip or untreated cotton twine, tie Sabal Palmetto buds and leave in place until Palmetto is established. Tying shall be as set forth in Florida Department of Agriculture's "Grades and Standards for Nursery Plants". Tying of other palms shall be at the option of the DBF.
   4. To reduce head volume, Palm fronds may be taper trimmed by not more than one- third (1/3).
   5. Palm trees showing cable or chain marks and equipment scars shall be rejected.

H. Chlorosis: The allowable level of Chlorosis in foliage shall be as set forth in the Florida Department of Agriculture's "Grades and Standards for Nursery Plants".

## 2.2 PLANTING SOILS

A. General Type: All plant material with the exception of Sabal Palmetto shall be planted with planting soil mixed with 50% original soil, if the soil is of good quality, as determined by the CITY. The planting soils shall be sandy loam (50% sand, and 50% muck) typical of the locality. The soil must be taken from ground that has never been stripped, with a slight acid reaction (5.5 to 6.5 pH) and without an

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excess of calcium or carbonate. Soil shall be delivered in a loose friable condition.

B. Special Type: Planting soil for palms shall be a good grade of salt free sand, which is free of all weeds.

**2.3 WATER**

A. Water shall be potable, from municipal water supplies or other sources, which are approved by a public health department.

**2.4 MULCH**

A. Mulch shall be Eucalyptus mulch or other approved non-native tree bark mulch. It must be uniformly shredded and be free from pieces of bark larger than 1 inch, foreign matter, weed seeds and any other organic or inorganic material. Submit sample for approval. DBF shall apply one application at initial installation and a second application prior to final acceptance.

**2.5 FERTILIZER**

A. New Plant Material: Trees, palms and shrubs, fertilize with Agriform planting tablets, 20- 20-5 formula, 21 gram or approved equal.

B. New Ground Covers: Fertilize with an approved fertilizer of fifty percent (50%) or greater organic 6-6-6 or 8-8-8 with minor elements including, but not limited to, iron zinc and manganese.

C. Composition of Quality: All fertilizer shall be uniform in composition and dry. Granular fertilizer shall be free flowing and delivered in manufacturers standard container with name of material, weight and guaranteed analysis printed on container. Tabletized fertilizer shall be delivered in unopened containers or boxes. All bags, containers or boxes shall be fully labeled with the manufacturer's analysis. Submit labels to CITY for approval prior to placement of fertilizer.

D. All shall comply with the State of Florida fertilizer laws.

**2.6 PRUNING PAINT**

A. Pruning paint shall be commercial tree paint, which is waterproof, antiseptic, adhesive, elastic and free of kerosene, water, cresol, and any other substances harmful to plant material.

**2.7 VEGETATIVE ROOT INHIBITOR**

A. A vegetative root inhibitor shall consist of a polypropylene fabric with root control time- release modules of Trifluralin with an effective life of 100 years or approved equal

B. Vegetative root inhibitor shall be Bio-Barrier as manufactured by Reemay, Inc. or approved equal.

**PART 3 EXECUTION**

**3.1 INSPECTION**

A. Utilities: The location and existence of utilities (overhead and underground) shall be thoroughly investigated and verified by the DBF before the work begins in the

area of said utilities. The DBF shall exercise care in digging and work so as not to damage existing utilities in said areas, such as underground pipes, cables, wires, etc. Should such overhead or underground obstructions be encountered which interfere with planting, the CITY shall be consulted immediately in order for a decision to be made on the relocations of plant material to clear such obstruction. The DBF shall be responsible for the immediate repair of any damage to utilities caused by DBF's work.

## 3.2 PREPARATION

A. Staking Plant Locations: Plant locations must be staked or marked prior to plant hole excavation or placing on deck, by scaling the plants from existing features found on-site and shown on the plans or by given dimensions if shown.

B. Spacing of Shrubs: Shrub beds located next to another bed, walkway, structure, etc., shall have the plants along the perimeter spaced so that the plants can mature properly without growing into the other bed, walkway, structure, etc.

C. Excavation of Plant Holes: Excavation of plant holes shall be roughly cylindrical in shape with the sides approximately vertical. The CITY reserves the right to adjust the size and shape of the plant hole and the location of the plant in the hole to compensate for unanticipated structures or unanticipated factors. All plant holes shall be sufficiently deep to allow the rootball to set on existing soil and have root collar at grade level. Plants shall be centered in the holes with the tree trunk locations scaled from existing permanent structures as shown on the drawings. Plants shall be set straight or plumb in locations.

All plant holes to accommodate plants with ball sizes less than 24 inches in diameter shall be at least 18 inch greater than the diameter of the ball. All plants holes to accommodate plants with ball sizes two feet (2') and larger in diameter shall be at least twice the diameter of the ball. The excavated material from the plant holes may not be used to back-fill around the plant material. Such material shall be disposed of either on the project site or off the site as directed by the CITY. Plant holes for shrub material planted in mass shall meet all requirements listed above for plant holes. However, they shall not be individual holes but one continuous hole or excavation. Plant holes for hedge material shall also meet all requirements listed above for plant holes, however, a continuous trench shall be used in lieu of individual holes.

## 3.3 INSTALLATION

A. Setting of Plants:

1. When lowered into the hole the plant shall rest on the prepared hole bottom such that the roots after settlement are level, or slightly above the level of its previous growth condition and the final level of the ground around the plant shall conform to the surrounding grade. The plants shall be set straight or plumb or normal to the relationship of their growth prior to transplanting. The CITY reserves the right to realign any plant material after it has been set.
2. Palms of the Sabal species may be set deeper than the depth of their original growth condition in order to lessen the necessity for support or bracing. For such deeper planting however, it will be required that the underlying soil be

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friable and that the clear trunk requirements set forth in the plant list be maintained from the finished grade and NOT from the previous grade of the palm trees before it was transplanted.

3. Plant material of the shrub category and smaller must be handled by the ball only. Plant material too large for hand handling, if moved by winch or crane, must be thoroughly protected from chain, rope or cable marks, girdling, bark slippage, limb breakage and any other damage that might occur by improper handling or negligence.
4. All palm trees handled by the trunks must be wrapped with burlap and wood battens, held in place by banding strips as called for in the details.

B. Backfilling:
1. Use planting soils approved by the City. Backfill to the bottom two thirds of the planting hole and firmly tamp and settle by watering as backfilling progresses. After having tamped and settled the bottom two thirds (2/3) of the hole, thoroughly puddle with water and fill remaining one third (1/3) of the hole with planting soil, tamping and watering to eliminate air pockets.

C. Application of Fertilizer:
1. Fertilize New Planting (Trees, Palms and Shrubs) as follows:
a.

| Specified Container Size | Application |
|---|---|
| Rate 1 gallon container | 1 tablet |
| 3 gallon container | 2 tablets |
| 5 gallon container | 3 tablets |
| 7 gallon container | 5 tablets |

b. Large tubs or boxes and B&B material shall receive one (1) tablet for each one- half (1/2) inch of trunk diameter (measured three (3) feet from ground). For large shrubs, one (1) tablet for each one (1) foot of height or spread.

D. Mulch: Within 24 hours after planting, planting areas must be mulched as called for in these specifications. The mulch shall be uniformly applied to a depth of two (2) inches over all shrub, tree and groundcover areas and any areas indicated on the plans.

E. Staking and Guying shall be installed within 24 hours; in accordance with details.

F. Initial Watering: Initially, water the plant material to develop uniform coverage and deep- water penetration of at least six inches (6"). Avoid erosion, puddling, and washing soil away from plant roots.

G. Hand Watering: Provide hand watering of plant material as necessary subject to weather conditions, to maintain healthy growing conditions until final acceptance. This shall be in addition to water received from irrigation system, if any.

H. Pruning
1. The amount of general pruning shall be limited to the minimum necessary to remove dead or injured twigs and branches and to compensate for the loss of roots as a result of transplanting operations. Pruning shall be done in such a manner as not to change the natural habit of shape of a plant, and in accordance with National Arborist Association standards for pruning.
2. All broken or damaged roots shall be cut off smoothly. The tops of all trees

shall be pruned in a manner complying with standard horticultural practices. All cut surfaces of one-half inch (1/2") or more in diameter above ground level shall be treated with approved commercial tree paint.

I. Weeding: In the event that weeds or undesirable vegetation becomes prevalent to such an extent that they threaten plant material, they shall be removed as directed by the CITY. If necessary, the plant material and/or planting soil shall be replaced as needed to eliminate the weeds at the expense of the DBF.

## 3.4 CLEANING AND PROTECTION

A. Disposal of Trash: All debris and other objectionable material created through planting operations and landscape construction shall be removed completely on a daily basis from the job or as directed by the CITY. Excess soil shall be disposed of as directed by the CITY.

B. Responsibility for Protection and Restoration of Property: The DBF shall be responsible for all damage to property whether it is accidental or necessary for the completion of the contract.

C. Protection Against Mechanical Damage: The DBF's responsibility for protection against mechanical damage shall include providing protection from vehicles and providing warning signs and barricades as might be necessary and DBF shall repair, restore and replace any planting areas which become damaged as a result of any negligence of the DBF or DBF's employees in complying with these requirements. Coordination shall be with the OWNER.

D. Responsibility Prior to Final Acceptance:

1. Maintenance shall begin immediately after each plant is planted and continue until final acceptance.
2. Plants shall be watered by hose, soaking thoroughly each day for the first two weeks (14 calendar days) and every other day for the following two week period. Soaking then shall continue on a twice weekly basis for another period of three (3) weeks for material over five feet (5') height, amounting to a total of 28 days after installation of planting under five feet (5') and a total of 45 days for plants over five feet (5'). All watering is required without regard to an irrigation system.
3. Plant maintenance shall include watering, pruning, weeding, cultivating, mulching, tightening and repairing of guys, stakes, braces, etc., replacement of sick or dead plants, resetting plants to proper grades or upright position and maintenance of the watering saucer, and all other care needed for proper growth of the plants. Plant material rejected during the course of the construction shall be removed within five (5) working days and replaced before the inspection for completion will be scheduled.
4. During the maintenance period and up to the issuance of Certificate of Final Acceptance, the DBF shall do all seasonal spraying and/or dusting of all planting. The materials and methods shall be in accordance with the highest standard nursery practices and as recommended by the CITY prior to implementation.
5. Planting areas and plants shall be protected against trespassing and

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damage. If any plants become damaged or injured they shall be treated or replaced, as directed and in compliance with this specification. No work shall be done within or over planting areas or adjacent to plants without proper safeguards and protection.

**END OF SECTION 02900**

## PART 1 GENERAL

### 1.2 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the concrete work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

B. Including but not necessarily limited to the following:
   1. Form work, shoring, bracing and anchorage.
   2. Concrete reinforcement and accessories.
   3. Cast-in-place concrete.
   4. Plugging abandoned pipelines and/or structures in place.

### 1.2 RELATED WORK

A. Section 02510 - Concrete sidewalk
B. Section 02513 - Asphaltic Concrete Paving – General
C. Section 03300 - Cast-in-Place Concrete.
D. All applicable sections of Division 1, 2, 3 and 4.

### 1.2 QUALITY ASSURANCE

A. All work shall be in accordance with ACI 301, latest edition, a copy of which shall be maintained on site.

B. Requirements of Regulatory Agencies: perform work in accordance with local building and other applicable codes.

C. Installation: Performed only by skilled laborers with satisfactory record of performance on completed projects of comparable size and quality

D. Inspection and Testing
   1. Test Cylinders - As per ASTM C-39.
      a. Minimum of three (3) concrete test cylinder shall be taken for every 75 or less cubic yards of concrete placed each day.
      b. Minimum of one (1) slump test shall be taken during any cold weather concreting, and be cured on job site under same conditions as the concrete it represents.
   2. Slump Test - As per ASTM C-143.
      a. Minimum of one (1) slump test shall be taken for each set of test cylinders taken.

### 1.2 SUBMITTALS

A. Test Reports: Reports of concrete compression, yield, air content and slump tests.

B. Certificates:
   1. Manufacturer's certification that materials meet specification requirements.
   2. Material content per cubic yards of each class of concrete furnished.
      a. Dry weights of cement.

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b. Saturated surface-dried weights of fine and coarse aggregate.
c. Quantities, type and name of all mixtures.
d. Weight of water.

3. Ready-mix delivery tickets as per ASTM C-94.

C. Shop Drawings:
1. Show sizes and dimensions for fabrication and placing of reinforcing steel and bar supports.
2. Indicate reinforcement sizes, spaces, locations and quantities or reinforcing steel, and wire fabric, bending and cutting schedules, splicing and supporting and spacing devices.
3. Indicate formwork dimensioning, materials, arrangement of joints and ties.
4. Shop drawings shall be prepared under seal of a Professional Structural Engineer, registered in the State of Florida.

### 1.2 DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.
B. Handle and store materials to prevent contamination.

### 1.2 JOB CONDITIONS

A. Allowable concrete temperatures:
1. Hot weather: Maximum 90 degrees F as per ASTM C-94.

B. Do not place concrete during rain, unless protection is provided.

## PART 2 PRODUCTS

### 2.1 FORM MATERIALS

A. Materials shall conform to ACI 301, latest edition
B. Plywood forms: Douglas Fir Species, solid one side, form grade, sound undamaged sheets.
C. Lumber: Southern Pine Species, No. 2 Grade, with grade stamp clearly visible.
D. Form Ties: Removable, snap-off metal, of fixed and adjustable length, cone ends.
E. Tubular Column Type: Round, spirally wound laminated fiber material, clearly visible.

### 2.2 REINFORCING STEEL

A. Reinforcing steel shall conform to ASTM A615, 60 ksi yield grade billet steel reformed bars; uncoated finish.
B. Welded steel wire fabric shall confirm to ANSI/ASTM A185, plain type; coiled rolls, uncoated finish.

### 2.3 CONCRETE MATERIALS

A. Cement: shall conform to ASTM C150, normal Type II Portland, gray color.
B. Fine and coarse aggregate shall conform to ASTM C33.
C. Water: clean and not detrimental to concrete.

## 2.4 ADMIXTURES

A. Air Entraining: ASTM C-260
B. Chemical: Type (as required) ASTM C-494.
C. Fly Ash and Pozzolans: ASTM C-618
D. Color - Conditioned Concrete: ASTM C-494 and ASTM C-979

## 2.5 ACCESSORIES

A. Non-shrink grout: pre-mixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents; capable of minimum compressive strength of 3500 psi.
B. Construction joints: locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to the CITY. Place construction joints perpendicular to the main reinforcement, continue reinforcement across construction joints.
C. Expansion joints: shall be a minimum of 3/4-inch thick asphalt impregnated fiberboard as per ASTM D-1751.
D. Form release agent shall be a colorless material, which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.
E. Water shall be clear and potable.

## 2.6 CURING MATERIALS

A. Water shall be clean and potable.
B. Absorptive mat shall be burlap fabric of 9 oz./sq. yd. clean, roll goods complying with AASHTO M182, Class 3.
C. Membrane curing compound shall conform to ASTM C309.
D. Clear Sealer: "Clear Bond" as manufactured by Guardian Chemical Co., Dayton Day- Chem Cure-W (J-9-A) or approved equal.
E. Color curing compound shall be liquid membrane-forming conforming to ASTM C 309 two- component Lithochrome Colorwax by L.M. Scofield Company, or approved equal, color to match admixture for color-conditioned concrete.

