



Department
of
Public Works

Infrastructure
Services Division
Facilities Development
& Management Section

**LOWER PARKING GARAGE RESTORATION
At
ZEIDLER MUNICIPAL BUILDING**

841 N Broadway
Milwaukee, Wisconsin

May, 2011

Project Number BU110100901
Official Notice No. 125

CITY OF MILWAUKEE, WISCONSIN
DEPARTMENT OF PUBLIC WORKS
INFRASTRUCTURE SERVICES DIVISION
FACILITIES DEVELOPMENT &
MANAGEMENT SECTION

PROJECT MANUAL
GOVERNING THE
LOWER LEVEL PARKING RESTORATION

At

ZEIDLER MUNICIPAL BUILDING
841 N. BROADWAY
MILWAUKEE, WISCONSIN

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CITY OF MILWAUKEE
GENERAL OFFICIAL NOTICE
TO CONTRACTORS

Separate sealed bids for each project will be received until 10:30 A.M. of the bid opening date at which time bids will be publicly opened and read for furnishing all material and doing all work for each project in accordance with the requirements of the respective Official Notice on the bid form furnished in accordance with plans, specifications, contract documents, and proposed form of contract on file in the office of the Department of Public Works, Municipal Building, 841 N. Broadway, Room 506, Milwaukee, Wisconsin, 53202.

PROSPECTIVE BIDDERS ARE TO CAREFULLY EXAMINE AND REVIEW ALL CONTRACT DOCUMENTS AND MATERIALS IN SAID OFFICE BEFORE SUBMITTING BID.

AFFIDAVITS OF NO INTEREST MUST ACCOMPANY THE BIDS, AND THE FAILURE OF PROSPECTIVE BIDDERS TO COMPLY WITH THESE REQUIREMENTS MAY DISQUALIFY THE BID.

THE CONTRACTOR/LESSEE AGREES TO COMPLY WITH ALL APPLICABLE REQUIREMENTS OF THE AMERICANS WITH DISABILITIES ACT OF 1990, 42 U.S.C. § 12101, ET. SEQ. THE TDD NUMBER FOR PUBLIC WORKS IS (414) 286-2025.

As part of the bid each bidder shall submit a list of anticipated subcontractors and the class of work to be performed by each, which list should not be added to nor altered without the written consent of the Commissioner of Public Works.

All contractor(s) and subcontractor(s) are required to furnish or have on file a certificate of insurance in accordance with the insurance provisions of the General Specifications.

All contractor(s) and subcontractor(s) are subject to the prevailing wage rates and hours of labor as prescribed by the Common Council of the City of Milwaukee consistent with provisions of Section 66.293 of the Wisconsin Statutes.

Copies of the actual work classifications and wage and fringe benefit rates enforced on this project are available in Room 506 of the Municipal Building.

Corporate surety will be required on performance and payment bonds for all projects listed in the following Official Notices. All applicable charter and Statutory provisions and ordinances, all the provisions of this official notice, invitation to bid, general and detailed specifications, special provisions, proposal, schedule of fixed prices, addendum and plans for this project and all other contract documents set forth in the invitation to bid will be incorporated and made part of the contract as if therein set forth in full.

Tie bids, when the lowest ones, will be decided by the Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

Signed: JEFFREY J. MANTES,
Commissioner of Public Works

Countersigned: W. MARTIN MORICS,
City Comptroller

**CITY OF MILWAUKEE
SPECIFIC OFFICIAL NOTICE NO. 125**

Important Notice:

The Invitation to Bid, all bid documents and the Plans & Specifications for the projects listed will be available electronically to prospective bidders via <http://www.mpw.net/bids/docs/125-2011>. Any required addenda or responses related to the listed projects will be posted on said website.

Bidders are encouraged to utilize this electronic method of obtaining bid documents as the Department of Public Works intends to solely use this method for future projects. At this time however, a limited number of hard copies of the above documents will also be available at address listed below.

Sealed bids will be opened on Thursday, June 16, 2011 at 10:30 A.M. for the **LOWER LEVEL PARKING RESTORATION**, located at Zeidler Municipal Building, 841 North Broadway, Milwaukee, WI 53202.

Bid Security Required: Bond, Certified Check, Cashier's Check, or Cash to a company bid: 10% of Contractor's Base Bid

Time for Completion: All work on this project shall be completed by Friday, September 30, 2011. Contractor shall not begin work on this project prior to Friday, July 18, 2011.

Liquidated Damages, per diem: \$800.00

The EBE requirement for this project is 25% of the contract base bid.
The residency requirement for this project is 40% of all hours worked on the project.

The apprenticeship requirements for this project are:

Apprentices from 2 of the following trade(s) are to be employed:

Buildings: Carpenter, Cement Mason, Electrician, Painter

The contractor shall specifically note the EBE, residency, and apprenticeship forms for this project. If the forms are not filled out properly, it will be cause for rejection of the bid.

Plans and project manual will be furnished to the prospective bidders upon payment of a \$ 10.00 non-refundable fee in room 506, Frank P. Zeidler Municipal Building, 841 North Broadway, Milwaukee, Wisconsin 53202. For general questions call 414-286-3314.

A \$10.00 per set additional non-refundable fee is required to obtain bid documents by mail. Plans are sent via U.S. mail unless other arrangements are made by the contractor.

Contractor must comply with all provisions of the CITY OF MILWAUKEE GENERAL OFFICIAL NOTICE TO CONTRACTORS published herein and at http://www.mpw.net/services/bids_home

Pre-Bid Meeting: A Pre-Bid Meeting is scheduled for Thursday, June 09, 2011, at 2:00 p.m. in Room 606 of the Frank P. Zeidler Municipal Building, 841 North Broadway, Milwaukee, Wisconsin. Bidder participation is urged to become familiar with all aspects of the project and bidding requirements.

SECTION 00100: INSTRUCTIONS TO BIDDERS

See also Instructions to Bidders in the "General Specifications" of the Department of Public Works, City of Milwaukee, Wisconsin, dated January 31, 1992, and all subsequent addenda.

BID FORM:

Submit a unit price for the work as indicated on the drawings and specified herein, complete in every respect.

Bids will not be accepted in any form except on the bid form included with this project manual.

The contractor must recognize and abide by the right of the Owner (City of Milwaukee) to accept or reject any or all bids in the best interests of the City.

UNIT PRICES:

Each bidder shall provide on the bid proposal the following unit prices that were used in arriving at the Base Bid. The unit prices will be used for additions to or deductions from work required under the contract.

Unit Price A:

Provide a lump sum price for general conditions and contractors fee including: mobilization, staging, etc.

Unit Price B:

Provide a unit price for the demolition and removal of concrete topping and waterproofing in the amount of 17,400 square feet per Sheet S100. This quantity shall include partial removal of the concrete driveway for loop detection replacement.

Unit Price C:

Provide a unit price for partial depth concrete surface repairs as detailed on Sheet S200 and described in Section 033000.

Unit Price D:

Provide a unit price for full depth concrete surface repairs as detailed on Sheet S200 and described in Section 033000.

Unit Price E:

Provide a lump sum price for the demolition, removal, and replacement of ten floor drains. Additionally, this lump sum shall include the installation of one floor drain. See Sheets P-1 and P-2 and Sections 220511 and 221300.

Unit Price F:

Provide a unit price for installation of the cathodic protection system in the amount of 17,400 square feet per Sheet S100A. The unit price shall be inclusive of all system components including but not limited to: mesh role, rectifier(s), reference cells, etc. See Sheets E100, E200, and E300, plus Division 26 – Electrical for additional details.

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Unit Price G:

Provide a unit price for the installation of concrete topping in the amount of 17,400 square feet per Sheet S100A.

Unit Price H:

Provide a unit price for painting of the interior walls, ceiling, columns, doors, etc. in the amount of approximately 50,000 square feet of surface area. Painting coat shall conform to procedures as specified in Section 099100.

Unit Price I:

Provide a unit price for application of waterproof traffic membrane of approximately 29,000 square feet of surface area. Traffic coating shall conform to procedures as specified in Section 071800. Section 079200 (joint Sealants) is related to this section.

Unit Price J:

Provide a lump sum price for application of pavement markings atop the waterproof membrane coating. Pavement markings shall conform to procedures as specified in Section 071800.

Unit Price K:

Provide a lump sum price for installation of loop detection at the interior and exterior locations adjacent to the garage doors. Sheets E100 and E200 depict this information.

Unit Price L:

Provide a lump sum price for repairs to interior finishes as a result of plumbing/concrete repairs/etc. Division 9 – Finishes details the projected working surfaces.

Unit Price M:

Provide a lump sum price for installation of door hardware. Division 9 – Finishes details the projected working surfaces.

Unit Price N:

Provide a lump sum price for installation of duct work. Division 9 – Finishes details the projected working surfaces.

BASE BID:

Base bid represents the cost summation for each individual item listed within the base bid. The value is determined by the following: 1) Multiply the unit price by the quantity to derive the total bid cost for each individual item; 2) Sum the individual items total cost to develop the base bid.

ALTERNATE:

Each bidder shall examine the plans and project manual thoroughly to determine what extent the Alternate will affect the bid.

Alternate 1: High Speed Garage Door

Alternate 1 includes the option for installation of two high speed garage doors including access control systems and card readers. These garage doors and access control systems will be installed in conjunction with the loop detection systems.

Alternate 2: Demolition of Concrete Topping

Alternate 2 includes the option for complete removal of the concrete topping course as shown on Sheet S100A. Provide unit price for removal of an additional 11,600 square feet of concrete topping course.

Alternate 3: Cathodic Protection System

Alternate 3 includes the option for cathodic protection system installation throughout the entire garage area as shown on Sheet E200. Provide unit price for installation of an additional 11,600 square feet of cathodic protection system.

Alternate 4: Install Concrete Wearing Course

Alternate 4 includes the option for installation of concrete topping course throughout the entire garage area as shown on Sheet S100A. Provide unit price for installation of an additional 11,600 square feet of concrete topping course.

CONTRACT AWARD:

The Commissioner of Public Works will award the contract on the basis of the Base Bid only or the Base Bid and the Alternate as funds permit.

CONTRACT BREAKDOWN:

Shortly after the award of the contract, each contractor shall submit a list showing the cost breakdown of the items in his contract. This list will be used as a basis for estimates of work completed for partial payment.

SITE VISIT:

All contractors shall visit the site, consult the drawings and project manual, be familiar with the work of other contractors and determine for himself all conditions affecting the work.

Failure by a contractor to be familiar with the project shall not release him from any obligation under this contract to complete the work in strict conformity with the plans and project manual and all City, State and Federal Codes or regulations pertaining to the work.

CONSTRUCTION START AND COMPLETION DATES

The start and completion dates are stated in the Specific Official Notice. The contractor may begin procuring materials and off-site fabricating (as appropriate and approved by Architect) on the date on the Notice to Proceed. The Notice to Proceed will be sent to the contractor directly following the signing of the contract.

BASE BID EXCLUSIONS:

The following work will be performed by the City of Milwaukee electricians:

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1. Electrical panel upgrade
2. Light fixture installation

ADDITIONAL PLANS/PROJECT MANUALS

These will be available at: <http://www.mpw.net/bids/docs/125-2011>

SECTION 00700: GENERAL CONDITIONS1. SCOPE:A. Index:

1. Scope
2. DPW General Specifications
3. Definitions
4. Control of Work and Materials
5. Samples and Tests
6. Project Coordination
7. Supervision of Work
8. Technical Specifications and Drawings
9. Safety Regulations
10. Code Rules

2. Department of Public Works General Specifications:

Provisions of the Department of Public Works General Specifications dated January 31, 1992, and subsequent addenda except as may be modified or expanded upon in this project manual, shall apply to all contractors and subcontractors working on the project. Copies of the General Specifications may be obtained from http://www.mpw.net/services/bids_home.

3. Definitions:

- A. Owner: City of Milwaukee.
- B. Facilities Manager: The Facilities Manager of Facilities Development and Management Section.
- C. Project Inspector: The authorized representative of the Commissioner assigned to make detailed inspection of any or all portions of the work and materials thereof. These inspections are not a substitute to those required by the Department of Neighborhood Services for permit and code compliance.
- D. Addenda: Written or graphic instruments issued prior to the execution of the contract which modify or interpret the bidding documents, including drawings and project manual by additions, deletions, clarifications or corrections. Addenda will become part of the contract documents when the contract is executed.
- E. Contract Drawings: Drawings of the work to be done as listed hereafter in Section 00850 Drawing Schedule and/or Section 00870 Plans and Details.

4. Control of Work and Materials:

- A. Detail and Shop Drawings: Shop drawings and other additional drawings which may be required for each contract of the work shall be prepared by each respective contractor unless otherwise directed by the Facilities Manager. Prints shall be the same size as contract documents when practical. Prints of each drawing shall be submitted to the Facilities Manager for approval before proceeding with the work. Changes ordered by the Facilities Manager shall be made and revised prints submitted as above. The Facilities Manager's approval of drawings shall not relieve the contractor of responsibility for errors.

- B. Primary Lines and Grades: The City of Milwaukee will mark two building corners along a line and will establish a benchmark, with a relative elevation, within close proximity to the site. Once established by the City, the contractor shall preserve all points and benchmark as long as needed during construction. The contractor will bear all costs associated with re-establishing points and benchmark.
- C. Construction Lines and Grades: The contractor must bear sole responsibility for the correct transferal of all construction lines and grades from the primary lines and grades points. He shall take such measurements from existing work as may be necessary to insure the proper construction of his work.
- D. Material Orders and Shipping Statements: The contractor shall furnish to the Facilities Manager at least two (2) copies of all material orders and shipping statements. Itemized weights of the materials and individual units of finished work shall be shown.
- E. Weighing of Materials and Fabricated Units: The weighing of materials and fabricated units such as structural steel, casings, etc., when required, shall be done in the presence of the Commissioner's representative. The contractor shall be responsible for the satisfactory weighing of such materials and units.
- F. Consignment and Delivery of Materials: The materials for the work shall be consigned to the contractor and he shall be responsible for the delivery of all materials required for the completion of the contract.