## 2.7 CONCRETE MIX

A. Mix concrete in accordance with ASTM C94.
B. Concrete:
    1. Compressive strength (28 days): 3000 psi.
    2. Slump: 4(±) 1 inch.
C. Concrete / Flowable fill for grouting and plugging:
    1. Compressive strength (28 days) 2000 psi.
    2. Slump: as required to grout and plug.

# PART 3 EXECUTION

## 3.1 FORMWORK ERECTION

A. Verify lines, levels, and measurement before proceeding with formwork.
B. Hand trimmed sides and bottom of earth forms; remove loose dirt.

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C. Align form joints.
D. Do not apply form release agent where concrete surfaces receive special finishes or applied coatings, which may be affected by agent.
E. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts.

**3.2 REINFORCING**

A. Place, support and secure reinforcement against displacement.

**3.3 PLACING CONCRETE**

A. Color Conditioned concrete, when batching, shall not be less than one-third of the capacity of the mixing drum (a minimum of four yards for a ten-yard mixer) and will be in full cubic yard increments.
B. Notify CITY minimum 24-hours prior to commencement of concreting operations.
C. Scratch, float, trowel, broom or belt finish surfaces, as scheduled or indicated on the Drawings.
D. Place 2000 psi concrete for pugging and grouting pipelines and structures in-place as required after proper connection to new service and function of system is completes.

**3.4 TOLERANCES**

A. Provide Class B tolerance to floor slabs according to ACI 301. Pitch to drains 1/4 inch per foot.

**3.5 FINISHES FOR EXPOSED SURFACES**

A. Provide exposed surfaces with finishes as called for on the Drawings.

**3.6 CONCRETE CURING**

A. Curing for standard grey work after finishing, cure concrete by keeping moist for one (1) week after placement. Floors and vertical surfaces may be sprayed with an approved curing compound to retard evaporation of water, if spraying is not objectionable because of future finishing requirements. Begin curing operations as soon as concrete has attained its initial set. Keep exposed concrete surface moist for at least one (1) week.
B. Apply a liquid membrane-forming compound, conforming with ASTM C 309, color to match that of the color condition concrete. Apply on flat work immediately after the finishing operation pursuant to the manufacturer's recommendations.

**END OF SECTION 03010**

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. Formwork for Cast-In-Place Concrete, with shoring, bracing, and anchorage.
B. Openings for other affected work.
C. Form accessories.
D. Stripping forms.

### 1.3 RELATED WORK

A. Section 03010 - Concrete.
B. Section 03300 - Cast-In-Place Concrete.

### 1.4 SYSTEM DESCRIPTION

A. Design, engineer and construct formwork, shoring and bracing to meet design code requirements, so that resultant concrete conforms to required shapes, lines, and dimensions.

### 1.5 QUALITY ASSURANCE

A. Construct and erect concrete formwork in accordance with ACI 301 and 347.

### 1.6 SUBMITTALS

A. Indicate pertinent dimensions, materials, and arrangement of joints and ties.
B. Prepare shop drawings under seal of Professional Structural Engineer registered in the State of Florida.
C. Manufacturers certification that materials meet specification requirements.

### 1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials in accordance with manufacturers recommendations.
B. Deliver form materials in manufacturer's packaging with installation instructions.
C. Store off ground in ventilated and protected area to prevent deterioration from moisture or damage.
D. Remove packaging from void forms.

## PART 2 PRODUCTS

### 2.1 FORM MATERIALS

A. Plywood: Douglas Fir Species; medium density overlaid one side grade; sound, undamaged sheets with straight edges.
B. Lumber: Southern Pine Species; No. 2 grade; with grade stamp clearly visible.
C. Tubular Column: Round, of spirally wound laminated fiber type; surface treated with release agent; of size required.

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## 2.2 FORMWORK ACCESSORIES

A. Form Ties: Snap-off metal of adjustable length; cone type; 1 1/2 inch break back dimension; free of defects that will leave holes no larger than 1-1/4 inches diameter in concrete surface.

B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, or impair natural bonding in color characteristics of coating intended for use on concrete.

C. Fillets for Chamfered Corners: Wood strips or rigid PVC plastic in maximum possible lengths.

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required; or strength and character to maintain formwork in place while placing concrete.

# PART 3 EXECUTION

## 3.1 INSPECTION

A. Verify lines, levels, and measurements before proceeding with formwork.

## 3.2 PREPARATION

A. Hand-trim sides and bottoms of earth forms; remove loose dirt prior to placing concrete.

B. Minimize form joints. Symmetrically align joints and make weathertight to prevent leakage of mortar.

C. Arrange and assemble formwork to permit dismantling, stripping, so that concrete is not damaged during its removal.

D. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

## 3.3 ERECTION

A. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.

B. Camber slabs and beams to achieve ACI 301 tolerances.

C. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close ports with tight fitting panels, flush with inside face of forms, neatly lifted so that joints will be apparent in exposed concrete surfaces.

D. Provide expansion strips on external corners of beams and columns, where exposed.

E. Install void forms. Protect from moisture before concrete placement. Protect from crushing during concrete placement.

F. Construct formwork to maintain tolerances in accordance with ACI 301.

## 3.4 APPLICATION OF FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

B. Do not apply form release agent where concrete surfaces are scheduled to receive

special finishes or applied coverings, which may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

## 3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for work embedded in or passing through concrete.
B. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
C. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

## 3.6 FORM REMOVAL

A. Notify CITY prior to removing formwork.
B. Do not remove forms and shoring until concrete has sufficient strength to support its own weight, and construction and design loads which may be imposed upon it. Remove load- supporting forms when concrete has attained 75 percent of required 28-day compressive strength, provided construction is reshored.
C. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F for 24-hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
D. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28-days. Determine potential compressive strength of in place concrete by testing field-cured specimens representative of concrete location of members.
E. Reshore structural members due to design requirements or construction conditions to permit successive construction.
F. Remove formwork progressively so no unbalanced loads are imposed on structure.
G. Do not damage concrete surfaces during form removal.
H. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.
I. Remove formwork in same sequence as concrete placement to achieve similar concrete surface coloration.

## 3.7 CLEANING

A. Clean forms to remove foreign matter as erection proceeds.
B. Ensure that water and debris drain to exterior through clean-out ports.

**END OF SECTION 03100**

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## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the Cast-In- Place Concrete Work, as indicated on the drawings, as specified herein or both except as for items specifically indicated as "NIC ITEMS".

B. Including but not necessarily limited to the following:

1. Cast-In-Place concrete walls, footings, foundation walls, paving, walks, slabs, formwork, reinforcing and all other components as indicated on the Drawings.

### 1.3 RELATED WORK

A. Section 03010 - Concrete.

B. Section 03100 - Concrete Form work.

C. Section 03370 - Concrete Curing.

D. Section 02510 - Concrete Sidewalk

### 1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum of five years' experience on 5 comparable concrete projects.

B. Requirements of Regulatory Agencies: Perform work in accordance with local building codes.

C. Allowable Tolerances: Flat work true to plane 1/8 inch in 10 feet.

D. Slump tests as per ASTM C-143, and test cylinders as per ASTM C-39.

### 1.5 TESTS

A. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of work.

B. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301

C. Tests of cement and aggregates will be performed to ensure conformance with requirements stated herein.

D. Three (3) concrete test cylinders will be taken for every 75 cubic yards. or less of each class of concrete placed each day.

E. One (1) slump test will be taken for each set of test cylinders taken.

F. All testings shall be at the expense of the DBF.

### 1.6 SUBMITTALS

A. Provide product data for specified products.

B. Test Reports: Reports of concrete compression, yield, air content, and slump tests.

C. Certificates:

1. Manufacturer's certification that materials meet specification requirements.

2. Material content per cubic yard of each class of concrete furnished.
   a. Dry weights of cement.
   b. Saturated surface-dried weights of fine and coarse aggregate.
   c. Quantities, type and name of admixtures.
   d. Weight of water.
3. Ready-mix delivery tickets, ASTM C-94.

D. Shop Drawings:
1. Show sizes and dimensions for fabrication and placing of reinforcing steel and bar supports.
2. Indicate bar schedules, stirrup spacing, and diagrams of bend bars.
3. Detail items of form systems affecting appearance of architectural concrete surfaces such as joints, tie holes, liners, patterns and textures. Show items in relation to entire form system.

### 1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.
B. Handle and store materials to prevent contamination.

### 1.8 ENVIRONMENTAL REQUIREMENTS

A. Allowable concrete temperatures:
1. - Hot Weather: Maximum 90° F as per ASTM C-94.

B. Do not place concrete during rain, unless protection is provided.

## PART 2 PRODUCTS

### 2.1 MATERIALS & MANUFACTURERS

A. Concrete Ready-Mix concrete ASTM C-94.

a Cement:
- ASTM C 150, Type II

b Admixtures:
- Air entraining: ASTM C-260
- Chemical: Type (as required) ASTM C-494.
- Fly ash and pozzolans: ASTM C-618
- Vapor Barrier: 6-mil thick film of type recommended for below grade application.

c Coarse aggregate: Not less than 50% clean, hard, crushed stone conforming to requirements of Table 2, size number 467 ASTM C-33.

d Slump 4 inch maximum; plus tolerance 0, minus tolerance 1 inch.

e Air content: 5% + 1%.

f Mix proportioning:
- In accordance with ASTM C-94.
- 28 day compressive strength of moist cured laboratory samples 3,000 PSI.

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- Use set retarding admixtures during hot weather only when approved by CITY.
- Minimum cement contents 5 sacks/cubic yards.
- Add air-entraining agent to concrete work exposed to exterior.

g Curing Material: Liquid membrane, ASTM C-309, Type 1.

h Mixes:

- ASTM C-94.
- Mix concrete only in quantities for immediate use.
- Do not retemper or use set concrete.

B. Bars.
   1. Deformed billet steel: ASTM A 615, Grade 60.

C. Wire Fabric:
   1. Welded Wire Fabric Steel: ASTM A 185

D. Tie Wire: FS QQ-W-461-G, annealed steel, black 16 ga. minimum.

E. Bar supports: Conform to "Bar Support Specification," CRSI Manual of Standard Practice.

F. Forms:
   1. Conform with ACI 347, Chapter 3, Material and Form Work.

G. Lumber:
   1. Softwood framing lumber: Kiln dried, PS-20.
   2. Boards less than 1 1/2 inch thick and 2 inch wide, used for basic forms and form liners: Kiln dried.
   3. Grade marked by grading rules agency approved by American Lumber Standards Committee.
   4. Light framing or studs for board or plywood forms, 2 inch to 4 inch width and thickness Construction Standard grade.
   5. Boards for basic forms Construction Standard grade.
   6. Board surface: Smooth.

H. Plywood:
   1. Exterior type softwood plywood, PS 1-66.
   2. Each panel stamped or branded indicating veneer grades, species, type and identification.
   3. Wood faced plywood for architectural concrete surfaces.
   4. Panel veneer grades: B - C.
   5. Mill-oiled sides and mill-sealed edges of panels.

I. Ties:
   1. Materials: Stainless Steel.
   2. Type: Snap Ties.
   3. Depth of breakback: 1 inch.
   4. Maximum diameter 1/4 inch.

J. Form coatings:
   1. Non-staining type.
   2. Agent: Pine oil derivative.

K. Water: Clean and potable.

## PART 3 EXECUTION

## 2.2 FORMWORK

A. Conform to ACI 347, Chapter 2, Construction; and Article 4.2, architectural Concrete.
B. Framing, Bracing and Plywood Form Liners: APA Form V 345-72.
C. Provide temporary openings in framework for concrete placement.
D. Fill voids of plywood joints with sealant and tool smooth.
E. DBF is responsible for the design, construction, removal and complete safety of formwork and shoring.
F. Form construction shall be provided to shape, lines dimensions of members shown; substantial, tight enough to prevent leakage, and properly braced or tied to maintain position and size, form sides and bottoms of members unless specifically excepted.

## 2.3 REINFORCING

A. Fabrication shall be provided to latest ACI Manual of Practice ACI-315.
B. Reinforcing free from excessive rust, scale or coating reducing bond. Bars bent cold in fabrication plant. Chairs, support bars, and other accessories furnished to carry and provide coverage as required by ACI Manual.
C. Unless otherwise indicated the minimum coverage is 3-inch for footings (slabs to have 3/4 inch minimum). Call any "crowding" of reinforcement to CITYs attention during placing.
D. Splices shall be Mesh 6-inch lap, bars 30 X diameter minimum.
E. Conduit or pipes embedded in concrete must have specific approval and be located to avoid cracking or reduction in strength. Provide extra strong pipe sleeves where pipes are allowed to pierce concrete beams or walls.
F. Placement:
    a Bar supports: CRSI 65.
    b Reinforcing bars: CRSI 63.
G. Steel Adjustment:
    a Move within allowable tolerances to avoid interference with other reinforcing steel, conduits, expansion joints, or embedded items.
    b Do not move bars beyond allowable tolerances without concurrence of CITY.
    c Do not heat, bend, or cut bars without concurrence of CITY.
H. Splices:
    a Lap splices: Tie securely with wire to prevent displacement of splices during placement of concrete.
    b Splice devices: Install in accordance with manufacturer's written instructions.
    c Welding: Perform in accordance with AWS Standards.
    d Do not splice bars except at locations shown on drawings without concurrence of CITY.
I. Wire Fabric:
    a Install in longest practicable length.
    b Lap adjoining pieces one full mesh minimum, and lay splices with 16-gauge wire.

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c Offset end laps in adjacent widths to prevent continuous laps.

J. Cleaning: Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that will reduce bond with concrete.

K. Protection During Concreting: Keep reinforcing steel in proper position during concrete placement.

## 2.4 JOINTS

A. Construction pours shall be continuous pours except where joints are indicated. No additional joints except by special acceptance in writing by the CITY. Allow no construction or interrupted pour joints in any exposed surface, unless treated as part of design.

a Where indicated and as detailed, provide saw cut type construction joints of sizes as called for on the drawings.

B. Expansion joints shall be constructed as shown on drawings.

a Expansion material shall be ½ inch continuous full depth strips set ½ inch below finish surface with ½ inch x ½ inch joint sealant filler above.

## 2.5 BUILT-IN ANCHORING DEVICES, FIXTURES, PIPE SLEEVES AND OTHER INSERTS

A. Build-in and coordinate as required and called for on the drawings all items to be constructed into concrete such as anchoring devices, fixtures, piping, sleeves and other inserts and items as required for a complete installation.

## 2.6 INSPECTION

A. Assure that excavation and formwork are completed, with smooth rubbed finish, and that excess water is removed.

B. Check that reinforcement is secured in place.

C. Verify that expansion joint material, anchors, and other embedded items are secured in position.

D. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete.

## 2.7 CONCRETE QUALITY

A. Design of mix shall be a laboratory designed mix to satisfy the following requirements and shall be approved by the CITY.

a Ready mixed concrete as per ASTM C-94 with 28 day strength 3,000 PSI minimum, for all standard grey concrete work.

b Proportion the concrete to work readily into forms and around reinforcement, without excessive manipulation, segregation or water gain. Approved additives may be used to achieve the above results.

c Slump shall be maximum 3 inch for footings, and for all other concrete shall be 3 inch to 5 inch.

d Submit for approval representative test results by independent laboratory to

substantiate proposed mix design.

## 2.8 PREPARATION FOR POURS

A. Notify the OWNER's Representative, CITY and other inspectors at least 36 hours prior to inspection.
B. Equipment forms, and reinforcing shall be clean and wet down, reinforcing firmly secured in place, runways set up and not resting on or displaying reinforcing.
C. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instruction.
D. At locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.

## 2.9 PLACING

A. Mixing and conveying shall be as per ASTM C-94 and as follows:
    a Maximum elapsed time from addition of water to placing in forms -60 minutes, (total mixing time).
    b Concrete handled and placed by methods, which keep concrete plastic, prevent separation of materials, and do not displace reinforcement.
B. Deposit as close as possible to final position to avoid segregation of materials. Restrict drop to 3 foot maximum (less for exposed concrete), using tremie if necessary.
    a Compact by mechanical vibration to thoroughly work around reinforcing and eliminate honeycomb.
C. Place concrete in accordance with ACI 301.
D. Hot Weather Placement: ACI 301.
E. Cold Weather Placement: ACI 301.
F. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.
G. Maintain concrete cover around reinforcing as follows:

| Item | Coverage |
|---|---|
| Beams | 1 1/2 inch |
| Supported Slabs | 3/4 inch |
| Column Ties | 1 1/2 inch |
| Walls (exposed to weather or backfill) | 2 inch |
| Footings and Concrete Formed Against Earth | 3 inch |
| Slabs on Fill | 2 inch |

H. Place concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur.
I. Saw cut control joints at an optimum time after finishing. Use 3/16 inch thick blade, cutting 1/3 depth of slab thickness.
J. Separate exterior slabs on fill from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface.
K. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify CITY upon discovery.

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## 2.10 CONCRETE CURING

A. Curing for standard grey work after finishing, cure concrete by keeping moist for one (1) week after placement. Floors and vertical surfaces may be sprayed with an approved curing compound to retard evaporation of water, if spraying is not objectionable because of future finishing requirements. Begin curing operations as soon as concrete has attained its initial set. Keep exposed concrete surface moist for at least one (1) week.

B. Apply a liquid membrane-forming compound, conforming to ASTM C 309, color to match that of the color condition concrete. Apply on flat work immediately after the finishing operation pursuant to the manufacturer's recommendations.

## 2.11 CONCRETE FINISHING

A. Unexposed concrete work shall be patched and repaired immediately after removal of forms.
   a Cut off metal ties a minimum of 1 inch back from surface of concrete.
   b Moderate honeycomb cut out and prepared for patching. Severe honeycomb with exposed steel reinforcing is to be removed or "united" at the discretion of the CITY.
      c Wet areas for patching and pack carefully with rich mortar rubbed to match surface.

B. Provide concrete surfaces to be left exposed, walls, columns, beams, with smooth rubbed finish.

C. Provide Class B tolerances to floor slabs and toppings according to ACI 301.

D. Pitch to drains 1/4 inch per foot.

E. Exposed concrete work shall be patched and repaired as accepted by CITY after consultation. Patching and rubbing will be kept to a minimum if possible, but when necessary will be done with great care to obtain maximum degree of matching in color and texture to adjacent finished concrete surfaces

F. Monolithic finish using care to obtain a level surface; floors out of level or with variation greater than 1/8 inch in 10 feet shall be corrected.

G. All finishes shall be as called for on the drawings.

## 2.12 SEPARATE FLOOR TOPPINGS

A. Prior to placing, roughen concrete base course and remove foreign materials. Broom and vacuum clean.

B. Place dividers, edge strips, reinforcing and other items to be cast in.

C. Apply bonding agent on base course in accordance with manufacturer's instructions. Apply sand and cement slurry coat on base course immediately prior to placing toppings.

D. Place concrete floor toppings to required lines and levels.

## 2.13 PATCHING

A. Notify CITY immediately upon removal of forms.

B. Patch imperfections.

## 2.14 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required levels and lines, details, and elevations.
B. Repair or replace concrete not properly placed or of the specified type.

## 2.15 FIELD QUALITY CONCRETE

A. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

## 2.16 PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
C. During curing period, protect concrete from damaging mechanical disturbances, water flow, loading, shocking, and vibration.

## 2.17 APPLICATION OF BOND COAT FOR CONCRETE LEVELING COAT FOR PAVERS AND TEXTURED SURFACES

A. Provide installation as per manufacturer's standard printed specifications, instructions and recommendations.

**END OF SECTION 03300**

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## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1- General Requirements shall govern the WORK under this section.

### 1.2 WORK INCLUDED

A. Maintenance of conditions for proper concrete curing.

### 1.3 RELATED WORK

A. Section 03010 - Concrete.
B. Section 03300 – Cast-in-Place Concrete
C. Section 02510 - Concrete Sidewalk

### 1.4 QUALITY ASSURANCE

A. Conform to requirements of ACI 301.

### 1.5 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.
B. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

### 1.6 SUBMITTALS

A. Provide product data for specified products.

### 1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature at 70 degrees F for three (3) days.

## PART 2 PRODUCTS

### 2.1 MATERIALS

A. Water: Clean and not detrimental to concrete.
B. Absorptive Mat: Burlap fabric of 9 ounce per square yard. Clean, roll goods.
C. Curing Compound: As per ASTM C309.

## PART 3 EXECUTION

### 3.1 INSPECTION

A. Verify concrete surfaces are ready for curing.

### 3.2 CURING COMPOUND

A. Apply curing compound in two (2) coats with second coat at right angles to first.
B. Apply in accordance with manufacturer's instructions.

### 3.3 SPRAYING

A. Spray water over slab areas; maintain wet for three (3) days.

### 3.4 ABSORPTIVE MAT

A. Saturate burlap side of burlap fabric mat. Place over slab areas, burlap side down;

lap edges and ends 12 inches. Maintain in place for seven (7) days.

## 3.5 CONCRETE CURING

A. Curing for standard grey work after finishing, cure concrete by keeping moist for one (1) week after placement. Floors and vertical surfaces may be sprayed with an approved curing compound to retard evaporation of water, if spraying is not objectionable because of future finishing requirements. Begin curing operations as soon as concrete has attained its initial set. Keep exposed concrete surface moist for at least one (1) week.

B. Apply a liquid membrane-forming compound, conforming to ASTM C 309, color to match that of the color condition concrete. Apply on flat work immediately after the finishing operation pursuant to the manufacturer's recommendations.

C. Cure concrete as scheduled or indicated.

D. Remove absorptive mat after curing.

**END OF SECTION 03370**

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# PART 1 GENERAL

## 1.1 RELATED SECTIONS

A. Requirements specified within this section apply to all sections in Division 16, ELECTRICAL. Work specified herein shall be performed as if specified in the individual sections.

## 1.2 DESIGN REQUIREMENTS

A. All electronic boards as part of electrical equipment shall meet the atmospheric conditions of the space the equipment is installed in. All electronic boards which are not installed in a conditioned environment shall be fungus-resistant.

B. All electrical equipment shall be rated for the conditions the equipment is installed in.

## 1.3 STANDARDS, CODES, PERMITS, AND REGULATIONS

A. Perform all work; furnish and install all materials and equipment in full accordance with the latest applicable rules, regulations, requirements, and specifications of the following:
   a. Local Laws and Ordinances.
   b. State and Federal Laws.
   c. National Electrical Code (NEC).
   d. State Fire Marshal.
   e. Underwriters' Laboratories (UL).
   f. National Electrical Safety Code (NESC).
   g. American National Standards Institute (ANSI).
   h. National Electrical Manufacturer's Association (NEMA).
   i. National Electrical Contractor’s Association (NECA) Standard of Installation.
   j. Institute of Electrical and Electronics Engineers (IEEE).
   k. Insulated Cable Engineers Association (ICEA).
   l. Occupational Safety and Health Act (OSHA).
   m. National Electrical Testing Association (NETA).
   n. American Society for Testing and Materials (ASTM).
   o. Florida Building Code, including Local County amendments.

B. Conflicts, if any, which may exist between the above items, will be resolved at the discretion of the ENGINEER.

C. Wherever the requirements of the Specifications or Drawings exceed those of the above items, the requirements of the Specifications or Drawings govern. Code compliance is mandatory. Construe nothing in the Contract Documents as permitting work not in compliance with these codes.

D. Obtain all permits and pay all fees required by any governmental agency having jurisdiction over the work. Arrange all inspections required by these agencies. On completion of the work, furnish satisfactory evidence to the ENGINEER that the work is acceptable to the regulatory authorities having jurisdiction.

## 1.4 ELECTRICAL COORDINATION

A. Work Provided Under this Contract:
   a. Provide and install complete electrical power system shown on drawings and as per specifications for lift station A-06, located on the corner of Ashbury

Road and Edgewater Drive. Coordinate with local utility company (FPL – phone number is listed on electrical drawing E-01) for installation of new service to each lift station complete in place. Coordinate with other disciplines for demolition of the existing lift station A-06.

b. Provide and install all electrical equipment indicated on the drawings and as described in the specifications including new utility meter, main/MTS, lift station control panel, control transformers, SPD (Surge Protection Device), etc. complete in place.
c. Provide and install all new underground conduit and wiring indicated on the drawings complete in place.
d. Provide and install new grounding system complete in place.
e. Provide and install all electrical required to support instrumentation and control system as shown on the drawings complete in place.
f. Provide all miscellaneous electrical including switches, terminations, fittings, wiring, conduit, junction box, terminal junction box, etc., not specified but obviously necessary for a complete working system in place.
g. Provide an Electrical Systems Analysis and Arc Flash Study per Specification 16015.

B. Temporary Power:

a. Provide temporary power for all office trailers and for all construction areas. Coordinate with local power and telephone utility for temporary construction power and telephone service during construction.

## 1.5 SUBMITTALS

A. The following information shall be provided for all electrical equipment:

a. A copy of each specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check-marks (√) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the DBF, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined shall signify compliance on the part of the DBF with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation.
b. Electrical equipment submittals shall be made by specification section. Submit one package per specification section and do not group multiple specification sections under one submittal package.
c. Provide complete conduit and equipment layouts: a scaled plan layout of the electrical room(s) showing spatial relationships of all equipment as well as the overall size of the room. Minimum scale shall be ¼”=1’-0”.
d. Provide a conduit plan for major power, instrumentation and control conduits, both interior and exterior, showing routing, size and stub up locations for buried or in slab conduits.

B. As part of the electrical submittal, the DBF shall provide a minimum of ¼”=1’- 0” scaled layout of the electrical equipment in the electrical room or major electrical equipment in a mechanical room showing sizes of all equipment and their spatial relationship. Non-electrical equipment shall be approved before finalizing the electrical layout in mechanical rooms.

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## 1.6 ENVIRONMENTAL CONDITIONS

A. All chemical rooms and areas shall be designated as corrosive.
B. All indoor chemical and process equipment areas shall be considered wet locations.
C. Electrical equipment in rooms designated as Classified by NFPA 70 (national electrical code) as Division 1 or Division 2 shall meet all requirements set forth for that classification as described in NEC article 500.

## 1.7 INSPECTION OF THE SITE AND EXISTING CONDITIONS

A. The Electrical Drawings were developed from past record drawings and information supplied by the OWNER. Verify all scaled dimensions prior to submitting bids.
B. Before submitting a bid, visit the site and determine conditions at the site and at all existing structures in order to become familiar with all existing conditions and electrical system which will, in any way or manner, affect the work required under this Contract. No subsequent increase in Contract cost will be allowed for additional work required because of the DBF's failure to fulfill this requirement.
C. Carry out any work involving the shutdown of the existing services to any piece of equipment now functioning in existing areas at such time as to provide the least amount of inconvenience to the OWNER. Do such work when directed by the ENGINEER.
D. After award of Contract, locate all existing underground utilities at each area of construction activity. Protect all existing underground utilities during construction. Pay for all required repairs without increase in Contract cost, should damage to underground utilities occur during construction.

## 1.8 RESPONSIBILITY

A. The DBF shall be responsible for:
   a. Complete systems in accordance with the intent of these Contract Documents.
   b. Coordinating the details of facility equipment and construction for all Specification Divisions which affect the work covered under Division 16, ELECTRICAL.
   c. Furnishing and installing all incidental items not actually shown or specified, but which are required by good practice to provide complete functional systems.

## 1.9 INTENT OF DRAWINGS

A. Electrical plan Drawings show only general location of equipment, devices, and raceway, unless specifically dimensioned. The DBF shall be responsible for the proper routing of raceway, subject to the approval of the ENGINEER.
B. Electrical equipment sizes and characteristics have been based on Square D and Eaton.
C. If the DBF chooses to and is allowed to substitute, the DBF shall be responsible for fitting all the equipment in the available space as shown on the Drawings or re-designing the space, at no additional cost to the OWNER, and shall reimburse the ENGINEER for time and materials spent in reviewing revised design.

## PART 2 PRODUCTS

### 2.1 GENERAL

A. Provide materials and equipment listed by UL wherever standards have been established by that agency. If a UL listing is not available, equipment shall have a label and listing from a nationally recognized testing laboratory (NRTL) acceptable to the authority having jurisdiction (AHJ) over the project location.

B. Equipment Finish:
   a. Provide manufacturers' standard finish and color, except where specific color is indicated.
   b. If manufacturer has no standard color, provide equipment with ANSI No. 61, light gray color.

## PART 3 EXECUTION

### 3.1 GENERAL

A. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

B. Install work in accordance with NECA Standard of Installation, unless otherwise specified.

### 3.2 LOAD BALANCE

A. Drawings and Specifications indicate circuiting to electrical loads and distribution equipment.

B. Balance electrical load between phases as nearly as possible on switchboards, panel boards, motor control centers, and other equipment where balancing is required.

C. When loads must be reconnected to different circuits to balance phase loads, maintain accurate record of changes made, and provide circuit directory that lists final circuit arrangement.

### 3.3 CHECKOUT AND STARTUP

A. Voltage Field Test:
   a. Check voltage at point of termination of power company supply system to project when installation is essentially complete and is in operation.
   b. Check voltage amplitude and balance between phases for loaded and unloaded conditions.
   c. Record supply voltage (all three phases simultaneously on the same graph) for 24 hours during normal working day.
      1) Submit Voltage Field Test Report within 5 days of test.
   d. Unbalance Corrections: Make written request to power company to correct condition if balance (as defined by NEMA) exceeds 1 percent, or if voltage varies throughout the day and from loaded to unloaded condition more than plus or minus 4 percent of nominal.
      1) Obtain a written certification from a responsible power company official that the voltage variations and unbalance are within their normal standards if corrections are not made.

B. Equipment Line Current Tests:

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a. Check line current in each phase for each piece of equipment.
b. Make line current check after power company has made final adjustments to supply voltage magnitude or balance.
c. If any phase current for any piece of equipment is above rated nameplate current, prepare Equipment Line Phase Current Report that identifies cause of problem and corrective action taken.

C. Startup:
a. Demonstrate satisfactory operation of all 240-volt electrical equipment. Participate with other trades in all startup activities.
b. Assist the I&C Contractor in verifying signal integrity of all control and instrumentation signals.