5. Samples and Tests:

- A. Method of Sampling: Samples of the materials proposed or furnished for the work may be taken by the Commissioner at any time; at the point of manufacture, point of delivery or site of work. They will be selected, as far as practicable, in accordance with standard methods of sampling such materials as specified in the standard of the American Society for Testing Material. All sampling shall be done by authorized representatives of the Commissioner. Selections will be in an orderly and systematic manner, insuring samples representative of the lot.
- B. A.S.T.M. Standards: Wherever the abbreviation A.S.T.M. is used in connection with the number of a standard specification, the specification referred to shall be the Standard of the American Society for Testing Materials, designated by that number, including all revisions in effect on the date of award of the contract. Should a revised or amended standard be issued
by the American Society for Testing Materials which, in the opinion of the Commissioner, conflicts with or causes undesirable changes in the standards referred to herein, the Commissioner reserves the right, by means of addenda to the project manual, to continue under the provisions of the pertinent standard referred to herein.
- C. Cost of Test Specimens and Samples: All test specimens of metals and all samples of non-metals required for tests shall be furnished by the contractor without cost to the City.
- D. Costs of Tests: All tests on test specimens of metals will be made at the expense of the contractor and the original test on samples of non-metals will be made at the expense of the City. In all cases, the testing procedure will be in accordance with Standard A.S.T.M. tests for such materials. Subsequent tests of non-metals requested by the contractor, when such tests are permitted by A.S.T.M. Specifications and approved by the

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Commissioner or subsequent tests ordered by the Commissioner will be made at the expense of the contractor.

6. Project Coordination:

- A. Contractors are required, so far as possible, to arrange work and to dispose of materials so as not to interfere with the work or storage of materials of other contractors or City forces engaged upon the work.
- B. Contractors shall give full cooperation to other trades and furnish any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.
- C. Where the work of a contractor will be installed in close proximity to the work of other trades, or where there is evidence that the work of a contractor will interfere with the work of other trades, he shall assist in working out space conditions to make satisfactory adjustments.
- D. If a contractor installs work before coordinating it with other trades or so as to cause interference with work of other trades, he shall make necessary changes in his work to correct the condition without extra charge.
- E. Contractors are required to join their work to that of others in a proper manner, and in accordance with the spirit of the plans and project manual, and to perform the work in the proper sequence in relation to that of other contractors, and as may be directed by the Project Inspector.

7. Supervision of Work:

- A. Contractors shall furnish the services of an experienced engineer or superintendent.
- B. He shall be constantly in charge of the installation of the work together with all subcontractors, skilled workers, helpers, and labor required to unload, transfer, erect, connect up, adjust, start, operate and test each system.
- C. He shall be thoroughly acquainted with and be responsible for the various subcontractors' work so that it is properly coordinated and supervised to the satisfaction of the Commissioner of Public Works or his representative.
- D. Upon written notice to a contractor of the lack of such coordination and supervision, the Commissioner of Public Works may authorize such services as may be required and deduct the cost of this service at an hourly rate of \$60.00 per hour per worker from the contract for the work.

8. Technical Specifications and Drawings:

A. Governing order of Contract Documents:

- 1. The following provision modifies DPW General Specifications Item 2.1.3.1:

Anything mentioned in the Technical Specifications and not shown on the drawings or shown on the drawings and not mentioned in the Technical Specifications, shall be as if shown on or mentioned in both. In case of difference between drawings

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and Technical Specifications, the Technical Specifications shall govern. In case of any discrepancy in drawings or Technical Specifications, the matter shall be immediately submitted to Buildings & Fleet Services for decision. Said discrepancy shall not be adjusted by the contractor.

B. All contractors shall have complete sets of plans and project manuals on the job site at all times.

9. Safety Regulations:

All work shall be done in accordance with the safety requirements referenced in the International Building Code, as adopted and amended by the State of Wisconsin and OSHA.

10. Code Rules:

The rulings, regulations and laws of the following shall be complied with in the completion of this project:

International Building Code, as amended and adopted by the State of Wisconsin
Plumbing and Drainage Codes of the City of Milwaukee
Ordinances of the City of Milwaukee
National Board of Fire Underwriters
OSHA
NFPA
FAA
NEC
IEEE
UL

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00821/1

SECTION 00821: INSPECTION CHARGES

The contractor will be charged a fee for inspection for each and every day such inspection is required after the time allowed for completion has expired.

Rev. 2/08 The amount of the fee for inspection shall be \$325.00 per day.

The time allowed for completion is stated in the Specific Official Notice and shall start with the date on the Notice to Proceed which will be sent to the contractor directly following the signing of the contract. The time allowed includes the time required for fabricating and procuring material and doing the work at the building site.

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MINIMUM WAGE SCALE

RESOLVED, By the Common Council of the City of Milwaukee, that building and construction trades workers in the construction industry employed upon public work projects done by contract for the City of Milwaukee, either new construction or repair work, upon any roads, bridges, sewers, streets, alleys, buildings, or any other public work, shall be paid no less than the hourly wage rates and fringe benefits which prevail in the Milwaukee metropolitan area for the same type of work or for closely related work. (FILE NUMBER 68-1317)

Prevailing hours of labor for all classes of laborers and mechanics means no more than ten (10) hours per day nor more than forty (40) hours per week and may not include any hours worked on a Saturday, Sunday, or one of six holidays. ALL work performed in excess of these prevailing hours must be paid at a rate of at least 1-1/2 times the hourly basis rate of pay (plus fringe benefits). *Fringe Benefits must be paid on ALL hours worked for ALL job classifications.*

If a contractor or subcontractor anticipates employing a person or persons in classifications, trades, or occupations that are not set forth in the Minimum Wage Scale, then that contractor or subcontractor is required to apply to the Commissioner of Public Works PRIOR to the bid opening date set forth in the official notice for the project for a special wage determination containing the classification(s) and associated wage and benefit rate(s). Special wage determinations requested after the bid opening date MAY be issued at the discretion of the Commissioner of Public Works' Office if it is satisfied that a special classification is used as a prevailing practice in the City of Milwaukee.

The Prime Contractor must provide each subcontractor with a copy of the Minimum Wage Scale with the appropriate classifications and rates for the type of work to be performed. The Minimum Wage Scale, including this cover sheet, must be physically included in the subcontract agreement between the prime and subcontractor.

Bidders are required to utilize the Wisconsin Department of Workforce Development's "Dictionary of Occupational Classifications and Work Descriptions" to determine the appropriate job classifications/wage rates for their employees prior to bidding and to insure employees are paid for those job duties they actually perform. This document can be found on their website at dwd.wisconsin.gov; type "dictionary" in the search box. All disputes and/or controversies regarding the proper classification of any laborer, worker, or mechanic employed on a City project will be referred to the State of Wisconsin Department of Workforce Development for final resolution and disposition.

ss. 66.0903(8), Wis. Stats.

Any contractor, subcontractor, or agent thereof, who fails to pay the prevailing rate of wages determined by the department under this subsection or pays less than 1-1/2 times the hourly basic rate of pay for all hours worked on the project in excess of prevailing hours of labor determined under this subsection, shall be liable to the employees affected in the amount of their unpaid minimum wages or their unpaid overtime compensation and an additional amount as liquidated damages.

Each contractor, subcontractor, or agent thereof participating in a project covered by this subsection shall keep full and accurate records clearly indicating the name and trade or occupation of every laborer, workman, or mechanic employed by him in connection with the project and an accurate record of the number of hours worked by each employee and actual wages paid therefor.

JOB CLASSIFICATION	HOURLY RATE	WELFARE PER HOUR	VACATION PER HOUR	PENSION PER HOUR	OTHER SPECIFIC BENEFITS	TOTAL FRINGES	TOTAL WAGE
ACOUSTIC CEILING TILE INSTALLER	31.38					18.16	49.54
ASBESTOS ABATEMENT WORKER	24.50	7.55	1.72	6.05	.48 A,I,S,E,T	15.80	40.30
BITUMINOUS, DUMPER, IRONER, SMOOTHER & TAMPER(Paving)	21.86	7.65	1.85	7.05	.33 A.T.	16.88	38.74
BITUMINOUS LUTEMAN, RAKER (Paving)	22.21	7.65	1.85	7.05	.33 A.T.	16.88	39.09
BITUMINOUS SHOVELER, LOADER, UTILITY MAN (Paving)	21.86	7.65	1.85	7.05	.33 A.T.	16.88	38.74
BLASTER (Laborer-Sewer, Water, Tunnel)	29.63	7.65	1.85	7.05	.43	16.98	46.61
Increase to \$48.16 on 6/6/11; \$49.89 on 6/4/12							
BLOCKLAYER - Buildings, Paving (see Cement/Concrete Blocklayer)							
BLOCKLAYER-Sewer,Water,Tunnel (see Cement/Concrete Blocklayer)							
BOILERMAKER	30.04	7.07	1.05	11.15	2.03 A,T; 3.50Annuity	24.80	54.84
BOILERMAKER FOREMAN	32.54	7.07	1.05	11.15	2.03 A,T; 3.50Annuity	24.80	57.34
BOILERMAKER GENERAL FOREMAN	34.54	7.07	1.05	11.15	2.03 A,T; 3.50Annuity	24.80	59.34
BOTTOM DIGGER,MISC.BOTTOM MAN	26.72	7.65	1.85	7.05	.43 A,I	16.98	43.70
Increase to \$45.28 on 6/6/11; \$46.98 on 6/11/12							
BRACER (Laborer-Sewer,Water,Tunnel)	29.11	7.65	1.85	7.05	.43	16.98	46.09
BRACER (Laborer-Sewer,Water,Tunnel)-Compressed Air	30.23	7.65	1.85	7.05	.43	16.98	47.21
BRICKLAYER (Buildings)	33.15	7.50	none	7.24	4.00 A,I	18.74	51.89
Effective 6/6/11	33.19	7.50	none	7.69	4.01 A,I	19.20	52.39
BRICKLAYER (Paving,Sewer,Water)	34.58					14.92	49.50
BRICKLAYER FOREMAN	36.70	7.50	none	7.24	4.00 A,I	18.74	55.44
Effective 6/6/11	36.77	7.50	none	7.69	4.01 A,I	19.20	55.97
BRICKLAYER SUBFOREMAN	34.93	7.50	none	7.24	4.00 A,I	18.74	53.67
Effective 6/6/11	34.97	7.50	none	7.69	4.01 A,I	19.20	54.17
CABINET INSTALLER	28.31					14.91	43.22
CARPENTER (Buildings)	29.32	9.56	2.06	8.26	1.09 A,I,T	20.97	50.29
6/6/11 Increase to \$52.74							
CARPENTER (Paving)	31.38					16.29	47.67
CARPENTER (Sewer, Water, Tunnel)	31.38					16.11	47.49
CARPENTER FOREMAN	32.46	9.56	2.06	8.26	1.09 A,I,T	20.97	53.43
CARPENTER SUBFOREMAN	30.89	9.56	2.06	8.26	1.09 A,I,T	20.97	51.86
CARPET LAYER,SOFT FLOOR COVERER	29.32	9.56	2.06	8.26	1.09 A,I,T	20.97	50.29
6/6/11 Increase to \$52.74							
CAULKER, Cleaner, Tuckpointer (Buildings,Shaft,Tunnel)	32.73	7.50	none	7.24	3.05 A	17.79	50.52
Effective 6/6/11	32.96	7.50	none	7.69	3.06 A	18.25	51.21
CAULKER, Cleaner, Tuckpointer (Paving, Sewer, Water)	33.35					14.47	47.82
CAULKER, Cleaner, Tuckpointer FOREMAN	33.48	7.50	none	7.24	3.05A	17.79	51.27
Effective 6/6/11	33.53	7.50	none	7.69	3.06 A	18.25	51.78
Add \$.75 for Swing Stage-Foreman							
CEMENT OR CONC.BLOCK LAYER (Buildings)	35.53					15.92	51.45
Add \$1.95 on 6/6/11 = \$53.40							
CEMENT OR CONC.BLOCK LAYER (Paving, Sewer, Water, Tunnel)	34.58					14.92	49.50
CEMENT OR CONC. BLOCK LAYER FOREMAN (Bldgs.;Shaft/Tunnel)	30.56	4.00		3.50	.61 A,I	8.11	38.67
CEMENT OR CONC. BLOCK LAYER FOREMAN (SWING STAGE)	31.31	4.00		3.50	.61 A,I	8.11	39.42
CEMENT MASON (FINISHER) (Buildings)	28.56	7.65	2.31	8.48	.37 A,I	18.81	47.37
Effective 5/30/11	30.26	7.80	2.31	8.93	.47 A,I	19.51	49.77
CEMENT MASON (Highway)	25.86	7.65	2.31	8.48	.20 A	18.64	44.50
Effective 6/1/11	27.02	7.80	2.31	8.93	.30 A	19.34	46.36
CEMENT MASON (Sewer,Water, Tunnel)	24.00					18.63	42.63
CEMENT MASON FOREMAN (Buildings)	31.65	7.65	2.31	8.48	.37 A,I	18.81	50.46
Effective 5/30/11	33.52	7.80	2.31	8.93	.47 A,I	19.51	53.03
CEMENT MASON FOREMAN (Highway)	27.11	7.65	2.31	8.48	.20 A	18.64	45.75
Effective 6/1/11	28.27	7.80	2.31	8.93	.30 A,I	19.34	47.61
CEMENT MASON FOREMAN (Sewer)	28.19	4.35		3.50	.30 A,I	8.15	36.34
CEMENT MASON FOREMAN (Tunnel)	28.96	4.45		3.90	.30 A,I	8.65	37.61
CONCRETE MANHOLE BUILDER (See Manhole Builder)							
DRYWALL TAPER OR FINISHER	28.17	8.40	none	6.45	.59 A,I	15.44	43.61
ELECTRICAL LINE CONSTRUCTION ONLY:							
Line Constructor (also under Line Constructor)-(Buildings,Paving,Sewer,Water,Tunnel)	31.66					13.94	45.60
Heavy Equipment Operator (Buildings,Paving,Sewer,Water,Tunnel)	26.88					13.71	40.59
Light Equipment Operator (Buildings,Sewer, Water, Tunnel)	27.66					0.00	27.66
Light Equipment Operator (Paving)	28.21					14.30	42.51
Heavy Truck Driver (Buildings, Sewer, Water, Tunnel)	17.00					8.50	25.50
Heavy Truck Driver (Paving)	24.68					16.16	40.84
Light Truck Driver (Buildings, Sewer, Tunnel, Water)	25.44					0.00	25.44
Light Truck Driver (Paving)	22.92					11.87	34.79
Groundman (Buildings, Sewer, Water, Tunnel)	17.41					9.80	27.21
Groundman (Paving)	29.06					15.39	44.45
ELECTRICIAN (Buildings)	31.10	8.70	3.11	5.53	.96 A,I; 2.40Annuity	20.70	51.80
ELECTRICIAN(Paving)	31.10					20.39	51.49
ELECTRICIAN (Sewer,Water,Tunnel)	32.53					18.34	50.87
ELECTRICIAN FOREMAN	34.21	8.70	3.42	5.63	1.05 A,I;2.40Annuity	21.20	55.41
ELECTRICIAN GENERAL FOREMAN	35.77	8.70	3.58	5.67	1.08 A,I;2.40Annuity	21.43	57.20
ELEVATOR CONSTRUCTOR/MECHANIC	41.71	10.525	3.34	6.46	2.15 E,H,W;4.25 Annuity	26.725	68.435