D. Conflicts, if any that may exist between the above items will be resolved at the discretion of the ENGINEER.

E. Wherever the requirements of the Specifications or Drawings exceed those of the above items, the requirements of the Specifications or Drawings govern. Code compliance is mandatory. Construe nothing in the Contract Documents as permitting work not in compliance with these codes.

F. Obtain all permits and pay all fees required by any governmental agency having jurisdiction over the work. Arrange all inspections required by these agencies. On completion of the work, furnish satisfactory evidence to the ENGINEER that the work is acceptable to the regulatory authorities having jurisdiction.

**END OF SECTION 16010**

## PART 1 GENERAL

### 1.1 REFERENCES

A. The following is a list of standards that may be referenced in this Section

a Institute of Electrical and Electronics Engineers, Inc. (IEEE):

- IEEE 242: Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
- IEEE 399: Recommended Practice for Industrial and Commercial Power System Analysis.
- IEEE 1584-2002: Guide for Performing Arc Flash Hazard Calculations.

b American National Standards Institute (ANSI): C57.12.00, Standard General Requirements for Liquid-immersed Distribution, Power, and Regulating Transformers.

c National Fire Protection Association:

a. NFPA 70E: National Electrical Safety Code Chapter 1.
b. NFPA 70: National Electrical Code.

d Occupational Safety & Health Administration (OSHA):

a. 29-CFR, Part 1910, sub part S.

### 1.2 SCOPE OF WORK

A. The requirements of this specification shall apply to the electrical distribution system and all external control panels, disconnect switches, etc. The end result shall be a fully protected and properly coordinated system with proper labels provided and installed for short-circuit values, and arc flash safety and personal protective equipment recommendations.

### 1.3 SUBMITTALS

A. Shop Drawings: Provide five copies of study in hard cover, three-ring binders, to include:
   1. Short circuit study and labels.
   2. Protective Device Coordination Study shall include all equipment protective devices. Submit within 30 days after approval of the short circuit study.
   3. Arc Flash Analysis/Assessment and labels.

### 1.4 QUALITY ASSURANCE

A. Short circuit, protective device coordination, and arc flash studies shall be prepared by the manufacturer of the existing electrical power distribution equipment, or a professional electrical engineer registered in the State of Florida, in accordance with IEEE 242 and IEEE 399.

### 1.5 SEQUENCING AND SCHEDULING

A. An initial, complete short circuit and protective device coordination study and arc flash study must be submitted with 90 days after notice to proceed.

B. The short circuit, protective device coordination and arc flash studies shall be updated prior to Project Substantial Completion. Utilize characteristics of as-installed equipment actual wire run lengths and materials.

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## 1.6 GENERAL

A. Equipment and component titles used in the studies shall be identical to the equipment and component titles shown on the Drawings.

B. Perform studies using digital computer with a software package such as SKM Power*Tools for Windows™ DAPPER™, CAPTOR™ and ARC FLASH™, ETAP, or approved equal.

C. Perform complete fault calculations for all busses on utility and generator power sources. Perform load flow and voltage drop studies for major feeders and loads with long feeder runs. Analysis shall include expected fault currents at industrial control panels manufactured in accordance with UL 508A and NEC article 409.

D. Fault source combinations shall include large motors, large transformers, utility and generator.

E. Utilize proposed and existing load data for the study obtained from Contract Documents and field survey. Coordinate with local power utility for available fault currents from utility services.

F. Existing Equipment:

6. Include fault contribution of existing motors, services, generators and equipment, as appropriate, in the study.
7. Obtain required existing equipment data from the field and FPl.

G. Provide a comprehensive report document containing the short circuit, device coordination and arc flash studies. As a minimum the report structure shall contain the following:

1. Executive Summary.
2. Methodology.
3. One Line Diagram(s).
4. Short Circuit Analysis.
5. Short Circuit Analysis Results/Conclusions/Recommendations.
6. Device Coordination Analysis.
7. Recommended protective devices settings.
8. Arc Flash Analysis.
9. Arc Flash PPE recommendations.

## 1.7 SHORT CIRCUIT STUDY

A. General

1. Use cable impedances based on copper conductors.
2. Use bus impedances based on copper bus bars.
3. Use cable and bus resistances calculated at 25 degrees C.
4. Use 600-volt cable reactance based on use of typical data of conductors to be used in this project.
5. Use transformer impedances 92.5 percent of "nominal" impedance based on tolerances specified in ANSI C57.12.00.

B. Provide

1. Calculation methods and assumptions.
2. Selected base per unit quantities.
3. One-line diagrams annotated with results of short circuit analysis.
   a. Three phase, line-to-line and single line to ground faults

b. Equipment Short Circuit Rating

4. Source impedance data, including electric utility system and motor fault contribution characteristics.
5. Short circuit report, demand load report, load flow report and input data reports.
6. Results, conclusions, and recommendations.

C. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed symmetrical three-phase bolted fault, bolted line-to-ground fault, and bolted line-to-line fault at each:
1. Calculation methods and assumptions.
2. Main breaker.
3. Low voltage switchboard and/or distribution panelboard.
4. Motor control centers, Motor starters, and VFD's.
5. Standby generator.
6. Automatic Transfer Switch.
7. All branch circuit panelboards.
8. Industrial control panels manufactured in accordance with UL 508A and NEC article 409.
9. Disconnect switches and other significant locations throughout the system.
10. Future load contributions as shown on one-line diagram.

D. Verify:
1. All equipment, main breaker, ATS, and protective devices are applied within their ratings.
2. Adequacy of switchgear, switchboard, panelboards, and motor control centers bus bars to withstand short circuit stresses.
3. Adequacy of transformer windings to withstand short circuit stresses.
4. Cable and busway sizes for ability to withstand short circuit heating, besides normal load currents.

## 1.8 PROTECTIVE DEVICE COORDINATION STUDY

A. Proposed protective device coordination time-current curves for distribution system, graphically displayed on conventional log-log curve sheets. Time Current Curve plots from the software program are acceptable.

B. Each curve sheet to have title and one-line diagram that applies to specific portion of system associated with time-current curves on that sheet.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

D. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Perform device coordination on time-current curves for low voltage distribution system(s).

F. Provide Individual protective device time-current characteristics on log-log paper or software generated graphs.

G. Plot Characteristics on Curve Sheets:
1. Electric utility's relays (if applicable).
2. Electric utility's fuses including manufacturer's minimum melt, total clearing,

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tolerance, and damage bands (if applicable).

3. Medium voltage equipment relays (if applicable).
4. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
5. Low voltage equipment circuit breaker trip devices, including manufacturer’s tolerance bands.
6. Pertinent transformer full-load currents at 100 and 600 percent.
7. Transformer magnetizing inrush currents.
8. Transformer damage curves.
9. ANSI transformer fault withstand parameters.
10. Significant symmetrical and asymmetrical fault currents.
11. Ground fault protective device settings.
12. Cable damage curves.
13. Circuit breaker panelboard main breakers, where appropriate.
14. Motor circuit protectors for major motors

## 1.9 ARC FLASH ANLYSIS

A. Perform incident energy calculations in accordance with IEEE 1584-2002 Guide for Performing Arc Flash Hazard Calculations for all equipment analyzed in the short circuit study. Tabular results and recommended labels from the software program are acceptable.

B. Furnish recommendations for Personal Protective Equipment, in accordance with OSHA standards, and proper labels to be located on the electrical equipment in accordance with NEC Article 110.16.

C. Use data from short circuit and device coordination study.

D. Use manufacturer data for: enclosure type; gap between exposed conductors or busway; grounding type; number of phases and connection; and working distance.

## 1.10 TABULATIONS

A. General Data:
   1. Short circuit reactances of rotating machines.
   2. Cable and conduit material data.
   3. Bus data.
   4. Transformer data.
   5. Circuit resistance and reactance values.

B. Short Circuit Data
   1. Fault impedances.
   2. X to R ratios.
   3. Asymmetry factors.
   4. Motor contributions.
   5. Short circuit kVA.
   6. Symmetrical and asymmetrical fault currents.

C. Recommended Protective Device Settings:
   1. Relays:
      a. Relay name.
      • Device number.

- Description.
- TCC catalog number.
- Short circuit ratings.
- Current tap.
- Time dial (as applicable).
- Instantaneous pickup (as applicable).
- Ground fault settings (as applicable).

2. Circuit Breakers:
   a. Breaker name.
   - Breaker Description.
   - Model number.
   - TCC catalog number.
   - Short circuit rating.
   - Frame/Sensor rating.
3. Motor Circuit Protectors (MCP):
   a. MCP name.
   - MCP Description.
   - Model number.
   - TCC catalog number.
   - Short circuit rating.
   - Frame/Sensor rating.
   - Instantaneous settings.
4. Fuses:
   a. Fuse name.
   - Fuse Description.
   - Model number.
   - TCC catalog number.
   - Short circuit rating.
   - Fuse rating.

**1.11 STUDY ANALYSES**

B. Written Summary:
   1. Scope of studies performed.
   a Explanation of bus and branch numbering system.
   b Selected equipment deficiencies.
   c Results of short circuit and coordination studies.
   d Comments or suggestions.

C. Suggest changes and additions to equipment rating and/or characteristics.

D. Notify Engineer in writing of existing circuit protective devices improperly rated for new fault conditions.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION**

**3.1 GENERAL**

A. Adjust relay and protective device settings according to values established by the coordination study.

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B. Make other minor modifications to equipment as required to accomplish conformance with the short circuit and protective device coordination studies.
C. Provide and install short-circuit and arc flash labels on all electrical panels, enclosed circuit breakers, motor starters, VFD's, and disconnect switches in accordance with NFPA 70-2014 and NFPA 70E-2015.
D. Notify Engineer in writing of any required major equipment modifications.

**END OF SECTION 16015**

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Division.

### 1.2 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required for a complete electrical system as hereinafter specified and shown on the Drawings. Electrical work to be performed under this Contract includes, but is not limited to, the following:
   1. Provide and install all equipment, conduit, and wiring for the electrical work indicated on the civil site plans and the electrical drawings in accordance with Division 16 of the specifications.

B. The work, apparatus and materials which shall be furnished under these Specifications and accompanying Drawings shall include all items listed hereinafter and/or shown on the Drawings. Certain equipment will be furnished as specified in other Sections of these Specifications which will require wiring thereto and/or complete installation as indicated. All materials necessary for the complete installation shall be furnished and installed by the DBF to provide complete power, communication systems, instrumentation, wiring and control systems as indicated on the Drawings and /or as specified herein.

C. The work shall include complete testing of all equipment and wiring at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; sub-standard work will be rejected.

### 1.3 GENERAL INFORMATION

A. Each bidder or his authorized representatives shall, before preparing his proposal, visit all areas of the sites in which work under this Section is to be performed and carefully inspect the existing conditions. The submission of the proposal by the bidder shall be considered evidence that he or his representative has visited the sites and noted the locations and conditions under which the work will be performed and that he takes full responsibility for a complete knowledge of all factors governing his work.

B. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost.

### 1.4 CODES, INSPECTIONS AND FEES

A. All material and installation shall be in accordance with the latest edition of the National Electrical Code and all applicable national, local and state codes.

B. All equipment and material shall be U.L. listed.

C. Pay all fees required for permits and inspections.

### 1.5 UTILITY COORDINATION

A. The DBF shall coordinate with local representatives of the power utility to ensure

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the proper installation of these utilities at the project sites. Utility installation(s) shall be in accordance with the requirements of the Contract Documents and meet all requirements of the respective utility

## 1.6 TEMPORARY ELECTRICAL FACILITIES

A. The DBF shall furnish, install, and maintain all materials and equipment required to provide temporary light and power to perform the work of all trades during construction until work is completed. Adequate lighting and receptacle outlets for operation of hand tools shall be provided throughout the project, including trailers, field offices, etc. and shall be extended as construction progresses.

B. All reasonable safety requirements shall be observed to protect workers and the public from shock and fire hazards.

1. Ground fault circuit interrupters shall be employed in accordance with codes.

a Ground wires are required in all circuits. Ground poles are required on all outlets. All metallic cases shall be grounded.

b Raintight cabinets shall be used for all equipment in wet locations.

## 1.7 INTERPRETATION OF DRAWINGS

A. The Drawings are not intended to show exact locations of conduit runs.

B. Unless otherwise approved by the Engineer conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.

C. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.

D. All wire, conduit, circuit breaker, and motor starter sizes shown on the drawings are indicative of the sizes required based upon the equipment shown. These may vary depending upon the actual equipment furnished. The DBF shall make adjustments as required to meet the installation requirements of equipment.

E. The locations of equipment and devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

F. Circuit layouts shown are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. Additional circuits shall be installed whenever needed to conform to the specific requirements of the equipment.

G. All connections to equipment shall be made as shown, specified, and directed and in accordance with the approved shop drawings.

H. All cutting and patching necessary throughout the existing site shall be done in a thoroughly workmanlike manner.

## 1.8 COMPONENT INTERCONNECTIONS

A. Component equipment furnished under this Specification will not be furnished as integrated systems.

B. Analyze all systems components and their shop drawings; identify all terminals and prepare drawings or wiring tables necessary for component interconnection

## 1.9 MATERIALS

A. The materials used in all systems shall be new, unused, of the manufacturer's latest design, and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or Manufacturer's Specifications shall be submitted for approval as required by the Engineer.
B. Materials and equipment used shall be Underwriters Laboratories, Inc. listed.
C. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been damaged, such damage shall be repaired by the DBF at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried-out and put through such special tests as directed by the Engineer, at the cost and expense of the DBF, or shall be replaced by the DBF at his own expense.
D. All electrical panels, enclosures, raceways, conduits, wireways, boxes, cabinets, etc., shall be fabricated of metal, Non-metallic substitutes are not acceptable. This does not apply to buried work.

## 1.10 SHOP DRAWINGS

A. Shop drawings shall be submitted for approval of all materials, equipment, apparatus, and other items as required by the Engineer.
B. Shop drawings shall be submitted for all equipment supplied under Division 16 of the specifications.
C. Prior to submittal by the DBF, all shop drawings shall be checked for conformance with the Contract requirements. Shop drawings shall bear the date checked checker's name and indication of approval. Provide an itemized list noting all discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted shall be returned.
D. The Engineer's check shall be only for conformance with the design concept of the project and compliance with the Specifications and Drawings.
E. No material shall be ordered, or shop work started until the Engineer's approval of shop drawings has been given.

## 1.11 WARRANTY

A. All equipment furnished and installed, and all work performed under Division 16 shall be guaranteed by the DBF against defects of workmanship, materials, and proper installation for a minimum period of one (1) year from date of acceptance. This time shall be increased to the periods stated within individual specification sections as required.

## 1.12 RECORD DRAWINGS

As the work progresses, legibly record all field changes on a set of project Contract Drawings. When the project is complete, furnish a complete set of "as-built"

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drawings for the Project Record Documents.

**1.13 TESTS**

A. Test all systems in the presence of the Engineer and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

**END OF SECTION 16050**

## PART 1 GENERAL

### 1.1 SCOPE OF WORK

B. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

### 1.2 APPLICATIONS

A. Schedule 40 PVC conduit shall be used underground, unless otherwise noted. Transitions to exposed, outdoor locations shall be made using rigid aluminum conduit starting with the last 90 degree elbow.