JOB CLASSIFICATION	HOURLY RATE	WELFARE PER HOUR	VACATION PER HOUR	PENSION PER HOUR	OTHER SPECIFIC BENEFITS	TOTAL FRINGES	TOTAL WAGE
FENCE ERECTOR (Buildings, Sewer, Water, Tunnel))	22.50					3.65	26.15
FENCE, GUARD RAIL, BRIDGE BUILDER (Paving)	21.86	7.65	1.85	7.05	.33 A,E,T	16.88	38.74
FIBER OPTIC LABORER - Buildings(Outside,other than Concrete Encased)	15.00					3.09	18.09
FIBER OPTIC LABORER - Paving (Outside, other than Concrete Encased)	22.79					15.30	38.09
FIBER OPTIC LABORER - Sewer,Water,Tunnel (Outside,other than Concrete Encased)	12.50					0.00	12.50
FIRE SPRINKLER FITTER - see SPRINKLER FITTER							
FLAGPERSON, TRAFFIC CONTROL (Paving)	18.35	7.65	1.85	7.05	.33 A,E,T	16.88	35.23
FLAGPERSON, TRAFFIC CONTROL (Sewer,Water,Tunnel)	19.83					15.65	35.48
FLOOR COVERER, Soft	29.32	9.56	2.06	8.26	1.09 A,I,T	20.97	50.29
FLOOR COVERER FOREMAN (Buildings, Tunnel)	32.46	9.56	2.06	8.26	1.09 A,I,T	20.97	53.43
FLOOR COVERER SUBFOREMAN	30.89	9.56	2.06	8.26	1.09 A,I,T	20.97	51.86
FORKLIFT-AIR, ELECTRIC EQUIPMENT & POWER BUGGY OPERATOR-LABORER (also see under Laborer-Fork Lift Operator)	27.28					15.01	42.29
GAS OR UTILITY PIPELINE LABORER (other than Sewer & Water)	18.74					14.93	33.67
GLAZIER	32.25	8.25	none	6.99	.70 A	15.94	48.19
Effective 6/1/11	32.80	9.15	none	7.54	.80 A	17.49	50.29
	Increase to \$52.44 on 6/1/12						
GUNITE MACHINEMAN (Laborer-Buildings)	27.39					15.01	42.40
	6/1/11 Add \$2.25 = \$44.65						
INSULATOR (BATT & BLOWN)	17.11					17.69	34.80
INSULATOR (HEAT & FROST)(can also be used for ASBESTOS WORKER)	33.28	7.45	none	8.07	.74 A,E,I; 6.25 Annuity	22.51	55.79
INSULATOR FOREMAN (HEAT & FROST)(5 man crew incl. Foreman)	35.78	7.45	none	8.07	.74 A,E,I; 6.25Annuity	22.51	58.29
IRONWORKER-Buildings	31.31	8.87	none	8.07	.81 A,I; 4.25Annuity	22.00	53.31
	6/6/11 Increase to \$55.10						
IRONWORKER-Paving,Sewer, Water, Tunnel	31.31					21.79	53.10
	Add \$2.00 on 6/6/11= \$55.10						
IRONWORKER FOREMAN	33.31	8.87	none	8.07	.81 A,I;4.25Annuity	22.00	55.31
IRONWORKER GENERAL FOREMAN	33.81	8.87	none	8.07	.81 A,I;4.25Annuity	22.00	55.81
JACKHAMMER OPERATOR (Laborer-Buildings)	25.54	7.65	1.85	7.05	.51	17.06	42.60
	6/1/11 Increase to \$44.65						
JOINTMAN (Laborer-Sewer,Water)	29.11	7.65	1.85	7.05	.43	16.98	46.09
JOINTMAN (Laborer-Sewer,Water)-Compressed Air	30.23	7.65	1.85	7.05	.43	16.98	47.21
LABORER- Fork Lift Operator, Air & Electrical Equipment, Power Buggy Operators (also listed under Fork Lift Operator-Laborer)	27.28					15.01	42.29
	6/1/11 Add \$2.25 = \$44.54						
LABORER-GENERAL (Buildings)	25.32	7.65	1.85	7.05	.51	17.06	42.38
	6/1/11 Increase to \$44.43						
LABORER-Paving	23.34					17.30	40.64
LABORER -Sewer,Water,Tunnel	24.80	7.65	1.85	7.05	.43	16.98	41.78
	Increase to \$43.33 on 6/6/11; \$45.06 on 6/4/12						
	Add \$2.00 all tunnel work under 15 lbs. compressed air; \$2.00 for 0-30 lbs. compressed air						
	Add \$3.00 over 30 lbs. compressed air						
LABORER FOREMAN (Buildings)	26.68	7.55	1.85	7.05	.51	17.06	43.74
LANDSCAPER-Buildings	13.80					15.10	28.90
	6/1/12 Add \$1.00 = \$ 29.90; 6/1/13 add \$1.00 = \$30.90; 6/1/14 add \$1.00 = \$31.90						
LANDSCAPER - Paving	21.86	7.65	1.85	7.05	.33 A,E,T	16.88	38.74
LANDSCAPER-Sewer,Water	13.79	7.65	1.85	7.05	.43	16.98	30.77
LATHER	31.38					16.11	47.49
LINE CONSTRUCTOR(ELECTRICAL)(Building,Paving,Sewer,Water,Tunnel)	31.66					13.94	45.60
	ALSO SEE Electrical Line Construction						
MANHOLE BUILDER, Concrete	29.11	7.65	1.85	7.05	.43 A,I	16.98	46.09
MARBLE FINISHER	26.25	7.50	none	7.24	3.45	18.19	44.44
	Effective 6/6/11						
	26.29	7.50	none	7.69	3.45	18.64	44.93
MARBLE MASON	33.15	7.50	none	7.24	3.66	18.40	51.55
	Effective 6/6/11						
	33.19	7.50	none	7.69	3.67	18.86	52.05
MARBLE MASON FOREMAN	36.70	7.50	none	7.24	3.66	18.40	55.10
	Effective 6/6/11						
	36.77	7.50	none	7.69	3.67	18.86	55.63
METAL BUILDING ERECTOR	13.00					6.86	19.86
MILLWRIGHT	26.70	9.56	1.60	7.18	6.48 A,I,M,T	24.82	51.52
MILLWRIGHT FOREMAN	29.20	9.56	1.60	7.18	6.48 A,I,M,T	24.82	54.02
MILLWRIGHT GENERAL FOREMAN	29.70	9.56	1.60	7.18	6.48A,I,M,T	24.82	54.52
MORTAR MIXER - Buildings	25.43	7.65	1.85	7.05	.51 I,S,E	17.06	42.49
	6/1/11 Increase to \$44.54						

5/23/11

JOB CLASSIFICATION	HOURLY RATE	WELFARE PER HOUR	VACATION PER HOUR	PENSION PER HOUR	OTHER SPECIFIC BENEFITS	TOTAL FRINGES	TOTAL WAGE	
OPERATORS-BUILDING CONSTRUCTION SITE PREPARATION, UTILITY & LANDSCAPING WORK ONLY								
Crane, Backhoe 130,000 lbs. & over; Boring Machine	33.07	9.15	none	6.75	1.25	17.15	50.22	
Effective 5/30/11	34.07	9.15	none	7.50	1.35	18.00	52.07	
Tractor or Truck Mounted Hydraulic Backhoe; Gradall (Cruz-Aire type); Mechanic or Welder; Bulldozer or Endloader; Grader or Motor Patrol; Scraper(Self propelled or Tractor Drawn) 5 cu yards or more capacity; Power Subgrader; Asphalt Milling Machine; Boring Machine (Horizontal, Vertical or Directional); Air Track, Rotary or Percussion Drilling Machine; Trencher, Post Hole Digger or Driver; Compactor; Tug or Launch (Not Performing Work on the Great Lakes).	32.32	9.15	none	6.75	1.25	17.15	49.47	
Effective 5/30/11:	33.32	9.15	none	7.50	1.35	18.00	51.32	
ON SUNDAYS AND HOLIDAYS, PAY TWO TIMES THE HOURLY BASIC RATE								
Forklift, Backfiller, Broom or Sweeper; Environmental Burner, Stump Chipper	33.24					17.61	50.85	
Effective 5/30/11	33.02	9.15	none	7.50	1.35	18.00	51.02	
Crusher, Screening or Wash Plant; Air Compressor (400 CFM or Over); Pump (3 inch or over) or Well Points; Refrigeration Plant or Freeze Machine; Skid Steer Loader (with or without attachments); Skid Rig; Stump Chipper; Mulcher; Vibratory Hammer or Extractor, Greaser, Compactor (Self Propelled), Farm or Industrial Type Tractor	32.32					16.75	49.07	
Add \$1.85 on 5/31/11 = \$50.92								
Work performed on the Great Lakes including Diver; Wet Tender or Hydraulic Dredge Engineer	35.05					18.08	53.13	
Work performed on the Great Lakes including Crane or Backhoe Operator; Mechanic or Welder; Assistant Hydraulic Dredge Engineer; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder; 70 Ton or Over Tug Operator	37.45					19.45	56.90	
Add \$.50/hour for Friction Crane, Lattice Boom or Crane Certification (CCO) ON SUNDAYS & HOLIDAYS, PAY TWO TIME HOURLY BASIC RATE								
Work performed on the Great Lakes including Deck Equipment Operator or Machineryman (maintains Cranes over 50 tons or Backhoes over 115,000 lbs.); Tug, Launch or Loader, Dozer or like equipment when operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery	33.35					19.33	52.68	
ON SUNDAYS & HOLIDAYS, PAY TWO TIME HOURLY BASIC RATE								
Work performed on the Great Lakes including Deck Equipment Operator; Machineryman or Fireman (operates 4 units or more or maintains Cranes 50 tons or under or Backhoes 115,000 lbs. Or under), Deck Hand, Deck Engineer or Assistant Tug Operator	32.20					18.69	50.89	
OPERATORS-BUILDING CONSTRUCTION EXCLUDING SITE PREPARATION, UTILITY, PAVING & LANDSCAPING WORK								
Crane, Tower Crane or Derrick, with or without attachments, with a lifting capacity of over 100 tons; Crane, Tower Crane or Derrick, with Boom, Leads and/or Jib lengths measuring 176 feet or over	38.06	9.15	none	8.10	1.02 A,I,L,S	18.27	56.33	
Effective 6/1/11	39.16	9.15	none	9.00	1.12 A,I,L,S	19.27	58.43	
There will be a wage increase of the higher of \$.50 per 100 ton or per 100 feet of boom (or any portion thereof) for the length of the boom over 200 feet or lifting capacity of the crane over 200 tons to a maximum of 300 tons or 300 feet. ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE								
Crane Operators with CCO certification	38.56	9.15	none	8.10	1.02 A,I,L,S	18.27	56.83	
Effective 6/1/11	39.66	9.15	none	9.00	1.12 A,I,L,S	19.27	58.93	
ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE								
Crane over 300 ton OR 300 ft.	Add \$.01/hour per foot OR ton, whichever is greater							
Crane, Tower Crane or Derrick, with or without attachments, with a lifting capacity of 100 tons or under; Crane, Tower Crane or Derrick, with Boom, Leads and/or Jib lengths measuring 175 or under; Backhoe (Track Type) having a Mfg.'s rated capacity of 130,000 lbs. or over, Caisson Rig; Pile Driver	37.56	9.15	none	8.10	1.02 A,I,L,S	18.27	55.83	
Effective 6/1/11	38.66	9.15	none	9.00	1.12 A,I,L,S	19.27	57.93	
ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE								

JOB CLASSIFICATION	HOURLY RATE	WELFARE PER HOUR	VACATION PER HOUR	PENSION PER HOUR	OTHER SPECIFIC BENEFITS	TOTAL FRINGES	TOTAL WAGE	
OPERATORS - BUILDING CONSTRUCTION								
<i>EXCLUDING SITE PREPARATION, UTILITY, PAVING & LANDSCAPING WORKS</i>								
CONTINUED								
Crane Operators with CCO certification	38.06	9.15	none	8.10	1.02 A,I,L,S	18.27	56.33	
Effective 6/1/11	39.16	9.15	none	9.00	1.12 A,I,L,S	19.27	58.43	
ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE								
Backhoes (excavators) under 130,000 lbs.; self-erecting tower cranes with a lifting capacity of 4,000 lbs and under; skid rigs; dredge operator; mechanic; concrete paver (over 27E); concrete spreader and distributor; forklift; hydro-blaster (10,000 psi and over); Traveling Crane (Bridge Type); Dredge(not performing work on the Great Lakes)	37.06	9.15	none	8.10	1.02 A,I,L,S	18.27	55.33	
Effective 6/1/11	37.47	9.15	none	9.00	1.12 A,I,L,S	19.27	56.74	
ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE								
Crane Operators with CCO certification	37.56	9.15	none	8.10	1.02 A,I,L,S	18.27	55.83	
Effective 6/1/11	38.66	9.15	none	9.00	1.12 A,I,L,S	19.27	57.93	
Material hoists; stack hoists; tractor or truck mounted hydraulic backhoe; tractor or truck mounted hydraulic crane (5 tons or under); hoist (tuggers, 5 ton and over); hydro-excavators; daylighters; concrete pumps; Rotec type conveyors; tractor (over 40 H.p.); bulldozer; endloader, scraper operator; sideboom; straddle carrier; welder; bituminous plant and paver operator; roller (over 5 tons); rail leveling, machine (railroad); tie placer; tie extractor; tie tamper; stone leveler; rotary drill operator and blaster; percussion drill operator; air track drill and/or hammers; trencher (wheel type or chain type having over 8-inch bucket); milling machine, post hole digger, Concrete breaker, tamper, Gradall, Concrete Paver, Boring Machine	36.47					18.10	54.57	
Effective 6/1/11	37.47	9.15	none	9.00	1.12 A,I,L,S	19.27	56.74	
ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE								
Backfiller; concrete auto breaker (large), concrete finishing machines(road type); roller(rubber-tired);concrete batch hopper; Concrete conveyor systems; grout pumps; concrete mixers (14S or over); screw type pumps and gypsum pumps; tractor; trencher (chain type having bucket 8-inch and under); industrial locomotives; rollers (under 5 tons); timber shear; processor; timber equipment; firemen (pile drivers and derricks); robotic tool carrier with or without attachments	29.82					17.96	47.78	
Effective 6/1/11	35.59	9.15	none	9.00	2.12 A,I,L,S	19.27	54.86	
ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE								
Farm or Industrial Type Tractor; Greaser, Compactor (Self-Propelled); Concrete Saw (Vermeer Type); Concrete Bump Cutter or Grooving Machine; Tining or Curing Machine; Roller (5 tons or under); Broom or Sweeper; Hoist (Tugger); Environmental Burner; Crusher, Screening or Wash Plant; Air, Electric or Hydraulic Jacking System; Air Compressor (400 CFM or over); Generator (150KW or over); Pump (3 inch or over) or Well Points; refrigeration Plant or Freeze Machine; Skid Steer Loader (with or without attachments); Stump Chipper; Mulcher; Vibratory Hammer or Extractor; Robotic Tool Carrier (with or without attachments), Oiler, Forklift	29.44	9.15	none	8.10	1.02 A,I,L,S	18.27	47.71	
Effective 6/1/11	30.44	9.15	none	9.00	1.12 A,I,L,S	19.27	49.71	
ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE								
Gas or Utility Pipeline, except Sewer & Water (Primary Equipment)	34.89					19.68	54.57	
Gas or Utility Pipeline, except Sewer & Water (Secondary Equipment)	30.21					16.85	47.06	
	Add \$1.60 on 6/1/11 - \$48.66							
Fiber Optic Cable Equipment	24.39					15.45	39.84	
	Add \$1.75 on 2/1/11 = \$41.59							

JOB CLASSIFICATION	HOURLY RATE	WELFARE PER HOUR	VACATION PER HOUR	PENSION PER HOUR	OTHER SPECIFIC BENEFITS	TOTAL FRINGES	TOTAL WAGE
OPERATORS -SEWER,WATER,SHAFT & TUNNEL							
Crane, Tower Crane or Derrick, with or without attachments, with a lifting capacity of over 100 tons; Crane, Tower Crane or Derrick, with Boom, Leads and/or Jib lengths measuring 176 feet or over; Backhoe (Track Type) 130,000 or over	33.59	9.15	none	7.75	1.09 A,I,L,S	17.99	51.58
Effective 6/6/11	34.69	9.15	none	8.45	1.19 A,I,L,S	18.79	53.48
	Increase to \$55.29 on 6/4/12 Add \$.25/hour for operating Tower Crane ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE						
Crane, Tower Crane or Derrick, with or without attachments, with a lifting capacity of 100 tons or under; Crane, Tower Crane or Derrick, with Boom, Leads and/or Jib lengths measuring 175 feet or under; Backhoe (Track type) having a Mfr.'s rated capacity of under 130,000 lbs. or over; Traveling Crane (Bridge type); Caisson Rig; Pile Driver; Dredge operator (not performing work on the Great Lakes), Skid Rlgs, Concrete Paver Concrete Spreader, Concrete Pumps, Concrete Conveyor (Rotec), Boring Machines	32.81	9.15	none	7.75	1.09 A,I,L,S	17.99	50.80
Effective 6/6/11	33.91	9.15	none	8.45	1.19 A,I,L,S	18.79	52.70
	Increase to \$54.51 on 6/4/12 Add \$.25/hour for operating Tower Crane ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE						
Truck Mounted Hydraulic Crane (10 tons or under); Tractor or Truck Mounted Hydraulic Backhoe; Gradall (Cruz-Aire Type); Mechanic or Welder; Bulldozer or Endloader; Grader or Motor Patrol; Grout Pump, or Concrete Conveyor (Bidwell type); Concrete Breaker (Manual or Remote); Concrete Batch Plant; Power Subgrader; Concrete Paver; Concrete Grinder or Planing Machine; Concrete Conveyor System; Concrete Slipform Placer, Curb and Gutter Machine; Roller (over 5 ton); Shouldering Machine; Air Track, Rotary or Percussion Drilling Machine; Straddle Carrier or Travel Lift; Manhoist or Elevator; Material or Stack Hoist; Trencher; Sideboom; Post Hole Digger or Driver; Tug or Launch (not performing work on the Great Lakes)	31.86	9.15	none	7.75	1.09 A,I,L,S	17.99	49.85
Effective 6/6/11	32.96	9.15	none	8.45	1.19 A,I,L,S	18.79	51.75
	Increase to \$53.56 on 6/4/12 Add \$.25/hour for operating Tower Crane ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE						
Farm or Industrial Type Tractor; Compactor (self-propelled); Concrete Saw (Vermeer type); Concrete Bump Cutter or Grooving Machine; Tining or Curing Machine; Roller (5 ton or under); Broom or Sweeper; Hoist (Tugger); Environmental Burner	30.81					17.75	48.56
Effective 6/6/11	31.91	9.15	none	8.45	1.19 A,I,L,S	18.79	50.70
	Increase to \$52.52 on 6/4/12 Add \$.25/hour for operating Tower Crane ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE						
Crusher, Screening or Wash Plant; Air, Electric or Hydraulic Jacking System; Air Compressor (400 CFM or over); Generator (150kw or over); Pump (3 inch or over) or Well Points; Refrigeration Plant or Freeze Machine; Skid Steer Loader (with or without attachments); Robotic Tool Carrier (with or without attachments); Stump Chipper; Mulcher; Vibratory Hammer or Extractor; Oiler; Forklift, High Pressure Utility Locating Machine (daylighting machine), Greaser	29.41					17.75	47.16
Effective 6/6/11	30.81	9.15	none	8.45	1.19 A,I,L,S	18.79	49.30
	Increase to \$51.11 on 6/4/12 Add \$.25/hour for operating Tower Crane ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE						
Work performed on the Great Lakes including Diver; Wet Tender or Hydraulic Dredge Engineer	37.70	9.00	none	7.65	1.05	17.70	55.40
Work performed on the Great Lakes including Crane or Backhoe Operator; Mechanic or Welder; Assistant Hydraulic Dredge Engineer; Hydraulic Dredge Leverman or Diver's Tender	36.20	9.00	none	7.65	1.05	17.70	53.90
Work performed on the Great Lakes including Deck Equipment Operator or Machineryman (maintains Cranes over 50 tons or Backhoes over 115,000 lbs); Tug, Launch or Loader, Dozer or like equipment when operated on a Barge, Breakwater Wall, Slip, Dock or Scow	32.20					18.69	50.89

JOB CLASSIFICATION	HOURLY RATE	WELFARE PER HOUR	VACATION PER HOUR	PENSION PER HOUR	OTHER SPECIFIC BENEFITS	TOTAL FRINGES	TOTAL WAGE
Work performed on the Great Lakes including Deck Equipment Operator; Machineryman or Fireman (operates 4 units or more or maintains Cranes 50 tons or under or Backhoes 115,000 lbs. or under), Deck Hand, Deck Engineer, or Assistant Tug Operator	32.20					18.69	50.89
OPERATORS - LOCAL STREET OR MISCELLANEOUS PAVING CONCRETE PAVEMENT OR BRIDGE WORK ONLY							
Crane, Tower Crane or Derrick, with or without attachments, with a lifting capacity of over 100 tons; Crane, Tower Crane or Derrick, with Boom, Leads and/or Jib Lengths measuring 176 feet or over	33.07	9.15	none	8.10	.93 A,L	18.18	51.25
Effective 6/1/11	34.22	9.15	none	8.80	1.03 A,L	18.98	53.20
Crane, Tower Crane or Derrick, with or without attachments, with a lifting capacity of 100 tons or under; Crane, Tower Crane or Derrick, with Boom, Leads and/or Jib lengths measuring 175 feet or under; Backhoe (Track type) having a Mfr. rated capacity of 130,000 lbs. or over; Caisson Rig; Pile Driver; Dredge (not performing work on the Great Lakes)	32.57	9.15	none	8.10	.93 A,L	18.18	50.75
Effective 6/1/11	33.72	9.25	none	8.80	1.03 A,L	18.98	52.70
Increase to \$54.62 on 6/1/12; \$56.62 on 6/1/13; \$58.37 on 6/1/14 Premium Pay: For State Highway Construction type project, add \$1.50/hour for work on projects involving temporary traffic control setup, for lane & shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period). ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE							
Backhoe (Track Type) having a Mfr.'s rated capacity of under 130,000 lbs.; Tractor or Truck Mounted Hydraulic Backhoe; Gradall (Cruz-Aire Type); Mechanic or Welder; Bulldozer or Endloader; Grader or Motor Patrol; Scraper (Self propelled or Tractor Drawn) 5 cu yards or more capacity; Concrete Pump, Grout Pump or Concrete Conveyor (Rotec or Bidwell Type); Concrete Breaker (Manual or Remote); Concrete Batch Plant; Power Subgrader; Concrete Paver; Concrete Grinder or Planing Machine; Concrete Conveyor System; Concrete Slipform Placer Curb and Gutter Machine; Air Track, Rotary or Percussion Drilling Machine; Straddle Carrier or Travel Lift; Trencher; Post Hole Digger or Driver; Tug or Launch (not performing work on the Great Lakes), Concrete Bump Cutter or Grooving Machine	32.07	9.15	none	8.10	.93 A,L	18.18	50.25
Effective 6/1/11	33.22	9.15	none	8.80	1.03 A,L	18.98	52.20
Farm or Industrial Type Tractor; Greaser; Compactor (Self-Propelled); Concrete Saw (Vermeer Type); Tining or Curing Machine; Environmental Burner, Mulcher, Concrete Spreader	31.81	9.15	none	8.10	.93 A,L	18.18	49.99
Effective 6/1/11	32.96	9.15	none	8.80	1.03 A,L	18.98	51.94
ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE							
Crusher, Screening or Wash Plant; Air Compressor; Generator; Pump (3 inch or over) or Well Points; Forklift; Skid Steer Loader (with or without attachments); Skid Rig; Stump Chipper; Vibratory Hammer or Extractor; Oiler	31.52	9.15	none	8.10	.93 A,L	18.18	49.70
Effective 6/1/11	32.67	9.15	none	8.80	1.03 A,L	18.98	51.65
ON SUNDAYS AND HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE.							
Fiber Optic Cable Equipment	22.79					15.30	38.09
Work performed on the Great Lakes including Diver, Wet Tender, or Hydraulic Dredge Engineer	35.05					18.08	53.13
Work performed on the Great Lakes including Crane or Backhoe Operator, Mechanic or Welder, Assistant Hydraulic Dredge Engineer, Hydraulic Dredge Leverman or Diver's Tender	35.05					18.08	53.13
Work performed on the Great Lakes including Deck Equipment Operator or Machineryman (maintains Cranes over 50 tons or Backhoes over 115,000 lbs.); Tug, Launch or Loader, Dozer or like equipment when operated on a Barge, Breakwater Wall, Slip, Dock or Scow	32.20					18.69	50.89
Work performed on the Great Lakes including Deck Equipment Operator; Machineryman or Fireman (operates 4 units or more and maintains Cranes 50 tons or under or Backhoes 115,000 lbs. Or under) or Assistant Tug Operator	32.20					18.69	50.89