B. Rigid aluminum conduit shall be used in exposed, outdoor locations except where specified otherwise.

C. PVC coated RGS conduit shall be used as raceways for shielded wiring.

D. All conduit of a given type shall be the product of one manufacturer.

## PART 2 PRODUCTS

### 2.1 RIGID CONDUIT

A. PVC conduit shall be rigid polyvinyl chloride type as manufactured by Carlon, an Indian Head Company, Phillips Petroleum Company, Triangle Pipe and Tube Company, Inc., or approved equal.

B. PVC coated rigid steel conduit shall be hot-dipped galvanized inside and out including threads. The PVC coating shall be UL listed for corrosion protection and be at least 40 mil thick. A 2 mil green urethane interior coating shall be provided. PVC coated rigid steel conduit shall be as manufactured by the Perma-Cote Company, Gilmer, Texas, or approved equal.

C. Rigid Aluminum Conduit:

1. Meet requirements of ANSI C80.5 and UL 6.
2. Material: Type 6063, copper-free aluminum alloy.

### 2.2 BOXES AND FITTINS

A. Terminal boxes, junction boxes, pull boxes, etc., shall be schedule 80 PVC unless otherwise shown on the Drawings. Covers shall be gasketed and fastened with stainless steel screws. Boxes shall be as manufactured by Hoffman Engineering Company or approved equal.

B. Conduit hubs shall be as manufactured by Meyers Electric Products, Inc., Raco Division, Appleton Electric Company, or approved equal.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. No conduit smaller than 3/4 inch electrical trade size shall be used, nor shall any have more than four (4) 90 degree bends in any one run. Pull boxes shall be provided as required or directed.

B. An equipment grounding conductor sized per article 250-95 of the N.E.C. shall be installed in every raceway whether or not shown on the Drawings.

C. All underground conduit shall be buried at least 24 inches below grade.

D. A three (3) inch wide warning tape, red with black stenciled letters "CAUTION - CAUTION - CAUTION ELECTRICAL LINE BURIED BELOW" shall be installed at

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least 12 inches above, and along the entire length of all underground conduit.

E. No wire shall be pulled until the conduit system is complete in all details.
F. The ends of all conduits shall be tightly plugged to exclude dust and moisture while under construction.
G. Conduit supports shall be spaced at intervals of eight (8) feet or less, as required to obtain rigid construction.
H. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface.
I. All conduits on exposed work shall be run at right angles to and parallel with the surrounding wall or slab. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduits shall be run perfectly straight and true.
J. All earth, sod, etc., moved during the installation of underground conduit shall be replaced by the DBF to its original state.
K. Conduits terminating in gasketed enclosures shall be terminated with conduit hubs.
L. The ends of all conduits terminating in panels and cabinets shall be filled with silicone gel. Filling shall be done after the cable has been pulled in order to prevent moisture in the terminating enclosure.

**END OF SECTION 16110**

## PART 1 GENERAL

### 1.1 SCOPE OF WORK

A. Furnish, install and test all wire, cable, and appurtenances as shown on the Drawings and as hereinafter specified

### 1.2 APPLICATIONS

A. Wire for all low voltage power and motor circuits shall be type XHHW, stranded.
B. Single conductor wire for control, indication and metering shall be type THHN/THWN No. 14 AWG, stranded.
C. Wire for process instrumentation shall be shielded pairs No. 16 AWG, stranded with individual drain wires.

### 1.3 SUBMITTALS

A. Samples of proposed wire and cable shall be submitted for approval. Each sample shall have the size, type of insulation and voltage stencilled on the jacket.
B. Approved samples will be sent to the project location for comparison by the Resident Engineer with the wire actually installed.
C. Installed, unapproved wire shall be removed and replaced at no additional cost to the Owner.

## PART 2 PRODUCTS

### 2.1 MATERIALS

A. All wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper conductors.
B. All conductors No. 8 AWG and larger shall be stranded.
C. Type XHHW shall be 600 volt cross-linked polyethylene (XLP) and type THHN/THWN shall be 600 volt as manufactured by the Hi-Tech Company, Rome Cable Corporation, The Okonite Company or approved equal.
D. Process instrumentation wire shall be 600 volt, PVC or polyethylene insulated, aluminum/polyester tape shielded, polyvinyl chloride jacketed, type “TC” as manufactured by the American Insulated Wire Company, Belden Corporation, “Beldfoil” 9342, or approved equal.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. All conductors shall be carefully handled to avoid kinks or damage to insulation.
B. Lubrications shall be used to facilitate wire pulling. Lubricants shall be U.L. listed for use with the insulation specified.
C. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.
D. Instrumentation cables shall be separated from power and control cables in pullboxes.
E. Shielding on instrumentation wire shall be grounded at the transmitter end only, or as directed by the supplier of the instrumentation equipment.

Wire and cable connections to terminals, splices, and taps shall be made with compression connectors. Connections of insulated conductors shall be insulated and covered. All connections shall be made using materials and installation

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methods in accordance with instructions and recommendations of the manufacturer of the particular item of wire and cable. The conductivity of all completed connections shall be not less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

F. All wire and cable shall be continuous and without splices between points of connection to equipment terminals, except a splice will be permitted by the Engineer if the length required between the points of connection exceeds the greatest standard shipping length available from the manufacturer specified or approved by the Engineer as the manufacturer of the particular item of wire and cable.

G. Steel fish tapes and/or steel pulling cables shall not be used in PVC conduit runs.

**3.2 TESTS**

A. All 600 volt wire insulation shall be tested with a megohm meter after installation. Tests shall be made at not less than 1,000 VDC

**END OF SECTION 16120**

## PART 1 GENERAL

### 1.1 RELATED SECTIONS

A. A. This section applies only when referenced by a motor-driven equipment specification. Application, horsepower, enclosure type, mounting, shaft type, synchronous speed, and any deviations from this section will be listed in the equipment specification. Where such deviations occur, they shall take precedence over this section.

### 1.2 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   a. Anti-Friction Bearing Manufacturers' Association (AFBMA):
      1) 9, Load Ratings and Fatigue Life for Ball Bearings.
      2) 11, Load Rating and Fatigue Life for Roller Bearings.
   b. American National Standards Institute (ANSI): C50.41, Polyphase Induction Motors for Power Generating Stations.
   c. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      1) 85, Test Procedure for Airborne Sound Measurements on Rotating Machines.
      2) 112, Standard Test Procedures for Polyphase Induction Motors and Generators.
      3) 114, Standard Test Procedures for Single-Phase Induction Motors.
      4) 620, Guide for Construction and Interpretation of Thermal Limit Curves for Squirrel-Cage Motors Over 500 Horsepower.
      5) 841, Recommended Practice for Chemical Industry Severe-Duty Squirrel-Cage Induction Motors, 600V and Below.
   d. National Electrical Manufacturers Association (NEMA):
      1) MG 1, Motors and Generators.
      2) MG 13, Frame Assignments for Alternating Current Integral Horsepower Induction Motors.
      3) 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   e. National Fire Protection Association (NFPA): 70, National Electrical Code. (NEC)
   f. Underwriters Laboratories (UL):
      1) 547, Thermal Protectors for Electric Motors.
      2) 674, Electric Motors and Generators Used in Hazardous (Classified) Locations.

### 1.3 DEFINITIONS

A. CISD-TEFC: Chemical industry, severe-duty enclosure.
B. DIP: Dust-ignition-proof enclosure.
C. EXP: Explosion-proof enclosure.
D. ODP: Open drip-proof enclosure.
E. TEFC: Totally enclosed, fan cooled enclosure.
F. TENV: Totally enclosed, nonventilated enclosure.
G. WPI: Open weather protected enclosure, Type I.
H. WPII: Open weather protected enclosure, Type II.
I. Motor Nameplate Horsepower: That rating after any derating required to allow for extra heating caused by the harmonic content in the voltage applied to the motor by its controller.

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## 1.4 SUBMITTALS

A. Shop Drawings:
   a. Descriptive information.
   b. Nameplate data in accordance with NEMA MG 1.
   c. Additional Rating Information:
      1) Service factor.
      2) Locked rotor current.
      3) No load current.
      4) Safe stall time for motors 200 horsepower and larger.
      5) Multispeed load classification (e.g., variable torque).
      6) Adjustable frequency drive motor load classification (e.g., variable torque) and minimum allowable motor speed for that load classification.
   d. Enclosure type and mounting (e.g. horizontal, vertical).
   e. Dimensions and total weight.
   f. Conduit box dimensions and usable volume as defined in NEMA MG 1 and NFPA 70.
   g. Bearing type.
   h. Bearing lubrication.
   i. Bearing life.
   j. Space heater voltage and watts.
   k. Description and rating of motor thermal protection.
   l. Motor sound power level in accordance with NEMA MG 1.
   m. Maximum brake horsepower required by the equipment driven by the motor.
   n. Description and rating of submersible motor moisture sensing system.

B. Quality Control Submittals:
   a. Factory test reports, certified.
   b. Manufacturer's Certificate of Proper Installation, 100 horsepower and larger.
   c. Operation and Maintenance Manual.

# PART 2 PRODUCTS

## 2.1 MANUFACTURERS

A. General Electric.
B. Reliance.
C. MagneTek.
D. Siemens.
E. Baldor.
F. U.S. Motors.
G. Westinghouse.
H. Toshiba.

## 2.2 GENERAL

A. For multiple units of the same type of equipment, furnish identical motors and accessories of a single manufacturer.
B. In order to obtain single source responsibility, utilize a single supplier to provide a drive motor, its driven equipment, and specified motor accessories.
C. Meet requirements of NEMA MG 1.
D. Frame assignments in accordance with NEMA MG 13.

E. Provide motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.
F. Motors shall be specifically designed for the use and conditions intended, with a NEMA design letter classification to fit the application.
G. Lifting lugs on all motors weighing 100 pounds or more.
H. Operating Conditions:
   a. Maximum ambient temperature not greater than 50 degrees C.
   b. Motors shall be suitable for operating conditions without any reduction being required in the nameplate rated horsepower or exceeding the rated temperature rise.
   c. Overspeed in either direction in accordance with NEMA MG 1.

## 2.3 HORSEPOWER RATING

A. As designated in motor-driven equipment specifications.
B. Constant Speed Applications: Brake horsepower of the driven equipment at any head capacity point on the pump curve not to exceed motor nameplate horsepower rating, excluding any service factor.
C. Adjustable Frequency, Adjustable Speed Applications: Driven equipment brake horsepower at any head capacity point on the pump curve not to exceed motor nameplate horsepower rating, excluding any service factor.

## 2.4 SERVICE FACTOR

A. 1.15 minimum at rated ambient temperature, unless otherwise indicated.

## 2.5 VOLTAGE AND FREQUENCY RATING

A. System Frequency: 60-Hz.
B. Voltage Rating: Unless otherwise indicated in motor-driven equipment specifications:

| Size | Voltage | Phases |
|---|---|---|
| 1/2 hp and smaller | 115 | 1 |
| 3/4 hp through 400 hp | 460 | 3 |
| 450 hp and larger | 4,000 | 3 |

C. Suitable for full voltage starting.
D. One hundred horsepower and larger also suitable for reduced voltage starting with 65 or 80 percent voltage tap settings on reduced inrush motor starters.
E. Suitable for accelerating the connected load with supply voltage at motor starter supply terminals dipping to 90 percent of motor rated voltage.

## 2.6 EFFICIENCY AND POWER FACTOR

A. For all motors except single-phase, under 1 horsepower, multispeed, short time rated and submersible motors, or motors driving gates, valves, elevators, cranes, trolleys, and hoists:
   a. Efficiency:
      1) Tested in accordance with NEMA MG 1, paragraph 12.54.1.
      2) Guaranteed minimum at full load in accordance with Table 1 or as indicated in motor-driven equipment specifications.

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b. Power Factor: Guaranteed minimum at full load in accordance with Table 1 or as indicated in motor-driven equipment specifications.

## 2.7 LOCKED ROTOR RATINGS

A. Locked rotor kVA Code F or lower if motor horsepower not covered by NEMA MG 1 tables.
B. Safe stall time 15 seconds or greater.

## 2.8 INSULATION SYSTEMS

A. Single-Phase, Fractional Horsepower Motors: Manufacturer's standard winding insulation system.
B. Motors rated over 600 Volts: Sealed windings in accordance with NEMA MG 1.
C. Three-Phase and Integral Horsepower Motors, Unless Otherwise Indicated in Motor-Driven Equipment Specifications: Class F with Class B rise at nameplate horsepower and designated operating conditions, except EXP and DIP motors which must be Class B with Class B rise.

## 2.9 ENCLOSURES

A. All enclosures to conform to NEMA MG 1.
B. Unless otherwise noted, all motors shall be TEFC and shall furnish with a drain hole with porous drain/weather plug.
C. Explosion-Proof (EXP):
   a. TEFC listed to meet UL 674 and NFPA 70 requirements for Class 1, Division 1, Group C and D hazardous locations.
   b. Drain holes with drain and breather fittings.
   c. Integral thermostat opening on excessive motor temperature in accordance with UL 547 and NFPA 70.
   d. Thermostat leads to terminate in a terminal box separate from main terminal box.
D. Dust-Ignition-Proof (DIP):
   a. TEFC listed to meet UL 674 and NFPA 70 requirements for Class II, Division 1, Group E, F, G.
   b. Integral thermostat opening on excessive motor temperature in accordance with UL 547 and NFPA 70.
   c. Thermostat leads to terminate in a terminal box separate from main terminal box.
E. Submersible: In accordance with Paragraph SPECIAL MOTORS.
F. Chemical Industry, Severe-Duty (CISD-TEFC): In accordance with Paragraph SPECIAL MOTORS.

## 2.10 TERMINAL (CONDUIT) BOXES

A. Oversize main terminal boxes for all motors.
B. Diagonally split, rotatable to each of four 90-degree positions. Threaded hubs for conduit attachment.
C. Except ODP, furnish gaskets between box halves and between box and motor frame.
D. Minimum usable volume in percentage of that specified in NEMA MG 1-11.06 and 20.62 and NFPA 70, Article 430:

| Voltage | Horsepower | Percentage |
|---|---|---|

| | | |
|---|---|---|
| Below 600 | 15 thru 125 | 500 |
| Below 600 | 150 thru 300 | 275 |
| Below 600 | 350 thru 600 | 225 |
| Above 600 | All Sizes | 200 |

E. Terminal for connection of equipment grounding wire in each terminal box.

## 2.11 BEARINGS AND LUBRICATION

A. Horizontal Motors:
   a. 3/4 horsepower and Smaller: Permanently lubricated and sealed ball bearings, or regreasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
   b. 1 Through 400 horsepower: Regreasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
   c. Above 400 horsepower: Regreasable antifriction bearings in labyrinth sealed end bells with removable grease relief plugs.
   d. Minimum 100,000 hours L-10 bearing life for ball and roller bearings as defined in AFBMA 9 and 11.

B. Vertical Motors:
   a. Thrust Bearings:
      1) Antifriction bearing.
      2) Manufacturer's standard lubrication 100 horsepower and larger.
      3) Oil lubricated 125 horsepower and larger.
      4) Minimum 50,000 hours L-10 bearing life.
   b. Guide Bearings:
      1) Manufacturer's standard bearing type.
      2) Manufacturer's standard lubrication 200 horsepower and larger.
      3) Oil lubricated 250 horsepower and larger.
      4) Minimum 100,000 hours L-1O bearing life.