JOB CLASSIFICATION	HOURLY RATE	WELFARE PER HOUR	VACATION PER HOUR	PENSION PER HOUR	OTHER SPECIFIC BENEFITS	TOTAL FRINGES	TOTAL WAGE
OPERATORS - ASPHALT PAVEMENT OR OTHER WORK							
Crane, Tower Crane or Derrick, with or without attachments, with a lifting capacity of over 100 tons; Crane, Tower Crane or Derrick, with Boom, Leads and/or Jib lengths measuring 176 feet or over	33.07	9.15	none	8.10	.93 A,L	18.18	51.25
Effective 6/1/11	34.22	9.15	none	8.80	1.03 A,L	18.98	53.20
Crane, Tower Crane or Derrick, with or without attachments, with a lifting capacity of 100 tons or under; Crane, Tower Crane or Derrick, with Boom, Leads and/or Jib lengths measuring 175 or under; Backhoe (Track Type) having a Mfr.'s rated capacity of 130,000 lbs. or over; Caisson Rig; Pile Driver; Dredge (not performing work on the Great Lakes)	32.57	9.15	none	8.10	.93 A,L	18.18	50.75
Effective 6/1/11	33.72	9.15	none	8.80	1.03 A,L	18.98	52.70
Backhoe (Track Type) having a Mfr.'s rated capacity of under 130,000 lbs.; Tractor or Truck Mounted Hydraulic Backhoe; Gradall (Cruz-aire Type); Mechanic or Welder; Bulldozer or Endloader; Grader or Motor Patrol; Scraper (Self Propelled or Tractor Drawn) 5 cu yards or more capacity; Concrete Breaker (Manual or Remote); Power Subgrader; Concrete Grinder or Planing Machine; Concrete Slipform Placer; Curb and Gutter Machine; Asphalt Plant; Asphalt Paver; Asphalt Screed; Asphalt Milling Machine; Roller (over 5 ton); Shouldering Machine; Trencher; Post Hole Digger or Driver	32.07	9.15	none	8.10	.93 A,L	18.18	50.25
Effective 6/1/11	33.22	9.15	none	8.80	1.03 A,L	18.98	52.20
Increase to \$53.22 on 6/1/12; \$55.22 on 6/1/13; \$56.97 on 6/1/14 ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE							
Farm or Industrial Type Tractor; Greaser; Compactor (self-propelled); Roller (5 ton or under); Broom or Sweeper; Environmental Burner	31.81	9.15	none	8.10	.93 A,L	18.18	49.99
Effective 6/1/11	32.96	9.15	none	8.80	1.03 A,L	18.98	51.94
Increase to \$53.22 on 6/1/12; \$55.22 on 6/1/13; \$56.97 on 6/1/14 ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE							
Crusher, Screening or Wash Plant; Air Compressor; Generator; Pump (3 inch or over) or Well Points; Forklift; Skid Steer Loader (with or without attachments); Skid Rig; Stump Chipper; Mulcher; Vibratory Hammer or Extractor; Oiler	31.52	9.15	none	8.10	.93 A,L	18.18	49.70
Effective 6/1/11	32.67	9.15	none	8.80	1.03 A,L	18.98	51.65
Increase to \$53.22 on 6/1/12; \$55.22 on 6/1/13 ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE							
Fiber Optic Cable Equipment	22.79					15.30	38.09
OVERHEAD DOOR INSTALLER	25.04					13.01	38.05
PAINTERS:							
Bridges, Iron	28.82	8.65	none	7.45	.69 I,A	16.79	45.61
Increase to \$47.66 on 6/1/11; \$49.86 on 6/1/12							
Buildings	28.47	8.65	none	7.45	.69 I,A	16.79	45.26
Increase to \$47.31 on 6/1/11; \$49.51 on 6/1/12							
Drywall	28.82	8.65	none	7.45	.69 I,A	16.79	45.61
Increase to \$47.66 on 6/1/11; \$49.86 on 6/1/12							
Paperhanging	28.67	8.65	none	7.45	.69 I,A	16.79	45.46
Increase to \$47.51 on 6/1/11; \$49.71 on 6/1/12							
Paving Construction	27.82					15.39	43.21
Sandblasting & Spraying	29.22	8.65	none	7.45	.69 I,A	16.79	46.01
Increase to \$48.06 on 6/1/11; \$50.26 on 6/1/12							
ALL Painter Classifications: Add \$.60 for EIFS work and \$1.00 for Lead Based Paint Removal							
PAINTER FOREMAN (Buildings)	29.22	8.65	none	7.45	.69 I,A	16.79	46.01
Effective 6/1/11	29.72	9.10	none	7.90	.79 I,A	17.79	47.51
PAVEMENT MARKING OPERATOR - Buildings, Sewer, Water	25.65					13.10	38.75
PAVEMENT MARKING OPERATOR - Paving	23.46					9.45	32.91
PILEDRIIVER - BUILDINGS	26.05	9.56	2.06	8.84	5.56 A,M,T	26.02	52.07
6/6/11 Increase to \$54.52							
PILEDRIIVER-LOFTSMAN	26.70	9.56	2.06	8.84	5.56 A,M,T	26.02	52.72
6/6/11 Increase to \$55.17							
PILEDRIIVER-SHEET PILING LOFTSMAN	26.80	9.56	2.06	8.84	5.56 A,M,T	26.02	52.82
6/6/11 Increase to \$55.27							
PILEDRIIVER - PAVING	28.11					21.16	49.27
PILEDRIIVER - SEWER, WATER, TUNNEL	28.11					23.76	51.87
PILEDRIIVER FOREMAN	28.86	9.56	2.06	8.84	5.56 A,M,T	26.02	54.88
PIPELAYER (Sewer, Water, Tunnel)	29.11	7.65	1.85	7.05	.43 A,I	16.98	46.09
PIPELAYER (Tunnel)(in compressed air 0-15)	30.23	7.65	1.85	7.05	.43 A,I	16.98	47.21
Over 15-30 lbs. - add \$2.00; Over 30 lbs. - Add \$3.00 hour							
PIPELINE FUSER OR WELDER (Gas or Utility)	29.85					17.34	47.19

JOB CLASSIFICATION	HOURLY RATE	WELFARE PER HOUR	VACATION PER HOUR	PENSION PER HOUR	OTHER SPECIFIC BENEFITS	TOTAL FRINGES	TOTAL WAGE
PLASTERER	30.36	7.65	none	8.93	.49 A	17.07	47.43
PLASTERER FOREMAN	32.06	7.80	none	9.38	.59 A	17.77	49.83
Effective 5/30/11	33.40	7.65	none	8.93	.49 A	17.07	50.47
Effective 5/30/11	35.27	7.80	none	9.38	.59 A	17.77	53.04
PLASTERER LABORER-Buildings	25.13	7.65	1.85	7.05	.40 I,T	16.95	42.08
PLASTERER LABORER FOREMAN	26.91	7.65	1.85	7.05	.40 I,T	16.95	43.86
PLUMBER (Buildings)	37.42	8.05	none	8.05	2.22 E,I	18.32	55.74
PLUMBER (Sewer,Water,Tunnel)	34.45					15.50	49.95
PLUMBER FOREMAN/GENERAL FOREMAN	41.91	8.05	none	8.05	2.22 E,I	18.32	60.23
POWER BUGGY OPERATOR - LABORER	24.32					12.01	36.33
PUMP INSTALLER (BUILDINGS)	24.22					14.80	39.02
PUMP INSTALLER (SEWER,WATER,TUNNEL)	23.52					13.90	37.42
RAILROAD TRACK LABORER-BUILDINGS,PAVING,SEWER,WATER	12.50					3.96	16.46
REFRIGERATION MECHANIC	37.21	9.45	none	8.68	1.20 I,T	19.33	56.54
REFRIGERATION FOREMAN	40.93	9.45	none	8.68	1.20 I,T	19.33	60.26
REFRIGERATION GENERAL FOREMAN	42.79	9.45	none	8.68	1.20 I,T	19.33	62.12
ROOFER (BUILDINGS) *	28.85	6.90	none	7.42	.28 T	14.60	*43.45
*All Roofers MUST be paid the Total Wage Rate Amount FOR ALL hours worked							
ROOFER (PAVING) *	28.85					13.60	*42.45
ROOFER FOREMAN *	29.85	6.90	none	7.42	.28 T	14.60	*44.45
SEWER, WATER, TUNNEL FOREMAN	31.84	7.65	1.85	7.05	.43 A, I	16.98	48.82
SEWER & WATER TUNNEL FOREMAN-Compressed Air	32.97	7.65	1.85	7.05	.43 A,I	16.98	49.95
SHEET METAL WORKER	37.20	6.60	none	9.08	1.02 I,T	16.70	53.90
SHEET METAL FOREMAN	40.40	6.60	none	9.08	1.02 I,T	16.70	57.10
SHEET METAL GENERAL FOREMAN	41.90	6.60	none	9.08	1.02 I,T	16.70	58.60
SIDING INSTALLER	36.60					15.48	52.08
SPRINKLER FITTER	33.70	7.40	3.12	10.78	.85 E,I,T	22.15	55.85
SPRINKLER FITTER FOREMAN	36.65	7.40	3.12	10.78	.85 E,I,T	22.15	58.80
STEAMFITTER (Buildings)	37.21	9.45	none	8.68	1.20 A,I,T	19.33	56.54
STEAMFITTER (Sewer,Water,Tunnel)	31.65					15.04	46.69
STEAMFITTER FOREMAN	40.93	9.45	none	8.68	1.20 A,I,T	19.33	60.26
STEAMFITTER GENERAL FOREMAN	42.79	9.45	none	8.68	1.20 A,I,T	19.33	62.12
STONE MASON-BUILDINGS	35.53					15.92	51.45
Add \$1.95 on 6/6/11 = \$53.40	34.58					14.92	49.50
STONE MASON-PAVING,SEWER,WATER	30.56	4.00		3.50	.61 A,I	8.11	38.67
STONE MASON FOREMAN	31.31	4.00		3.50	.61 A,I	8.11	39.42
STONE MASON FOREMAN ON SWING STAGE							
TAPER - See DRYWALL TAPER							
TELEDATA INSTALLER (Buildings)	24.65					15.17	39.82
TELEDATA INSTALLER (Paving,Sewer,Water,Tunnel)	24.09					14.48	38.57
TELEDATA TECHNICIAN	24.65	7.70	2.47	3.15	1.40 A,E,I; .70Annuity	15.42	40.07
TEMPERATURE CONTROL INSTALLER	35.81					16.98	52.79
TERRAZZO FINISHER	29.40					14.31	43.71
TERRAZZO MECHANIC	29.40					14.31	43.71
TERRAZZO FOREMAN (more than 3 journeymen)	32.95	7.10	none	8.16	.66	15.92	48.87
TILE FINISHER	15.05					9.43	24.48
TILE SETTER/LAYER	28.48	7.10	none	8.16	2.25 A,E	17.51	45.99
TILE SETTER/LAYER FOREMAN	30.48	7.10	none	8.16	2.25A,E	17.51	47.99
TOPMAN (Sewer & Water)	24.80	7.65	1.85	7.05	.43 A,I	16.98	41.78
TRUCK DRIVERS - Building Construction							
Single	26.87	8.80	3.16	7.30		19.26	46.13
Effective 6/1/11	27.87	10.12	3.16	7.70		20.98	48.89
Two Axle	21.42					5.62	27.04
Three or More Axle	26.62					17.81	44.43
Articulated, Euclid, Dumptr or Off Road Material Hauler	32.32					16.75	49.07
Add \$1.85 on 5/31/11 = \$50.92							
ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE							
TRUCK DRIVERS - Sewer,Water,Tunnel							
Single, Two Axle	21.42					5.62	27.04
Tandem/Tri Axle	25.22	10.00	3.33	6.45	.12	19.90	45.12
Effective 6/1/11	26.60	10.00	3.33	6.45	.12	19.90	46.50
Quad/Semi Trailer Truck	25.11	10.00	3.33	6.45	.12	19.90	45.01
Effective 6/1/11	26.49	10.00	3.33	6.45	.12	19.90	46.39
Articulated, Euclid, Dumptr or Off Road Material Hauler	31.89					17.96	49.85
ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE							
TRUCK DRIVERS - Paving							
Single, Two, Three or More Axle	26.87	8.80	3.16	7.30		19.26	46.13
Effective 6/1/11	27.87	10.12	3.16	7.70		20.98	48.89
Articulated, Euclid, Dumptr or Off Road Material Hauler	31.89					17.96	49.85
ON SUNDAYS & HOLIDAYS, PAY TWO TIMES HOURLY BASIC RATE							
Pavement Marking Vehicle (Buildings, Paving, Sewer, Water, Tunnel)	20.85					11.02	31.87
Shadow or Pilot Vehicle	21.42					5.62	27.04
Truck Mechanic (Buildings)	26.62					17.81	44.43
Truck Mechanic (Paving)	13.00					13.60	26.60
Truck Mechanic (Sewer,Water,Tunnel)	17.03					12.89	29.92

5/23/11

JOB CLASSIFICATION	HOURLY RATE	WELFARE PER HOUR	VACATION PER HOUR	PENSION PER HOUR	OTHER SPECIFIC BENEFITS	TOTAL FRINGES	TOTAL WAGE
TUCK POINTER, CAULKER, CLEANER (Buildings, Shaft, Tunnel)	32.73	7.50	none	7.24	3.05 A	17.79	50.52
Effective 6/6/11	32.96	7.50	none	7.69	3.06 A	18.25	51.21
TUCK POINTER, CAULKER, CLEANER (Paving, Sewer, Water)	33.35					14.47	47.82
TUCK POINTER, CAULKER, CLEANER FOREMAN	33.48	7.50	none	7.24	3.05 A	17.79	51.27
Effective 6/6/11	33.53	7.50	none	7.69	3.06 A	18.25	51.78
Add \$.75 for Swing Stage - Buildings, Shaft, Tunnel & Foreman							
UNDERWATER DIVER (EXCEPT ON GREAT LAKES) (Buildings, Paving, Sewer, Water, Tunnel)	32.31					14.91	47.22
UTILITY OR GAS PIPELINE LABORER (other than Sewer & Water)	18.74					14.93	33.67
	6/1/11 Add \$1.00 = \$34.67						
WATERPROOFER-BUILDINGS *	28.85					14.60	43.45
WATERPROOFER-PAVING *	28.85					13.60	42.45
*All Waterproofers/Roofers MUST be paid the Total Wage Rate Amount FOR ALL hours worked							
WELDER, Certified (Laborer-Buildings)	27.39					15.01	42.40
	6/1/11 Add \$2.25 = \$44.65						
WELLDRIILLER, PUMP INSTALLER (Buildings, Sewer, Water, Tunnel)	24.22					14.80	39.02
	6/1/11 Add \$1.60 = \$40.62						
ON SUNDAYS AND HOLIDAYS, PAY TWO TIMES THE HOURLY BASIC RATE							

FUND CODES:

- A - APPRENTICESHIP FUND
- B - EMPLOYEE SAVINGS FUND
- C - CONTRACTOR FUND OR COOPERATION FUND
- D - DEVELOPMENT FUND
- E - EDUCATION TRUST FUND
- H - HOLIDAYS
- I - INDUSTRY ADVANCEMENT PROGRAM FUND
- L - LABOR MANAGEMENT FUND

- M - MUIAR FUND
- S - SKILL IMPROVEMENT FUND
- T - TRAINING FUND
- W - WORK PRESERVATION

SECTION 00850: DRAWING SCHEDULE

The following listed drawings accompany and form a part of the project contract documents along with this project manual and generally illustrate the nature of the work.

<u>Sheet No.</u>	<u>Title</u>
G200	Title Sheet Sheet Index
	<u>Structural Drawings</u>
S100	Lower Parking Level Rehabilitation Plan (Base Bid)
S100A	Lower Parking Level Rehabilitation Plan (Alternate Bid)
S200A	Structural Notes and Details
	<u>Architectural Drawings</u>
AD100	Basement Existing Conditions Plan
AD101	Lower Parking Existing Conditions Plan
A101	Lower Parking Striping Plan
	<u>Plumbing Drawings</u>
P-1	Lower Parking Plumbing Plan
P-2	Basement Plumbing Plan
M3	Schedules and Details
	<u>Electrical Drawings</u>
E100	Lower Parking Electrical Demolition Plan Symbols and Abbreviations
E200	Lower Parking Electrical Proposed Plan
E300	Electrical Details

SECTION 01010: SUMMARY OF WORK:1. SCOPE:A. Index:

1. Scope
2. Project Description
3. Work by Others
4. Scheduling of Work

2. PROJECT DESCRIPTION:

- A. In general, the project includes the demolition of the existing concrete topping course, structural concrete repairs, installation of a cathodic protection system, and replacement of the concrete topping course. Furthermore, the project includes membrane installation, floor drain replacement, garage painting, and pavement striping.
- B. The City will vacate the lower parking garage floor during construction. However, the basement beneath the lower parking garage floor and all floors above will be occupied during normal business hours (7am-5pm). The contractor is required to coordinate all phases of construction with City forces, to minimize impact to City operations and to ensure the safety of City employees and property. Coordination shall include demolition during non-business hours (6pm to 6am) weekdays and all hours on weekends, the placement of staging on Market Street, interruption of utility service, delivery and storage of materials both on- and off-site, installation of all new materials and finishes, and project close-out.
- C. It is also understood that the submittal of proposal shall include furnishing all labor, material, equipment, and incidentals necessary for completion of the work required, including that which may not be directly shown on the drawings or in the specifications, but are necessary for proper operation and approval.
- D. Examine Documents and Visit Site:
 1. Before submitting a bid proposal, bidders should carefully examine the drawings and specifications; visit the site of work; fully inform themselves as to all existing conditions and limitations, including those of labor; and shall include in the bid proposal a sum sufficient to cover the cost of all items contemplated by the construction documents.
 2. Each sub-bidder further represents that he has inspected the site of the proposed work to ascertain any obstacles that might be encountered and other matters and conditions relevant to this work. This includes location of concealed service, utilities, structures, et c., which may be encountered or be affected by the contractor's work, and shall be responsible for any damage caused by neglect to provide proper precautions or protection.
 3. The nature of the work demands thorough review of all drawings and the project manual, and diligent and careful site inspection by all prospective sub-bidders as a means of determining the extent of work and conditions under which the work is to be performed.
 4. Additional charges will not be as considered for work which, prior to bidding, could

reasonably be inferred as appropriate by examination of the drawings and specifications, visiting the site, and closely reviewing the work as indicated above. No representations as to subsurface conditions are made.

5. Information pertaining to existing conditions that appear on the drawings is based on original construction. While such data has been collected with reasonable care, there is no expressed or implied guarantee that conditions so indicated are entirely representative of those actually existing or that unseen developments may not occur. They are merely provided to assist the Contractor in the investigation of conditions.
 6. Damage to the structure not documented prior to the renovation work will be the Contractor's responsibility to repair.
- E. The following outline is intended to serve as a general guide only, and not as a complete listing of work, operations, or materials. Consult the Table of Contents for a complete listing of items included.
1. Protection of all existing infrastructure within the limits of lower parking, the basement, and all areas adjacent to these limits from damage during all phases of construction.
 2. Demolish and removal of existing concrete topping course.
 3. Structural concrete floor repairs, floor drain replacement/installation, and overhead garage door conduit.
 4. Installation of cathodic protection system.
 5. Installation of new concrete topping.
 6. Application of new paint finish to walls and ceilings.
 7. Application of traffic membrane and parking striping.
 8. Installation of garage doors and associated hardware (alternate bid)
 9. Ductwork replacement in basement.
 10. Water may not be used to clean the garage surfaces without the written consent of the Engineer.

3. WORK BY OTHERS:

- A. City of Milwaukee electricians to furnish and install electrical panel and light fixtures.

4. SCHEDULING OF WORK:

- A. The contractor shall provide a construction schedule which includes all phases of construction, indicating the anticipated start and completion times for each of those phases. The contractor shall provide that complete schedule at the Pre-Construction Meeting arranged by the City.

- B. Concrete floor and structural repair demolition shall be conducted off hours (6pm – 6am) or weekends.
- C. Concrete installation shall be conducted off hours (6pm-6am) or weekends.
- D. Traffic membrane installation shall be conducted off hours (6pm-6am) or weekends.
- E. Painting shall be conducted off hours (6pm – 6am).
- F. All other work may be conducted during normal business hours (7am-5pm), off hours, or weekends.
- G. Shut downs of existing equipment and connections to existing equipment must be arranged in advance with the Project Inspector from Facilities Development and Management Section. Power outages, if any, must be scheduled on Saturdays.
- H. The City of Milwaukee reserves the right of not allowing the contractor to work when special events are scheduled for the building or noise being created by the contractor is disturbing to personnel in the building. These changes in work schedule shall be conducted at no additional cost to the City of Milwaukee. Noisemaking work shall be scheduled during off hours (6pm to 6am) weekdays or on weekends.

PROTECTION AND REPAIRS:

- A. The Contractor shall continuously maintain adequate protection of all his work and materials, whether worked or unworked, on or off the site of the project, and shall protect the work and materials of all other Contractors and the City of Milwaukee's property from damage arising in connection with their contracts.
- B. Whenever damage or destruction of property of any character resulting from neglect, misconduct or omission due to the manner or method of execution or non-execution of the work or caused by defective work or the use of improper materials, the Contractor shall be held responsible and not released until the work shall have been corrected, completed and the requirements and intent of these documents complied with.
- C. All damages of each and every kind resulting from neglect or refusal of the Contractor to protect such work materials, and property during erection, construction and completion of the project shall be made good by the Contractor.
- D. The Contractor shall repair all damages that the Contractor, employees or subcontractors may do to any other work or the parking structure. Repairs must be done in a neat and workmanlike manner to match existing construction and must meet with the approval of the Commissioner of Public Works or his representative.
- E. If any faults are found with the Contractor's work, the Contractor shall repair or replace any of the parts furnished or installed as directed without any additional costs to the City of Milwaukee.

SECTION 01210: PROJECT MEETINGS1. SCOPE:A. Index:

1. Scope
2. Pre-Construction Meeting
3. Progress Meetings

2. PRE-CONSTRUCTION MEETING:

- A. Soon after the award of the contract and prior to the start of construction, the contractor shall attend a pre-construction conference with representatives of the City.
- B. The contractor shall have at the meeting responsible representatives from subcontractors who are to perform major work on the project.
- C. The purpose of the meeting is to discuss in detail the plans and specifications. The discussion shall include:
 1. Schedule
 2. Equipment
 3. Material Storage
 4. Traffic Control
 5. Inspection Requirements
 6. Protection Procedures for the structure, adjacent facilities, environment, and personnel.
 7. Hours of Work
- D. The contractor shall submit the construction schedule to the architect/engineer at this meeting and a listing of subcontractors and their work. The contractor shall describe, in detail, when each portion of the work is expected to be accomplished. The subcontractors shall participate in the discussion. The architect/engineer will serve to interpret the contract documents should such questions arise.
- E. Any other questions that the contractor or his subcontractors have about the work or its scheduling shall be raised at this meeting.
- F. Requirements for contract administration and construction operations will be defined for participants.
- G. Time, date, and place of the meeting will be determined by the Engineer.

3. PROGRESS MEETINGS:

- A. Weekly meetings will be held for the purpose of coordinating and expediting the work.
- B. Attendance at project meetings by the contractor is mandatory. These meetings shall also be attended by representatives of each subcontractor who is either working at the site or is affected by work being done at the site. The contractor shall submit an updated construction schedule at these meetings and a short narrative should be written, describing the cause of any delays and intended action to remedy these delays.

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- C. Contractors shall give a verbal report of progress on the project, discuss the work schedule for the coming period, and present all conflicts, discrepancies, or other difficulties for resolution.

SECTION 01300: SUBMITTALS/PERMITS1. SCOPE:A. Index:

1. Scope
2. Submittals
3. Permits
4. Inspection

2. SUBMITTALS:

A. Comply with the requirements of the General Conditions and as follows:

1. Forward Submittals not more than 20 calendar days after the Notice to Proceed date. No work, as indicated on any shop drawing, samples, hardware list, etc., shall be started until those submittals have been reviewed and work authorized.
2. All submittals must be thoroughly reviewed by the prime contractor for conformance to contract documents, prior to submission to the City, or its agents, for review. Shop drawings and catalog information shall be stamped "Reviewed By" and signed by the contractor's reviewer. The prime contractor shall review all subcontractor submittals prior to submittal to the City for compliance with contract documents and to coordinate all work.
3. Include with each submittal a transmittal letter signed and dated by the prime contractor containing the following:
 - a. Name of Contractor
 - b. Name of Project
 - c. List of Submittals
 - d. Name of Manufacturer or Supplier
 - e. Additional information as required for the items being provided.

B. Shop Drawings, Catalog Information, Calculations, and Samples:

1. Shop Drawings: Submit one blue/black line print review. The City will notify the contractor in writing and return one copy marked "REVIEWED - NO EXCEPTIONS TAKEN" with minor or no notations. The City will also notify the contractor in writing and return one copy, along with comments, when the drawings are marked either "REJECTED" or "REVISE AND RESUBMIT". For those shop drawings, the contractor will be responsible for resubmitting a new print.
2. Catalog Information and Calculations: Submit four copies for City's record and additional numbers of copies required for the contractor's purpose. The City will notify the contractor in writing and return the contractor's copies, with or without notation,

marked either " REVIEWED - NO EX CEPTIONS T AKEN", "REVISE A ND RESUBMIT", O R "REJECTED". Catalog i nformation or c alculations m arked "REVISE AND R ESUBMIT" or " REJECTED" m ust be r esubmitted i n t he s ame quantities as originally required.

3. Samples: S ubmit two s amples of r equested m aterials f or t he C ity's r ecor ds and additional samples, if desired, to be returned to the contractor. The City will notify the contractor in writing, whether the samples are approved or rejected. If they are rejected, new samples must be resubmitted as originally required.
4. Corrections or comments made on the submittals during the review do not relieve the contractor from compliance with requirements of the contract documents. The check i s onl y f or r eview o f g eneral c onformance w ith t he d esign c oncept o f t he project and g eneral c ompliance w ith t he i nformation g i ven i n t he c ontract documents. C ontractors ar e r esponsible f or c onforming and c orrelating al l quantities an d di mensions; s electing f abrication pr ocesses and t echniques of construction; c oordinating t heir w ork w ith t hat o f al l o ther t rades; an d p erforming their work in a safe manner.