C. Regreasable Antifriction Bearings:
   a. Readily accessible, grease injection fittings.
   b. Readily accessible, removable grease relief plugs.

D. Oil Lubrication Systems:
   a. Oil reservoirs with sight level gauge.
   b. Oil fill and drain openings with opening plugs.
   c. Provisions for necessary oil circulation and cooling.

## 2.12 NOISE

A. Measured in accordance with IEEE 85 and NEMA MG 1.

B. Motors controlled by adjustable frequency drive systems shall not exceed sound levels of 3 dBA higher than NEMA MG 1.

## 2.13 BALANCE AND VIBRATION CONTROL

A. In accordance with NEMA MG 1-12.06.

## 2.14 EQUIPMENT FINISH

A. External Finish: Prime and finish coat manufacturer's standard. Field painting in accordance with Section 09900, PAINTING AND PROTECTIVE COATINGS.

B. Internal Finish: Bore and end turns coated with clear polyester or epoxy varnish**.**

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## 2.15 SPECIAL FEATURES AND ACCESSORIES

A. Screen Over Air Openings: Stainless steel on motors with ODP, WPI, and WPII enclosures meeting requirements for Guarded Machine in NEMA MG 1.

B. Winding Thermal Protection:

a. Thermostats:

1) Motors for constant speed and adjustable speed application 30 through 75 horsepower.

2) Bi-metal disk or rod type thermostats embedded in stater windings (normally closed contact).

3) Automatic reset contacts rated 120 volts ac, 5 amps minimum, opening on excessive temperature. (Manual reset will be provided at motor controller.)

C. Nameplates:

a. Raised or stamped letters on stainless steel or aluminum.

b. Display all motor data required by NEMA MG 1-10.37 and NEMA MG 1-10.38 in addition to bearing numbers for both bearings.

c. Premium efficiency motor nameplates to also display NEMA nominal efficiency, full load power factor, and maximum allowable kVAR for power factor correction capacitors.

## 2.16 SPECIAL MOTORS

A. Requirements in this article take precedence over conflicting features specified elsewhere in this section.

B. Submersible Pump Motors:

a. Manufacturers:

1) Reliance.

2) Flygt.

b. At 100 Percent Load:

| Horsepower | Guaranteed Minimum Efficiency | Guaranteed Minimum Power Factor |
|---|---|---|
| 5 thru 10 | 80 | 82 |
| 10.1 thru 50 | 85 | 82 |
| 50. 1 thru 100 | 87 | 82 |
| Over 100 | 89 | 82 |

c. Insulation System: Manufacturer's standard Class B or Class F.

d. Motor capable of running dry continuously.

e. Enclosure:

1) Hermetically sealed, watertight, for continuous submergence up to 65-foot depth.

2) Listed to meet UL 674 and NFPA 70 requirements for Class 1, Division 1, Group D hazardous atmosphere.

3) Seals: Tandem mechanical.

f. Bearing and Lubrication:

1) Permanently sealed and lubricated, replaceable antifriction guide and thrust bearings.

2) Minimum 15,000 hours L-10 bearing life.

g. Inrush kVA/horsepower no greater than NEMA MG 1 and NFPA 70, Code F.
h. Winding Thermal Protection:
    1) Thermal sensor and switch assembly, one each phase, embedded in stater windings and wired in series.
    2) Switches normally closed, open upon excessive winding temperature, and automatically reclose when temperature has cooled to safe operating level.
    3) Switch contacts rated at 5 amps, 120 volts ac.
i. Motor Seal Failure Moisture Detection:
    1) Probes or sensors to detect moisture beyond seals.
    2) Probe or sensor monitoring module for mounting in motor controller, suitable for operation from 120-volt ac supply.
    3) Monitoring module with control power transformer, probe test switch and test light, and two independent 120-volt ac contacts, one opening and one closing when the flux of moisture is detected.
j. Bearing Overtemperature Protection for Motors Larger than 100 Horsepower:
    1) Sensor on lower bearing housing monitoring bearing temperature.
    2) Any monitoring relay necessary to provide 120-volt ac contact opening on bearing overtemperature.
k. Winding thermal protection, moisture detection, and bearing overtemperature specified above may be monitored by a single device providing two independent 120-volt ac contacts, one closing and one opening on malfunction.
l. Connecting Cables:
    1) One cable containing power, control, and grounding conductors.
    2) Each cable suitable for hard service, submersible duty with watertight seal where cable enters motor.
    3) Length: 30 feet minimum, coordinate proper length.
    4) UL 1 listed and sized in accordance with NFPA 70.

## 2.17 FACTORY TESTING

A. Tests:
a. In accordance with IEEE 112 for polyphase motors and IEEE 114 for single-phase motors.
b. Routine (production) tests on all motors in accordance with NEMA MG 1, plus no load power at rated voltage and polyphase, rated voltage measurement of locked rotor current. Test multispeed motors at all speeds.
c. For energy efficient motors, test efficiency at 50, 75, and 100 percent of rated horsepower:
    1) In accordance with IEEE 112, Test Method B, and NEMA MG 1, paragraphs 12.54 and 12.57.
    2) For motors 500 horsepower and larger where facilities are not available to test by dynamometer (Test Method B), determine efficiency by IEEE 112, Test Method F.
d. Power factor:
    1) Speed.
    2) Current at rated horsepower.
    3) kW input at rated horsepower.
    4) On motors of 100 horsepower and smaller, furnish a certified copy of a

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motor efficiency test report on an identical motor.

B. Test Report Forms:
   a. Routine Tests: IEEE 112, Form A-1.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. In accordance with manufacturer's instructions and recommendations.
B. Align motor carefully and properly with driven equipment.
C. Secure equipment to mounting surface with anchor bolts. Provide anchor bolts meeting manufacturer's recommendations and of sufficient size and number for the specified seismic conditions.

### 3.2 FIELD QUALITY CONTROL

A. General: Inspection and testing limited to motors rated 5 horsepower and larger.
B. Visual and Mechanical Inspection:
   a. Proper electrical and grounding connections.
   b. Shaft alignment.
   c. Blockage of ventilating air passageways.
   d. Operate Motor and Check For:
      1) Excessive mechanical and electrical noise.
      2) Overheating.
      3) Correct rotation.
      4) Check vibration detectors, resistance temperature detectors, or motor inherent protectors for functionability and proper operation.
      5) Excessive vibration.
   e. Check operation of space heaters.
C. Electrical Tests:
   a. Insulation Resistance Tests:
      1) In accordance with IEEE 43 at test voltages established by NETA ATS, Table 10.2 for:
         - Motors above 200 horsepower for l0-minute duration with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
         - Motors 200 horsepower and less for 1-minute duration with resistances tabulated at 30 and 60 seconds.
      2) Insulation resistance values equal to, or greater than, ohmic values established by manufacturers.
   b. Calculate polarization index ratios for motors above 200 horsepower. Investigate index ratios less than 1.5 for Class A insulation and 2.0 for Class B insulation.
   c. Insulation resistance test on insulated bearings in accordance with manufacturer's instructions.
   d. Measure running current and voltage and evaluate relative to load conditions and nameplate full-load amperes.
   e. Overpotential Tests:
      1) Applied dc voltage in accordance with IEEE 95.
      2) Limited to 4,000-volt motors rated 1,000 horsepower and greater.
      3) Test results evaluated on pass/fail basis.

## 3.3 SUPPLEMENTS

A. Table supplements**:**

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| TABLE 1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| MOTOR PERFORMANCE REQUIREMENTS | | | | | | | | | |
| | | % Guar. Min. Full Load Efficiency | | | | %Guar. Min. Full Load Power Factor | | | |
| | | Horizontal | | Vertical | | Horizontal | | Vertical | |
| hp | Nom.Speed rpm | Drip-proof ODP | TEFC | Drip-proof ODP | TEFC | Drip-proof ODP | TEFC | Drip-proof ODP | TEFC |
| 1 | 1800 | 80.0 | 81.5 | | | Mfr.'s Std. | Mfr.'s Std. | | |
| | 1200 | 78.5 | 79.3 | | | Mfr.'s Std. | Mfr.'s Std. | | |
| 1.5 | 3600 | 79.3 | 81.5 | | | Mfr.'s Std. | Mfr.'s Std. | | |
| | 1800 | 79.3 | 82.0 | | | Mfr.'s Std. | Mfr.'s Std. | | |
| | 1200 | 82.5 | 84.0 | | 82.0 | Mfr.'s Std. | Mfr.'s Std. | | Mfr.'s Std. |
| 2 | 3600 | 82.0 | 84.0 | | | Mfr.'s Std. | Mfr.'s Std. | | |
| | 1800 | 81.5 | 83.7 | | | Mfr.'s Std. | Mfr.'s Std. | | |
| | 1200 | 85.5 | 85.5 | 83.7 | 83.7 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 900 | 82.9 | 82.5 | 82.9 | 81.7 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| 3 | 3600 | 82.0 | 84.0 | 82.0 | 82.0 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1800 | 84.8 | 86.5 | 84.8 | 84.8 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1200 | 87.5 | 88.1 | 87.5 | 86.6 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 900 | 84.1 | 82.9 | 84.1 | 82.9 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| 5 | 3600 | 84.8 | 86.5 | 84.8 | 84.8 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1800 | 86.5 | 86.5 | 84.8 | 84.8 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1200 | 87.5 | 88.1 | 87.5 | 86.6 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 900 | 87.5 | 86.5 | 87.5 | 86.6 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| 7.5 | 3600 | 86.5 | 88.1 | 84.8 | 86.6 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1800 | 89.3 | 89.5 | 89.3 | 88.4 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1200 | 88.5 | 88.5 | 88.4 | 87.5 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 900 | 87.5 | 86.5 | 87.5 | 86.6 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| 10 | 3600 | 89.3 | 89.5 | 89.3 | 88.4 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |

| TABLE 1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| MOTOR PERFORMANCE REQUIREMENTS | | | | | | | | | |
| | | % Guar. Min. Full Load Efficiency | | | | %Guar. Min. Full Load Power Factor | | | |
| | | Horizontal | | Vertical | | Horizontal | | Vertical | |
| hp | Nom.Speed rpm | Drip-proof ODP | TEFC | Drip-proof ODP | TEFC | Drip-proof ODP | TEFC | Drip-proof ODP | TEFC |
| | 1800 | 89.3 | 89.5 | 89.3 | 88.4 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1200 | 89.5 | 89.5 | 89.3 | 88.4 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 900 | 89.3 | 88.5 | 89.3 | 88.4 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| 15 | 3600 | 88.5 | 89.8 | 88.4 | 88.4 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1800 | 91.0 | 91.0 | 90.9 | 90.2 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1200 | 90.2 | 90.2 | 90.2 | 89.3 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 900 | 89.3 | 88.5 | 89.3 | 88.4 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| 20 | 3600 | 91.0 | 90.6 | 90.9 | 89.3 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1800 | 91.7 | 91.7 | 91.7 | 90.9 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1200 | 91.0 | 90.6 | 90.2 | 89.3 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 900 | 90.2 | 89.5 | 89.3 | 88.4 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| 25 | 3600 | 91.7 | 91.0 | 91.7 | 90.2 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1800 | 92.4 | 92.4 | 92.4 | 91.7 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1200 | 91.7 | 91.0 | 90.9 | 89.3 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 900 | 90.2 | 89.5 | 89.3 | 88.4 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| 30 | 3600 | 91.7 | 91.4 | 89.5 | 88.4 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1800 | 92.4 | 92.4 | 92.4 | 91.7 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 1200 | 91.7 | 91.0 | 91.7 | 90.2 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| | 900 | 91.7 | 91.7 | 90.9 | 90.9 | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. | Mfr.'s Std. |
| 40 | 3600 | 91.7 | 91.7 | 90.2 | 89.3 | 86.6 | 86.1 | 87.0 | 89.0 |
| | 1800 | 93.6 | 93.0 | 92.8 | 91.7 | 78.2 | 78.2 | 83.0 | 84.5 |
| | 1200 | 92.4 | 92.4 | 91.7 | 90.9 | 81.5 | 81.5 | 81.5 | 81.5 |
| | 900 | 91.7 | 91.0 | 90.9 | 90.2 | 70.0 | 70.5 | 70.0 | 70.5 |
| 50 | 3600 | 92.0 | 92.0 | 90.2 | 89.3 | 85.1 | 86.7 | 89.0 | 89.0 |
| | 1800 | 93.6 | 93.0 | 92.8 | 91.7 | 79.5 | 79.4 | 82.5 | 82.5 |
| | 1200 | 92.4 | 92.4 | 91.7 | 90.9 | 81.5 | 81.5 | 81.5 | 81.5 |

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| TABLE 1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| MOTOR PERFORMANCE REQUIREMENTS | | | | | | | | | |
| | | % Guar. Min. Full Load Efficiency | | | | %Guar. Min. Full Load Power Factor | | | |
| | | Horizontal | | Vertical | | Horizontal | | Vertical | |
| hp | Nom.Speed rpm | Drip-proof ODP | TEFC | Drip-proof ODP | TEFC | Drip-proof ODP | TEFC | Drip-proof ODP | TEFC |
| | 900 | 91.7 | 91.7 | 90.9 | 90.9 | 78.5 | 72.9 | 78.5 | 80.0 |
| 60 | 3600 | 92.7 | 93.0 | 91.7 | 90.9 | 85.8 | 88.3 | 87.5 | 89.0 |
| | 1800 | 93.6 | 94.1 | 93.5 | 92.8 | 80.5 | 79.9 | 80.5 | 80.5 |
| | 1200 | 93.0 | 93.0 | 92.8 | 91.7 | 81.5 | 81.5 | 81.5 | 81.5 |
| | 900 | 92.4 | 91.7 | 91.7 | 90.9 | 79.5 | 73.2 | 79.5 | 79.5 |
| 70 | 3600 | 93.6 | 93.6 | 91.7 | 91.7 | 87.1 | 88.5 | 88.5 | 88.5 |
| | 1800 | 94.5 | 94.5 | 93.5 | 93.5 | 81.0 | 81.5 | 81.0 | 81.5 |
| | 1200 | 93.6 | 93.5 | 93.5 | 92.8 | 82.0 | 82.0 | 82.0 | 82.0 |
| | 900 | 92.8 | 92.4 | 92.8 | 91.7 | 80.5 | 74.5 | 80.5 | 81.0 |
| 100 | 3600 | 93.6 | 93.3 | 91.7 | 90.7 | 87.0 | 88.2 | 87.0 | 88.5 |
| | 1800 | 95.1 | 94.5 | 94.0 | 93.5 | 81.0 | 81.0 | 81.0 | 81.0 |
| | 1200 | 93.6 | 93.6 | 92.8 | 92.8 | 82.1 | 81.7 | 85.5 | 85.5 |
| | 900 | 93.5 | 92.4 | 92.8 | 91.7 | 77.0 | 77.3 | 77.0 | 80.0 |
| 125 | 3600 | 93.6 | 93.7 | 91.7 | 91.7 | 86.4 | 89.1 | 87.0 | 90.5 |
| | 1800 | 94.5 | 94.7 | 93.5 | 92.8 | 85.4 | 85.5 | 87.5 | 86.0 |
| | 1200 | 93.6 | 94.1 | 93.5 | 92.8 | 82.7 | 82.3 | 85.5 | 85.5 |
| | 900 | 93.5 | 93.0 | 92.8 | 92.4 | 78.5 | 78.5 | 78.5 | 78.5 |
| 150 | 3600 | 93.6 | 93.7 | 92.4 | 91.7 | 86.5 | 90.0 | 86.5 | 90.5 |
| | 1800 | 95.0 | 95.2 | 94.5 | 94.0 | 82.5 | 85.0 | 84.5 | 85.0 |
| | 1200 | 94.5 | 94.5 | 93.5 | 94.0 | 81.5 | 81.5 | 81.5 | 81.5 |
| | 900 | 93.5 | 93.0 | 92.8 | 92.4 | 78.0 | 78.5 | 78.0 | 78.5 |
| 200 | 3600 | 94.3 | 94.3 | 92.4 | 93.0 | 87.8 | 89.4 | 91.0 | 91.0 |
| | 1800 | 95.0 | 95.2 | 94.0 | 94.0 | 85.2 | 86.5 | 87.0 | 87.0 |
| | 1200 | 94.5 | 94.5 | 93.5 | 93.5 | 79.0 | 82.5 | 79.0 | 82.5 |
| 250 | 3600 | 94.3 | 94.7 | 91.7 | 92.4 | 85.0 | 86.5 | 85.0 | 96.5 |