- C. "Or E qual": W henver t he w ords "or e qual" or s imilar t erm i s u sed, i t s hall m ean as determined by the Commissioner of Public Works or agent. All drawings, data and bulletins necessary to make an "or equal" determination shall be submitted to the Facilities Manager of Buildings & Fleet Services. Such review shall apply to design only and shall in no way relieve the contractor from the responsibilities as outlined in Item 2B above. Evaluation of "or e qual" products w ill b e m ade at t he t ime o f s hop d r awing s ubmission. A ny c hange required in design and coordination between all contractors, subcontractors, or trades due to the use of "or equal" materials shall become the contractor's responsibility. Any costs for detailed e ngineering r eviews a nd/or a ny c osts t o i ncorporate "or e qual" pr oducts w ill be borne by the contractor.

3. PERMITS:

- A. The City of Milwaukee will provide the general building and occupancy permits.
- B. Contractors s hall obt ain, f rom t he C ity o f M i lwaukee D epartment o f C ity D evelopment and/or other government or private agencies, all special permits as may be necessary i n their work.
- C. Contractors shall obtain all permits to occupy or work in the public way as may be necessary for their work.
- D. Contractors shall notify the City and/or appropriate utilities when making utility connections as part of the project.

4. INSPECTION:

- A. Facilities D evelopment an d M an agement S ection w ill pr ovide d aily i nspection t o v erify compliance w ith c ontract d ocuments, i dentify c ontractors and c rew s on t he j ob, v erify compliance with contract conditions (EBE, residency, wage requirements), and record job progress and conditions.

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- B. Contractors shall arrange with the Department of Neighborhood Services/Construction Trades Division and permit issuing agencies for all code compliance inspections as required by all permits including, but not limited to, the general building and all special permits issued by that agency.
- C. Contractors shall arrange with the appropriate City agency for compliance inspections, as required, for all permits including, but not limited to, curb and pavement cuts and patches, and public way occupancy and utility connections.

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SECTION 01500: JOB SITE UTILITIES, FACILITIES, AND SECURITY

1. SCOPE:

A. Index:

1. Scope
2. Building Security
3. Temporary or Trial Usage
4. Occupancy During Construction
5. Scaffolding
6. Electrical Power
7. Water
8. Toilet Facilities
9. Security and Weather Protection
10. Parking

2. BUILDING SECURITY:

A. General:

The Downtown Complex is open to the public from 8:00 AM until 4:45 PM, Monday through Friday, excluding holidays. Since most contracted work takes place outside normal business hours, it is essential that contractors and their City agents understand and abide by security policy.

Outlying buildings are not generally open to the public. Contracted work in these buildings can take place at any time. It is essential that contractors and their City agents understand and abide by security policy.

B. Scope:

At the beginning of any project, a copy of this policy and procedure statement will be added to the project manual for bid consideration and shall be distributed at the Pre-Construction Meeting. All City agents/officials responsible for engaging contractors, all contractors, and all subcontractors shall be held responsible for following the procedures.

C. City Agents/Officials:

1. Any City agents/officials who commission outside contractors to work in any of the facilities managed by Facilities Development and Management Section shall provide the following information no less than twenty-four (24) hours in advance of the work:

- a. The names of any contract or subcontract employees who will be present in the facilities (for the purpose of designing badges appropriate to their work area):

Green – Zeidler Municipal Building, 841 North Broadway
Red – City Hall, 200 East Wells Street
Yellow – 809 North Broadway
Gold – Any outlying buildings

These names must be listed on a sign-in sheet available in the Zeidler Municipal Building, Room 602 (Buildings & Fleet Services support staff – Extension 8222). City agents/officials shall be responsible to ensure the sheet and badges are transported to the appropriate location where the work is to be completed (in the Downtown Complex it would go to the City Hall Information Center, for outlying buildings to the person responsible for controlling access in the facility) the day before work is to begin.

- b. A list of keys and/or access cards required for access only to the areas necessary for work involved in the project. The keys and card will be received from the Security Manager or his designee and signed out to the City agents/officials responsible for the contracted work. The City employee will take the keys and/or access cards to the City Hall Information Center or the person responsible for controlling access in the outlying building where they shall be logged under the name of the contractor's company. When a project is complete, the City agents/officials must retrieve the keys/cards and return them to Buildings & Fleet Services support staff in Room 602 of the Zeidler Municipal Building.
- c. The City agents/officials are responsible for communicating the security policy and procedures to contractors. The City agents/officials shall act as liaison for all communication between Buildings & Fleet Services and the contractor.

D. Contractors:

1. Contractors shall abide by City security policy and procedures at all times during the scope of their participation in a project. Failure to comply will result in the contracted employee being escorted from the premises and the resulting lost time and expense shall be deducted from the contractor's invoice or penalties of \$50.00 per occurrence as determined by the contracting City agent/official.
 - a. All access should be provided in advance through the City agent/official. Contractors shall enter and exit only through those doors designated by City agents/officials (the Market Street entrance to City Hall and the doors established by the person responsible for access at outlying buildings). All other exterior doors are locked and alarmed and are not to be used as delivery points unless the City agent/official has been provided 24 hour notification to provide additional security coverage at that point while the delivery is in progress.
 - b. All of the contractor's employees and all of the employees of any of his subcontractors shall wear at all times while on the site, in a clearly visible location, an identification card. The identification card is to have a minimum 1" x 1" color photo of the head and shoulders. The photo is to have been taken no more than one year previously. The card is to be laminated with clear plastic and is to contain the company name, employee's name, and the employee's signature, and is to be furnished by the contractor or respective subcontractor.
 - c. **Effective October 1, 2004 - City of Milwaukee Policy Change**

The following policy has been established to maintain control of City

Property and to ensure the physical protection of the City Hall Complex.

Anyone signing out access cards and/or keys from the Information Center will be following the steps below.

- 1) Sign in on the sheet assigned to the project you are working on and pull that sheet and provide it to the Operator noting that you will need to sign out City property to access the building.
- 2) Provide the Operator your driver's license as collateral for the return of City property.
- 3) Sign out the property in the sign out book as per current policy.
- 4) The Operator will file your driver's license until such time as you sign in and return the City property at which time your license will be returned.
- 5) Sign out at the end of your workday on the sign out sheet.

Under NO circumstances will keys or cards be disbursed without the user signing for the property and providing the City Hall Operator their driver's license as collateral.

In the event that keys or cards are not returned daily the contractor in question will have a deduct (security violation) as per the contract. Individuals who loose or fail to return keys will be responsible for the cost of re-keying to the City.

Contractors will sign in on pre-approved forms and also wear the City identification badges (also to be worn at all times on the premises). Keys or access cards will be signed out as provided by the City agent/official and required for the work. These keys, cards, and badges must be returned at the end of each shift before signing out. Failure to do so will result in a \$50.00 penalty for each occurrence.

- d. Contractors shall not ask custodians or mechanics to unlock doors. All access should be provided in advance through the City agent/official. In the rare case where access is not provided, the City Hall Operator may be contacted to assist in providing access. The contractor shall cooperate with security personnel at all times. The contractor should be prepared to allow searches of equipment when leaving, and should remain only in the areas designated on the sign-in sheets. Security will question a contractor who has an identification badge that indicates a work area other than the area he or she is in.
- e. If the contractor requires use of the loading dock in Upper Parking, 24 hour advance notice shall be given to the City agent/official to make arrangements to provide additional security coverage while the delivery is in progress. The contractor or subcontractor shall meet the delivery driver and take delivery at that point. At no time shall a driver be allowed in the facilities without following the access procedure stated above.
- f. If after normal business hours work is required in the outlying buildings, all

subcontractors and trades will arrange appropriate security measures and lock-up procedures with the contractor in writing. Any work completed at night shall be left "open" for City inspection of the work. The contractor shall notify the City agent/official 24 hours in advance of after-hours work in writing, indicating the type of work to be done and the security measures to be taken by the contractor.

- g. The contractor shall provide plywood door and window closures during construction to secure the structure from weather and damage from vandalism. The contractor is responsible to maintain the security of the space where they are working during construction.
- h. If proper notification is not provided to the contractor, the subcontractor or trades shall be liable for any subsequent damage/vandalism/inspection cost, etc., due to lack of security/inspection coordination.
- i. Use of City materials is strictly prohibited unless pre-arranged through the City employee contact.
- j. At no time shall any interior doors that control access or exterior doors be propped open.
- k. All doors must remain closed at all times unless a specific task pertaining to the project requires access through door(s). Once task is complete, the doors must be closed, secured, and locked immediately.
- l. The pole mounted security camera located at the garage entrance drive must remain operational at all times. Contractor must protect security camera and conduit during all phases of construction.

3. TEMPORARY OR TRIAL USAGE:

The owner shall have the right to make temporary or trial usage of any mechanical device, machinery, apparatus, equipment, work, material or construction supplied under contract before final completion or acceptance of the work, and the same shall not be construed as evidence of acceptance of the work by the owner.

4. OCCUPANCY DURING CONSTRUCTION:

The owner will occupy the premises while work is in progress. Contractor is to coordinate his work as to not interfere with the owner's operation or compromise building security.

5. ELECTRICAL POWER:

Contractor may use existing outlets for power. Available outlets are 120 and 240 Volt single phase and 480 Volt three phase. Contractor is to supply his own lines. OSHA regulations require that employers use either ground fault circuit interrupters or an assured equipment grounding conductor program in addition to any other regulations for equipment grounding conductors. The cost of the current used will be paid for by the City.

6. WATER:

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Contractor may use existing hose bibs for water. Contractor is to supply his own hoses. Contractor's hoses shall be leak free and contractor is to regulate the flow to limit it to project related use. The cost of the water will be paid for by the City.

7. TOILET FACILITIES:

Contractor may use existing toilet facilities in the building.

8. SECURITY AND WEATHER PROTECTION:

Contractor is to furnish, install, and maintain 8' high, nine gauge steel fence fabric at the exterior of the building, across any door or other openings into the building during construction to maintain security after work hours when not working on these openings. The fabric is to be securely fastened at the sides of the opening. Contractor is also to furnish, install, and maintain a waterproof tarp that completely covers the door opening between the fence and the building fastened to prevent rain from entering the building and secured against wind release. Contractor is to remove the fence fabric and tarp at the completion of each phase of the project when the permanent doors provide security and weather protection.

9. PARKING:

Contractor is responsible for parking of vehicles. No parking areas will be provided by the City.

SECTION 01505: CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 SCOPE:

- A. This section specifies requirements for salvaging, recycling and disposing of construction waste for purposes of protecting the environment and reducing project cost.

Requirements include the following:

1. Developing a Construction Waste Management Plan including waste management goals and provisions for waste reduction and recycling.
2. Implementing, monitoring and documenting the waste management plan.
3. Incorporating special programs.
4. Evaluating construction waste management.

1.2 RELATED DOCUMENTS AND SECTIONS:

- A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

B. Related documents include the following

1. Section 01010 "Summary of Work"
2. Section 01300 "Submittal & Permits"
3. Section 001500 "Utilities, Facilities, and Security" for environmental-protection measures during construction.

1.3 PRECONSTRUCTION MEETING:

- A. After a award of Contract and prior to the commencement of the Work, schedule and conduct a meeting with the Owner and Architect to discuss the proposed Construction Waste Management Plan and to develop a mutual understanding regarding details of environmental protection.

1.4 CONSTRUCTION WASTE MANAGEMENT PLAN:

A. Construction Waste Management Plan

1. The purpose of the Construction Waste Management Plan is to identify construction waste reduction goals, identify targeted materials, and explain specific waste reduction actions to be taken, by whom, and when.
2. The Contractor shall develop a Construction Waste Management Plan for this Project within 15 working days after Contract award or prior to any waste removal. The Owner and the Architect will furnish the Contractor with information that will assist in the development of the Construction Waste Management Plan. Submit the Construction Waste Management Plan (include document/report form) to the Architect for approval prior to implementing the Plan.

B. The Plan, which should be entered into and generated by WasteCapTRACE, shall include the following:

1. A list of waste materials expected to be generated from the Project debris.

2. A list of each material proposed to be salvaged, reused, recycled, and discarded. Identify applicable markets for reuse and recycling. At a minimum, all materials required by state law to be recycled shall be recycled (e.g., cardboard, cans, bottles, office paper , fluorescent tubes, refrigerants mercury, etc.) and scrap metal shall be recycled.
 3. Separation and materials handling procedures: Description of how waste materials identified above will be separated, cleaned (if necessary) and protected from contamination.
 4. Educational and Motivational Procedures: Meetings to be held and other proposed methods for educating construction personnel regarding waste reduction and recycling. Construction waste management requirements should be discussed at least monthly at project site meetings.
 5. Waste Auditing Procedures: Methods of monitoring and enforcing the Plan.
 6. Documentation procedures: Methods of documenting materials leaving the Project site as waste, for the reuse or recycling to allow Summary or Waste Progress Reports to be submitted with Applications for Payment.
 7. The Lead contractor shall distribute copies of the Construction Waste Management Plan to DPW's Project manager.
- C. Progress Documentation: Document solid waste disposal and diversion. Include the date of removal, type of waste removed, quantity by weight and volume, final destination and use (recycled, reused or landfilled), and net cost or income.
1. Document on the Form acceptable to the Owner and Architect.
 2. With each Application for Payment, submit updated documentation identifying solid waste disposal and diversion.
 3. With each Application for Payment, submit manifests, weight tickets, receipts and invoices identifying the Project and construction waste material.
- D. Record Submittals: Submit the following:
1. Summary of solid waste disposal and diversion. Submit on form acceptable to the Owner and Architect.
 2. End-of-Project recycling rates and landfill rates demonstrating the percentage of construction waste that was recycled or reused.