| TABLE 1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| MOTOR PERFORMANCE REQUIREMENTS | | | | | | | | | |
| | | % Guar. Min. Full Load Efficiency | | | | %Guar. Min. Full Load Power Factor | | | |
| | | Horizontal | | Vertical | | Horizontal | | Vertical | |
| hp | Nom.Speed rpm | Drip-proof ODP | TEFC | Drip-proof ODP | TEFC | Drip-proof ODP | TEFC | Drip-proof ODP | TEFC |
| | 1800 | 85.4 | 95.4 | 94.5 | 94.5 | 79.0 | 79.0 | 79.0 | 79.0 |
| | 1200 | 95.0 | 94.5 | 94.5 | 93.5 | 82.0 | 82.0 | 82.0 | 82.0 |
| 300 | 3600 | 93.7 | 94.3 | | | 89.8 | 89.9 | | |
| | 1800 | 95.4 | 95.2 | 94.5 | 94.0 | 80.0 | 80.0 | 800 | 80.0 |
| | 1200 | 93.7 | 93.7 | | | 84.5 | 90.1 | | |
| 350 | 3600 | 94.3 | 94.7 | | | 89.4 | 85.9 | | |
| | 1800 | 94.7 | 94.7 | | | 85.9 | 85.9 | | |
| 400 | 3600 | 94.3 | | | | 88.4 | | | |
| | 1800 | 9437 | | | | 86.8 | | | |
| 450 | 3600 | 94.7 | | | | 89.1 | | | |
| 500 | 3600 | 94.7 | | | | 88.3 | | | |

**END OF SECTION 16405**

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## PART 1 GENERAL

### 1.1 SCOPE OF WORK

A. Furnish and install a complete grounding system in strict accordance with Article 250 of the National Electric Code and as hereinafter specified and shown on the Drawings.

## PART 2 PRODUCTS

### 2.1 GROUND RODS

A. Ground rods shall be copper clad steel 5/8 inch diameter x 20 foot minimum length. Ground rods shall be Copperweld or be an approved equal product.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. DBF shall not allow any grounding connections to be painted. If the connections are painted, they shall be disassembled and remade with new fittings.

B. Grounding electrodes shall be driven as required. Where rock is encountered, grounding plates may be used in lieu of grounding rods.

C. All equipment enclosures, motor frames, conduits systems, exposed structural steel, and similar items shall be grounded.

D. Exposed connections shall be made by means of approved grounding clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A or approved equal. All buried connections shall be made by welding process equal to Cadweld.

E. All grounding conductors shall be laid slack and where exposed to mechanical injury, shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard.

F. The DBF shall exercise care to insure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

### 3.2 TESTS

A. The DBF shall test the ground resistance of the system. Testing shall not be performed within 48 hours of rainfall. All test equipment shall be provided by the DBF and approved by the Engineer. Dry season resistance of the system shall not exceed 5 ohms. Submit test results to the Engineer for approval. In the event that the specified resistance cannot be achieved through the grounding as shown, provide additional grounding as directed by the Engineer.

B. All grounding system continuity shall be checked with a low range ohmmeter.

**END OF SECTION 16452**

# PART 1 GENERAL

## 1.1 SCOPE OF WORK

A. Provide all labor, materials, equipment, and incidentals required, and install, place in operation and field test variable frequency drive(s) (VFD's).

B. The variable frequency drive shall be a space vector Pulse-Width Modulated (PWM) design. Modulation methods which incorporate "gear-changing" techniques are not acceptable. The final responsibility of distributor or packager modifications to a third- party standard product will reside with the VFD manufacturer. The VFD manufacturer shall have overall responsibility for the drives. All drives shall be supplied by one manufacturer. The VFD shall be manufactured within the United States of America to alleviate concerns of future serviceability and parts availability.

C. VFD's shall be six (6) pulse units.

## 1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Pumps, General

## 1.3 QUALITY ASSURANCE

A. The entire VFD system as described in section 2.01B shall be factory assembled and system tested by the VFD manufacturer to assure a properly coordinated system.

B. Codes: Provide equipment in full accordance with the latest applicable rules, regulations, and standards of:
   a. Local Laws and Ordinances.
   b. State and Federal Laws.
   c. National Electric Code (NEC).
   d. Underwriters Laboratories (UL).
   e. American National Standards Institute (ANSI).
   f. National Electrical Manufacturers Association (NEMA).
   g. Institute of Electrical and Electronics Engineers (IEEE).

C. The complete drive system shall be UL listed.

D. Acceptable Manufacturers:
   a. Allen Bradley.
   b. No Approved "or Equal"

## 1.4 SUBMITTALS

A. Submittals shall be custom prepared by the VFD manufacturer for this specific application.

B. Submittal information shall include, but not be limited to:
   a. Equipment dimensions, including stub-up locations, shipping splits and shipping weights.
   b. Catalog cuts of major components.
   c. Spare parts list, per Paragraph 3.03.
   d. Certifications, including:
      1) Warranty, per section 1.04.
      2) Efficiencies, per section 2.02.A.1.
   e. Harmonic Distortion Analysis, per section 2.01D.

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### 1.5 WARRANTY

A. All equipment furnished under this section shall be warranted for onsite parts and labor by the DBF and the equipment manufacturers for a period of five (5) years after completion of startup.

## PART 2 PRODUCTS

### 2.1 MATERIAL AND EQUIPMENT

A. Any modifications to a standard product required to meet this specification shall be performed by the VFD manufacturer only. Distributor or system integrator changes to the VFD manufacturer's product are specifically disallowed.

B. The VFD system shall consist of a power factor correction / harmonic filter unit, input rectifier-grade phase-shifting transformer, 6 pulse converter section, output inverter and control logic section, harmonic filtering unit, and input line reactor. All components listed including power factor correction / harmonic filter shall be integral to the VFD lineup, factory wired and tested as a complete system. The entire VFD system shall meet the requirements of NEC article 409 and IEEE 508A for fault current withstand ratings as indicated on the project electrical drawings.

C. Input circuit breaker, interlocked with the enclosure door, with through-the-door handle to provide positive disconnect of incoming AC power and shall be capable of being locked in the open position.

D. VFD system shall maintain a 0.95 minimum true power factor throughout the entire speed range.

### 2.2 VARIABLE FREQUENCY DRIVES

A. Ratings

a. The drive system shall be 96% efficient at full load and full speed and 95.5% efficient at 51% load and 80% speed. Losses to be utilized in drive system efficiency calculation shall include input transformer, harmonic filter, and power factor correction if applicable, VFD converter and output filter if applicable. Auxiliary controls, such as internal VFD control boards, cooling fans or pumps, shall be included in all loss calculations.

b. Rated Input Power: 460 Volts 60 Hz, +10%, -5% at rated load, 3-phase.

1) Voltage Dip Ride-Through: VFD shall be capable of sustaining continued operation with a 40% dip in nominal line voltage. Output speed may decline only if current limit rating of VFD is exceeded.

2) Power Loss Ride-through: VFD shall be capable of a minimum 3 cycle power loss ride-through without fault activation.

c. Output Power: As required by motors supplied.

d. Ambient Temperature Range: 0 to 40°C.

e. Elevation: Up to 3300 feet (1000 meters) above MSL without derating.

f. Atmosphere: Non-condensing relative humidity to 95%.

g. AC Line Frequency Variation: +/- 3 Hertz.

h. Power Unit Rating Basis: 110% rated current continuous, 150% rated current for one minute, at rated temperature.

B. Construction

a. The controller shall produce an adjustable AC voltage/frequency output. It shall have an output voltage regulator to maintain correct output V/Hz ratio

despite incoming voltage variations.

b. The controller shall have a continuous output current rating of 100% of motor nameplate current.
c. The converter section shall be 6 pulse minimum utilizing diodes.
d. The inverter output shall be generated by IGBTs. Pulse Width Modulation strategy will be of the space vector type implemented to generate a sine-coded output voltage. The VFD shall not induce excessive power losses in the motor. The worst-case RMS motor line current measured at rated speed, torque and voltage shall not exceed 1.05 times the rated RMS motor current for pure sine wave operation. The inverters shall be able to sustain 1600-volt surges.
e. The controller(s) shall be suitable for use with any standard NEMA-B squirrel-cage induction motor(s) having a 1.15 Service Factor or with existing standard NEMA-B squirrel-cage induction motor(s) with nameplate data as shown on the plans. Provide drives with dV/dT output filters manufactured by Trans-Coil type KLC if the pump is more than 50ft of cable length from VFD. At any time in the future, it shall be possible to substitute any standard motor (equivalent horsepower, voltage and RPM) in the field.
f. The control logic section shall be fully digital and not require analog adjustment pots or fixed selector resistors. A power failure will not necessitate a reload of any drive parameter or configuration.
g. Minimum Starting Speed: When called to operate, the VFD shall immediately ramp to a minimum speed. The minimum speed shall be adjustable but initially set at 70% of maximum speed. The 4-20 MA speed signal from the PLC and potentiometer on the front of the drive shall modulate the signal between the minimum speed setpoint and the maximum output speed of the drive; i.e., at the 4 MA signal, the VFD shall run at the minimum speed. At the 20 MA signal, the VFD shall run at full speed. The potentiometer shall also adjust speed between the minimum speed setpoint and the maximum running speed. Below the minimum speed setpoint, the potentiometer shall have no effect.
h. All 6-pulse VFD’s shall be provided with 3% input line reactors.

C. Basic Features

a. The VFD shall include a customer selectable automatic restart feature. When enabled, the VFD shall automatically attempt to restart after a trip condition resulting from instantaneous overcurrent, overvoltage, out of saturation or overload. For safety, the drive shall shut down and require manual reset and restart if the automatic reset/restart function (programmable for up to 3 attempts) is not successful within a customer programmable time period. Auto-Restart shall be programmable to allow for individual fault selection.
b. A door-mounted membrane keypad with integral 2-line minimum, 24-character LCD display shall be furnished, capable of controlling the VFD and setting drive parameters. The keypad shall include the following features:
    1) The digital display must present all diagnostic message and parameter values in English engineering units when accessed, without the use of codes.
    2) The digital keypad shall allow the operator to enter exact numerical settings in English engineering units. A user menu written in plain English (rather than codes) shall be provided in software in nonvolatile memory as a guide to parameter setting and resettable in the field through the keypad. Multiple levels of password security shall be available to protect

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drive parameters from unauthorized personnel. The drive set up parameters must be able to be transferred to new boards to reprogram spare boards.

3) The following digital door-mounted keypad indications may be selectively displayed:
   - Speed demand in percent.
   - Output current in amperes.
   - Output Frequency in hertz.
   - Input voltage.
   - Output voltage.
   - Total 3-phase KW.
   - Kilowatt hour meter
   - Elapsed time running meter.
   - RPM.
   - DC bus voltage.
4) VFD shall have the capability of communicating via an RS-232, RS-422, or RS-485 port.
5) VFD parameters, fault log and diagnostic log shall be downloadable via the RS-232, RS-422, or RS-485 port.

c. Refer to the VFD wiring diagram in the drawings for remote signals and alarms.

D. Enclosure

a. All VFD components shall be factory mounted and wired on a dead front, grounded, NEMA-1 enclosure. If a free-standing enclosure is provided, it shall be suitable for mounting on a concrete housekeeping pad.

E. Protective Features and Circuits: The controller shall include the following alarms and protective features:

a. Instantaneous overcurrent and overvoltage trip.
b. Undervoltage and power loss protection.
c. Power unit overtemperature alarm and protection. Upon sensing an overtemperature condition, the VFD is to automatically trip.
d. Electronic motor inverse time overload protection.
e. Responsive action to motor winding temperature detectors or thermostatic switches. A dry contact (NC) input to the VFD is required.
f. When power is restored after a complete power outage, the VFD shall be capable of catching the motor while it is still spinning and restoring it to proper operating speed without the use of an encoder.
g. The VFD shall be protected from damage due to the following, without requiring an output contactor:
   1) Three-phase short circuit on VFD output terminals.
   2) Loss of input power due to opening of VFD input disconnecting device or utility power failure during VFD operation.
   3) Loss of one (1) phase of input power.
h. The VFD shall continue to operate at a reduced capacity under a single-phase fault condition.
i. The VFD shall be able to withstand the following fault conditions without damage to the power circuit components:
   1) Failure to connect a motor to the VFD output.
   2) VFD output open circuit that may occur during operation.
   3) VFD output short circuit that may occur during operation.
j. Provide input line reactors (3% impedance) when no 12 or 18 pulse

transformers are supplied or required.

k. Three phase lightning and surge protection across the line input at each VFD. Lea International TVSS #GB-100.

l. Provide 120V motor heater power that is active when the motor is off and is off when the motor is active.

F. Parameter Settings

a. The following system configuring settings shall be provided and field adjustable, without exception, through the keypad/display unit. Except for Motor Nameplate Data, all parameters must be adjustable while the processor is on-line and the drive is running.

1) Motor Nameplate Data.
- Motor frequency.
- Number of poles.
- Full load speed.
- Motor volts.
- Motor full load amps.
- Motor HP.
- Current limit, max.

2) VFD Configuration Parameters.
- Independent accelerate/decelerate rates.
- Max/Min speed (frequency).
- Catch-a spinning load selection.
- No load boosts.
- Full load boost.
- Volts/Hertz ratio.
- Overspeed trip.
- Overload trip curve selection.
- Overload trip time selection.

3) Automatic VFD Control.
- PID utilizing an internal or external setpoint.
- Three selectable critical speed avoidance bands with programmable bandwidths.
- Auto start functions: On/Off, Delay On/Off. Operable from a 4- 20mA signal or from the PID output, command, or feedback signal.
- Speed Profile: Programmable entry and exit points.
- Programmable loss of signal control: Stop, maintain last speed, or default to preselected setpoint.

b. All drive setting adjustments and operation parameters shall be stored in a parameter log which lists allowable maximum and minimum points as well as the present set values. This parameter log shall be accessible via a RS-232, RS-422, or RS-485 serial port as well as on the keypad display.

G. Input/Output Features

a. Two programmable analog inputs: VFD speed in, spare.

b. Three programmable analog outputs: VFD speed output, Drive (output) current in Amps, spare.

c. Two programmable digital inputs: Run, spare.

d. Ten programmable digital outputs: VFD fault, VFD running, VFD in remote, 6 spare.

e. One Pot input (three wire control, +10 V, wiper and common).

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f. System Program providing built-in drive control or application specific configuration capability.

H. Diagnostic Features and Fault Handling

a. The VFD shall include a comprehensive microprocessor based digital diagnostic system that monitors its own control functions and displays faults and operating conditions.

b. A “Fault Log” shall be accessible via a RS-232, RS-422, or RS-485 serial link as well as line-by-line on the keypad display. The "FAULT LOG" shall record, store, display and output to a serial port upon demand, the following for the 64 most recent events:

4) Date and time of day.
5) Type of fault.
6) All faults and events shall be stored and displayed in English, not fault codes.

c. A "HISTORIC LOG" shall record, store, and output to a RS-232, RS-422, or RS-485 serial link port upon demand, the following selectable control variables at 1 msec. intervals for the 58 intervals immediately preceding and the 20 intervals immediately following a fault trip:

7) Torque demand.
8) Torque command.
9) Torque feedback.
10) Torque error.
11) Torque maximum.
12) Current demand.
13) Peak current.
14) Motor current.
15) DC bus voltage.
16) Line voltage.
17) Velocity demand.
18) Velocity reference.
19) PI min/max limit.
20) Boost.
21) VFD mode (Auto/Manual).

## PART 3 EXECUTION

### 3.1 FACTORY TESTING

A. **The VFD manufacturer shall provide as a minimum, the following quality assurance steps within his factory:**

1. Incoming inspection of components and raw materials based on strategic supplier base and experience. Sampling plans based on MIL STD 105E.
2. MIL STD 45662 calibration system.
3. All products subject to 100% testing and final inspection; no sampling plans permitted.

### 3.2 PRE-DELIVERY TESTING COORDINATION

A. One VFD unit of each specified type and application shall be shipped to the pump manufacturer’s test facility for complete operational testing. The VFD Manufacturer shall provide a qualified representative at the pump Manufacturer’s test facility during testing. All costs incurred by the VFD

Manufacturer to meet this requirement shall be included in the bid.

B. Certified test reports shall be submitted to the ENGINEER before the equipment is shipped to the project site.

## 3.3 STARTUP AND TRAINING

A. VFD manufacturer shall provide the services of a factory technician for startup assistance and training. Verification of VFD input harmonic voltage and current distortion limits specified must be verified as part of final startup and acceptance. If harmonic distortion requirements are not met, it is the responsibility of the VFD supplier to meet the specification at the supplier's expense. A recording type Fluke 41 or equivalent harmonic analyzer displaying individual and total harmonic currents and voltages must be utilized.

B. A 10% payment retainage will be released upon field test verification of harmonic specification requirements and final acceptance.

## 3.4 SPARE PARTS

A. **The** following **spare parts shall be furnished:**

a. Three of each type of fuse rated 460V or less.
b. Two of each type of converter power semiconductor.
c. Two of each type of inverter power semiconductor.
d. One of each type of type control printed circuit board and gate firing boards.
e. One keypad assembly.

## 3.5 FIELD QUALITY CONTROL

A. **Functional** Test**:**

a. Conduct on each VFD.
b. Inspect controller for electrical supply termination connections, interconnections, proper installation, and quiet operation.
c. Vibration Test: Complete assembly, consisting of motor, load, and flexible shafting, connected and in normal operation, shall not develop amplitudes of vibration exceeding limits recommended by current edition of Hydraulic Institute Standards. Where pumps and motors are separated by intermediate flexible shafting, measure vibration both at top motor bearing and at two points on top pump bearing, 90 degrees apart.
d. Record test data for report.

B. Performance **Test:**

a. Conduct on each VFD.
b. Perform under actual or approved simulated operating conditions.
c. Test for continuous 48-hour period without malfunction.
d. Demonstrate performance by operating the continuous period while varying the application load, as the input conditions allow, in order to verify system performance.
e. Record test data for report.

**END OF SECTION 16485**

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## PART 1 GENERAL

### 1.1 SCOPE OF WORK

A. Provide, install, and test all control panels and appurtenances as shown on the Drawings and as hereinafter specified.

### 1.2 STANDARDS

A. Control panels shall be in accordance with the National Electric Code and NEMA as applicable.

### 1.3 QUALITY ASSURANCE

A. The control panel manufacturer shall have total system control responsibility. The manufacturer shall have local experience in providing control panels of the types and functions as specified herein.

B. All control panels shall be either UL 508 listed or constructed by an UL approved shop and labeled accordingly.

### 1.4 CONTROL PANEL FUNCTIONS

A. The panel builder shall provide functions as described using his own standard schematics and arrangements. All wires shall be numbered and brought to numbered terminals. Complete schematics and outline Drawings shall be provided for approval.

## PART 2 PRODUCTS

### 2.1 CONSTRUCTION

A. All panels furnished shall be of the arrangement and design as shown on the Drawings and specified herein.

B. Panel construction shall be NEMA 4X 316 stainless steel with drip shield kit, 316 stainless-steel, with door gasket and three (3) point stainless steel latch, handle with nylon rollers and drip edge. Internal components shall be mounted on a back panel and selector switches, lights, etc., mounted on an interior dead-front panel. Enclosure shall be painted white and have sun shields on top and sides.

C. Access doors or panels shall have continuous stainless-steel hinges. Fabrication shall be of 11 gauge thick, sheet steel with stainless steel hardware, suitably braced internally for structural rigidity and strength. Front panels or sections containing instruments shall be not less than 7-gauge thick stretcher leveled sheet steel or 1/4-inch-thick anodized aluminum, reinforced to prevent warping or distortion. All sections shall be descaled, degreased, filled, ground and finished with two rust-resistant phosphate prime coats and two (2) air dry silicone alkyd finish coats of enamel which shall be applied by either the hot air spray or conventional cold spray methods. The final finish shall be smooth, free of runs, and uniform in tone and thickness. Unless otherwise noted, the colors to be used shall be selected by the OWNER from color chips supplied by the panel manufacturer. All cutouts shall be properly finished, including deburring and touch-up painting.

D. Nameplates shall be provided for all flush mounted equipment. The nameplates shall be constructed of black and white laminated, phenolic material having

engraved letters approximately 1/4 inch high, extending through the black face into the white layer. Nameplates shall be attached to panels by self-tapping stainless-steel screws.

E. Print storage pockets shall be provided on the inside of each panel. Its size shall be sufficient to hold all of the prints required to service the equipment. Reduced drawings shall be provided to be stored in these pockets.

F. All panel equipment shall be mounted and wired on or within the cabinet. All wiring within the panel shall be grouped together with harnesses or ducts and secured to the structure. All wiring shall be numbered in accordance with the numbering system used on the wiring/connection diagrams. Power and low voltage DC signal wiring shall be routed in separate wire ways. Crossing of the two system wires shall be at right angles. Parallel troughs of different systems shall be separated by a minimum of 12 inches. Wiring through for supporting internal wiring shall be plastic type with snap-on covers. The side walls shall be open-top type to permit wire changing without disconnecting. Wiring troughs shall not be filled to more than 60 percent visible fill. Wiring through covers shall be match marked to identify placement. If component identification is shown on covers for visibility, the ID shall also appear on the mounting sub-panel.

G. Power wire shall be minimum 12 AWG stranded, insulated for not less than 600 volts unless specified otherwise. Control wire shall be 14 AWG stranded, insulated and twisted shielded wire shall be 16 AWG. Use type XHHW-2 for outside to panel application and type MTW for wiring inside the panel. No THHN or other type of wire shall be used inside the control panel without the CITY approval. Wire color shall be, Line Power - Black; Neutral or common - White; AC Control - Red; DC Control - Blue; Equipment or Chassis Ground - Green; specified externally powered circuits - Orange.

H. All wiring shall terminate in a master terminal board, rigid type and numbered. The master terminal board shall have a minimum of 25 percent spares. Terminal blocks shall be arranged in horizontal rows and separated into groups. (Power, AC control, DC signal, and alarm). Terminal blocks shall be barrier type with the appropriate voltage rating (600 volts minimum) and shall be the raised channel mounted type. Wire connectors shall be the hook fork type with non-insulated barrel for crimp type compression connection to the wire. Wire and tube markers shall be the sleeve type with heat impressed letters and members. Direct interlock wiring between equipment will not be allowed. Only one side of a terminal block row shall be used for internal wiring. The field wiring side of the terminal shall not be within six (6) inches of the side panel or adjacent terminal.

I. All components shall be mounted in a manner that shall permit servicing, adjustment, testing and removal without disconnecting, moving or removing any other component. Components mounted on the inside panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required by the manufacturer to protect equipment from vibration. Component mounting shall be oriented in accordance with the component manufacturer's and industries' standard practices. All internal components shall be identified with suitable plastic or metal engraved tags attached with drive pins adjacent to (not on) each component identifying the

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component in accordance with the drawing, specifications, and supplier's data.

## 2.2 PUSH BUTTONS

A. Push buttons shall be heavy-duty, oil tight, with momentary contacts. Switches shall be supplied with the number of poles required for the application, an escutcheon plate, and contacts rated for 10 amperes at 120 volts AC. Push buttons shall be as manufactured by Square-D, Class 9001, Type K or approved equal by CITY.

## 2.3 ROTARY HAND SWITCHES

A. Rotary selector switches shall be heavy duty oil tight, with the number of poles and number of positions as required. Switches shall have a pistol grip handle and be of the maintained contact type rated for 10 amps at 120 volts AC. The switches required for "electronic duty" shall have low, stable, contact resistance and gold contacts. Provide make-before-break bridging contacts where required. Rotary hand switches shall be as manufactured by Square-D, Class 9001, Type K, standard knob, or approved equal by CITY.

## 2.4 LED PILOT LIGHTS

A. LED indicating lights shall be provided as shown on the Drawings. Units shall be approximately 1/2-inch diameter. Bulbs shall be of the push-to-test type shall be as manufactured by Square-D, unless otherwise noted on the drawings, or approved equal by CITY.

## 2.5 RELAYS

A. Relays shall be double pole, double throw, octal plug-in type with a transparent dust cover. The relay shall be equipped with an indicating light to indicate when its coil is energized. The relays shall have 10 amperes 120-volt AC contacts. Relays shall be as manufactured by Square D, Class 8501, Type KP, unless otherwise noted on the drawings, or approved equal by CITY.

## 2.6 TIME DELAY RELAYS

A. Time delay relays shall be of the pneumatic type with time delay and instantaneous contacts. Time delay relays shall be double pole, double throw with output contacts rated at 10 amperes, 120-volt AC minimum. The time delay relays shall be set for sixty seconds except where otherwise shown on the Drawings but shall be adjustable from 0 to 180 seconds. Time delay relays shall be as manufactured by Square-D, Class 9050, Type A, unless otherwise noted on the drawings, or approved equal by CITY.

## 2.7 TIMERS

A. Timers shall be plug-in type with a dust and moisture resistant case. The timers shall be of the multirange/analog or digital type with selectable ranges. The output contacts shall be rated at 10 amperes 120-volt AC minimum. The timer shall have a "timing in progress" indication. Timers shall be manufactured by Square D or approved equal by CITY.

## 2.8 CIRCUIT BREAKERS

A. Circuit breakers shall be thermal-magnetic, molded case, permanent trip. Voltage, current, interrupting ratings, and number of poles required shall be as shown on the Drawings. Circuit breakers used in 120/240-volt control panels shall be UL listed and have an interrupting capacity of not less than 18,000 amperes, RMS, symmetrical. Circuit breakers shall be manufactured by Square D or approved equal by CITY.

B. Do not substitute single-pole circuit breakers with handle ties for multi-pole breakers.

## 2.9 SURGE PROTECTIVE DEVICE (SPD) POWER APPLICATIONS

A. Refer to specification 16050 – Electrical System Analyses

## 2.10 PHASE MONITOR

A. Phase monitor shall be a three-phase solid state device with voltage sensing capabilities. Phase monitor shall have undervoltage capabilities with a UL listed relay. The monitor shall protect the motor against phase loss, phase unbalance, phase reversal, and undervoltage. Phase monitor shall be manufactured by ACT or approved equal by CITY.

## 2.11 MOTOR STARTER

A. The motor starter shall be a full voltage non reversing, NEMA rated, three phase starter with thermal motor overload units. Overload units shall have manual resets. Motor starter shall be manufactured by Square D or approved equal by CITY.

## 2.12 CONTROL POWER TRANSFORMER

A. If applicable, control power transformer shall be rated for 240x480V/120V A.C. and shall be rated with the appropriate kVA rating as called out in drawings. Control power transformer shall be manufactured by Square D or approved equal by CITY.

## 2.13 DUPLEX RECEPTACLE

A. A 20A duplex receptacle shall be installed within the control panel. Receptacle shall be GFCI Type and shall be manufactured by Leviton Company Type 6599-I, unless otherwise noted on the drawings, or approved equal by CITY.

## 2.14 INTRINSICALLY SAFE RELAYS

A. Intrinsically safe control relays shall be as manufactured by Pepperl + Fuchs, unless otherwise noted on the drawings, or approved equal by CITY.

## 2.15 ELAPSED TIME METER

A. Elapsed time meter shall be as manufactured by Yokogawa Type 240, unless otherwise noted on the drawings, or approved equal by CITY.

## 2.16 TERMINAL BLOCKS

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A. Terminal blocks shall be as manufactured by Square D Class 9080, unless otherwise noted on the drawings, or approved equal by CITY.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Seal all conduit entrances into control panels using sealing fittings as detailed on the drawings.

### 3.2 TESTS

A. The supplier shall test all equipment at the factory prior to shipment. Coordinate with pump supplier for testing and startup at the site for each lift station.

### 3.3 ACCEPTANCE

A. Upon successful completion of operation test and subsequent review and approval of the complete system's final documentation, the system shall be considered as acceptable.

**END OF SECTION 16810**

## PART 4 GENERAL

### 4.1 SCOPE OF WORK

A. Furnish and install all miscellaneous equipment as hereinafter specified and as shown on the Drawings

## PART 5 PRODUCTS

### 5.1 DISCONNECT SWITCHES

A. Fusible and non-fusible disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, 600 volt, 3-pole with full cover interlock. All current carrying parts shall be copper. Enclosure Type shall be NEMA-4X, stainless steel, with stainless steel mounting hardware except as shown on the drawings. Disconnect switches shall be horsepower rated as manufactured by the Square-D Company, Class 3110, Type H, or approved equal.

B. Surge arresters shall be installed on the main disconnect switch. Provide protection for each ungrounded conductor as required. These shall be connected to the line side of the protected equipment. Install a current limiting fuse in series with each pole of the arrester connection as recommended by the Manufacturer. All transient protection devices, including fuses, shall be installed within the protected equipment enclosures wherever possible. Surge arresters shall be as manufactured by the General Electric Company, Tranquell Series, Model 9L15 or approved equal.

**END OF SECTION 16950**

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