1.5 WASTE MANAGEMENT GOALS:

- A. Develop Construction Waste Management Plan that results in end-of-Project rates for the reuse/recycling of **50%** percent by weight or volume of total waste generated by the Project. Record the total construction waste reduction goal on the Construction Waste Management Plan Form.
- B. Reduce: The Project shall generate the least amount of waste and methods shall be used that minimize waste due to error, poor planning, breakage, mishandling, contamination, or similar factors. Promote the resourceful use of materials to the greatest extent possible.
- C. Reuse: The Contractor and Subcontractors shall reuse materials to the greatest extent possible. Reuse includes the following:
 1. Salvage reusable materials for resale, for reuse on this Project, or for storage for use on future projects.
 2. Return reusable items (e.g., pallets or unused products) to the material suppliers.

- D. Recycle: As many of the waste materials not able to be eliminated in the first place or salvaged for reuse shall be recycled. Waste disposal in landfills shall be minimized to greatest extent possible.

1.6 MATERIALS HANDLING AND SORTING:

- A. Handling:
 - 1. Materials that are contaminated prior to placing in collection containers shall be properly cleaned. Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling processes.
 - 2. Cover materials with tarps and keep truckloads level so as to prevent spillage.
 - 3. Arrange for collection by or delivery to the appropriate recycling or reuse facility.
 - 4. Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations. If encountered, such waste and materials shall be abated under separate contract.
- B. The following sorting methods are acceptable:
 - 1. Sorting recyclable materials at the Project site and transporting them to recycling markets directly from the Project site.
 - 2. Employing haulers who make use of a materials-recovery facility or a transfer station where recyclable materials are sorted from the waste and recycled before disposing of the remainder. If using a hauler or recycling facility to sort out recyclables, verify that the hauler sorts out all construction waste loads and is not limited to those that are not acceptable at the landfill. Also, verify that the hauler or recycling facility recycles at least three types of materials.

1.11 WASTE MANAGEMENT PLAN IMPLEMENTATION:

- A. The Contractor shall designate a party (or parties) who shall be responsible for instructing construction personnel and overseeing and documenting results of the Construction Waste Management Plan.
- B. Distribution: The Contractor shall distribute copies of the Construction Waste Management Plan to the Project Foreman, each Subcontractor, the Owner, and the Architect.
- C. Instruction: The Contractor shall provide on-site instruction regarding appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all construction personnel at the appropriate phases of the Project.
- D. Separation Facilities: The Contractor shall lay out and identify a specific area on the Project site to facilitate separation of materials for recycling, salvage, reuse, and return. Recycling and waste bin areas shall be kept neat and clean, and clearly marked to avoid contamination of materials. Materials for recycling include concrete, non-fibrous wallboard, paper, clean corrugated cardboard (no pizza boxes), non-treated wood, metals (steel, aluminum and copper), and glass bottles (no windows). Provide separate containers, preferably near the job trailer, with smaller containers located at convenient places throughout the job site. Empty smaller containers into larger containers every night or when full. Cover outdoor containers to keep out rain, snow, and wind-driven debris. Lock containers whenever site is not in use to prevent illegal dumping.
- E. Hazardous Waste: Hazardous waste shall be separated, stored, and disposed of according to applicable regulations.

- F. Application for Payments: With each Application for Payment, the Contractor shall submit a Summary of Waste generated by the Project. This reporting shall take place using WasteCapTRACE, an online documentation system. There is a fee, to be included in the bid, of two cents per square foot of gross construction for use of WasteCapTRACE. Failure to submit this information shall render the Application for Payment void, thereby delaying the Progress Payment. The Summary of Waste shall contain the following information:
1. The amount (in tons and/or cubic yards) of material landfilled from the Project, the identity of the landfill, and the related disposal cost. Include corresponding manifests, weight tickets, receipts, and invoices.
 2. For each material recycled from the Project, the amount (in tons and/or cubic yards), the date removed from the Project site, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of recycling. Include corresponding manifests, weight tickets, receipts, and invoices.
 3. Final Payment: Prior to a application for Final Payment, the Lead Contractor shall submit a Final Summary of Waste: reuse the recycling results for all prime and subcontractors, including the quantity of each material recycled, reused, or salvaged, the receiving party and the applicable diversion rates. The final report will be generated by WasteCapTRACE based on information entered throughout the project by the Lead Contractor.
- G. Implementing the Plan: The Contractor shall designate a party (or parties) responsible for implementing the Construction Waste Management Plan. This party (or parties) shall explain to Contractor's and Subcontractor's construction personnel, the Plan's goals and methods for achieving those goals.

1.12 SPECIAL PROGRAMS:

- A. The Contractor shall be responsible for final implementation of programs involving tax credits, rebates, or similar incentives related to recycling, if applicable to the Project. Revenues or other savings obtained for recycling or returns shall accrue to the Contractor.
- B. The Contractor shall be responsible for obtaining information packets related to the special programs prior to commencing Work.
- C. The Contractor shall document work methods, recycled materials, etc., as required for the tax credits, rebates, or other savings described above.

SECTION 01600: MATERIALS AND EQUIPMENT1. SCOPE:A. Index:

1. Scope
2. Materials
3. Equipment
4. Hazardous Material Requirements
5. Material Storage
6. Protection
7. Revisions

2. MATERIALS:

- A. Furnish materials of the type, qualities, and characteristics specified. The specification of a trade name and catalog number is intended to establish quality, type, character, and operating characteristics of the material required. Materials by other manufacturers of equal specifications will be accepted, excepting as may be specifically stated otherwise.
- B. Materials shall be delivered adequately protected, in merchantable condition, and in original unbroken packages if normally packaged. They shall be stored and handled so as to protect and maintain their merchantable condition.
- C. The Commissioner of Public Works or his representatives shall have the right to reject material not in compliance with the project manual, as well as damaged material, and the contractor shall remove such material from the construction site when and as directed.

3. EQUIPMENT:

- A. Internal combustion engine and compressors shall be equipped with mufflers to reduce noise to a minimum and shall not be operated in enclosed areas without adequate ventilation.
- B. All materials and work procedures used shall be in accordance with all air pollution control regulations in effect at the work site.

4. HAZARDOUS MATERIAL REQUIREMENTS:

- A. The requirements set forth in the OSHA Hazard Communication Standard, 29CFR19101.1200, U.S. Environmental Protection Agency (EPA), and Wisconsin Department of Natural Resources in the Wisconsin Administrative Code NR600, shall be met by each on-site contractor.

1. Material Safety Data Sheets (M.S.D.S.):

- a. All contractors, which may/may not include the City of Milwaukee, shall provide the M.S.D.S. for all hazardous chemicals to which any person may be exposed at the work site.
- b. A master list will be kept in the office of the Project Supervisor/Construction Manager and updated as materials are delivered.

2. Container Labeling:

- a. Each container of hazardous material at the work sites shall be clearly labeled with:
 - (1) Identity of the hazardous chemical(s).
 - (2) Appropriate hazard warning(s).
 - (3) Name and address of the manufacturer.

B. The City of Milwaukee reserves the right to stop the work of a contractor if compliance with OSHA regulations is inadequate. Work will not proceed until all applicable safety and health procedures are implemented by the contractor.

5. MATERIAL STORAGE:

- A. The storage areas shall be kept in good order and free of all rubbish and debris.
- B. Coordinate the delivery and storage of all materials and equipment with the Facilities Development and Management Section Project Inspector.
- C. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- D. Store and protect products in accordance with manufacturers' instructions.
- E. Store with seals and labels intact and legible.
- F. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- G. For exterior storage of fabricated products, place on sloped supports above ground.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
- L. The Contractor shall be assigned a portion of Market Street for staging and materials storage. The exact dimensions and location of staging are to be determined by the Engineer. Staging must be enclosed by chain link fence.
- M. Materials shall be stored so as to assure the preservation of their quality and fitness for the

work. When considered necessary, they shall be placed on wooden platforms or other hard, clean surfaces, and not on the ground, and they shall be placed under cover. Materials stored at the site shall not damage the structure in any way. Oil, grease or gasoline spills shall be cleaned up immediately.

- N. No damaged or imperfect materials, equipment, accessories, et c. will be accepted. All materials, equipment, accessories, et c., furnished or installed by this Contractor must function perfectly and as designed. If any argument should arise in regard to this requirement, the City will replace the parts and deduct the costs from the contract price.

6. PROTECTION:

- A. The premises and the works shall be adequately protected from damage from the commencement of work to the date of final acceptance.
- B. All construction work and traffic shall remain within the construction area.
- C. All damage shall be corrected or repaired by the contractor or contractors causing same at his or their own expense.
- D. All open pipes, pipe threads, fittings, and insulation must be protected during construction.
- E. The Contractor shall assume full responsibility for the protection and safekeeping of products stored on the premises. Construction equipment, tools, etc., shall not be stored in areas of the Owner's continued use.

7. REVISIONS:

The right is reserved to make modifications to a reasonable extent as building conditions may require, or as may be required to conform to code rulings, or manufacturer's standards without extra cost to the City.

SECTION 01700: CLEANING AND PROJECT CLOSE-OUT

1. SCOPE:

A. Index:

1. Scope
2. General
3. Safety Cleaning
4. Progress Cleaning
5. Disposal
6. Final Cleaning
7. Charges
8. Record Drawings
9. Operating Instructions and Maintenance Manuals
10. Guarantees

2. GENERAL:

Article 2.5.4 of the General Requirements of City of Milwaukee Department of Public Works shall be supplemented as specified hereinafter.

3. SAFETY CLEANING:

Safety cleaning: Each contractor is responsible for safety cleaning, which includes but is not limited to the following:

- A. Keep work areas, passageways, ramps, stairs, free of debris and scrap.
- B. Form and scrap lumber shall have nails withdrawn or bent over and lumber shall be stacked or removed.
- C. Remove spills of oil, grease, or other liquids immediately or sprinkle with sand.
- D. Hazardous material shall be handled in accordance with Section 01600. Each container of hazardous material at the work site shall be clearly labeled with:
 - a. Identity of the hazardous chemical(s).
 - b. Appropriate hazard warning(s).

4. PROGRESS CLEANING:

- A. Prime Contractor and subcontractor shall remove his rubbish and debris from building site promptly upon its accumulation, and prior to the contractor's regular Friday general clean up. Contractor shall perform broom cleaning of all appropriate surfaces each Friday afternoon.
- B. Combustible waste shall be stored in fire resistive containers and disposed of regularly.
- C. Oily, flammable or hazardous wastes such as caustics, acids, harmful dusts, etc., shall be stored in appropriate covered containers.

5. DISPOSAL:

- A. No burning of rubbish or debris will be allowed at site. No rubbish shall be thrown through opening or from heights without proper protection. Where dust will be generated or flying debris is likely to occur, provide dust tight chutes or other means to control dust.
- B. Containers: Contractor shall provide mobile industrial type waste containers in the number and size required, placed at adequate locations to handle debris or provide other methods of disposing of debris.
- C. Oil, flammable or hazardous wastes such as, but not limited to, caustics, acids, harmful dusts, etc., shall be placed in properly marked containers as necessary and disposed of at a site designed for such wastes.

6. FINAL CLEANING:

- A. Immediately prior to substantial completion.
- B. Contractors shall expedite or perform thorough cleaning, sweeping, washing and polishing of work to remove from work and equipment provided under his contract, all foreign matter, spots and soil, so as to put all such work and equipment, including finishes, in a complete and finished condition ready for acceptance and use intended.
- C. The contractor is responsible for final sweeping and dusting not covered by other subcontractors. This general cleaning shall include all areas and floors of the building, including the site outside the building.

7. CHARGES:

- A. If prime contractors do not remove rubbish or clean building as specified above, owner reserves right to have work done by others at contractor's expense.
- B. Employees of the owner who are required to clean up any rubbish or to sweep any floors will record all hours involved to complete such work. The cost incurred by the owner for this special cleaning and sweep-up work shall be charged against the contract price of the contractor as determined by owner.

8. RECORD DRAWINGS:

- A. At the completion of work and prior to final payment, the mechanical and electrical contractors shall provide Buildings & Fleet Services with three (3) marked up sets of prints showing all changes or variations from contract drawings, and not specified on change order drawings theretofore issued. Contractors providing buried or concealed piping, conduit, or similar items shall locate such items by dimensions and elevations.
- B. Other contractors shall provide one (1) marked up set of prints showing all changes or variations from contract drawings.
- C. Drawings shall show complete layout of revised piping, equipment, etc., as actually installed.

9. OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS:

01700/3

- A. The contractor shall, upon completion of all work, furnish the necessary skilled labor to instruct City personnel in the operation, adjustment, and maintenance of all equipment furnished.
- B. At termination of work, the contractor shall submit maintenance and operating manuals presenting full details of care and maintenance and operation of mechanical and electrical equipment of every nature. See specific requirements in relevant sections as applicable.
- C. The manual shall include manufacturer's instructions for maintenance and operation and shall be completely indexed, including the spare parts list. See specific requirements in relevant sections.
- D. Submit three (3) final copies in hard bound cover to Buildings & Fleet Services.
- E. The contractor shall allow for a four (4) hour training session for City maintenance personnel on all equipment and controls installed under this contract.

10. GUARANTEES:

- A. Each contractor shall guarantee to replace or repair promptly at his own expense, as directed by the Commissioner of Public Works or his agent, all workmanship or materials in which defects may develop within one (1) year from the date of final acceptance of his work. This guarantee includes all damage done to the City due to faulty equipment, poor installation or poor construction.
- B. Guarantee periods other than the one year time period are indicated in specific specification sections.

SECTION 02 41 19 - SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate detailed sequence of selective demolition and removal work, with starting and ending dates for each activity, interruption of utility services, use of elevator and stairs, and locations of temporary partitions and means of egress.
- B. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations.

1.4 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.

1.5 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - a. Those (if any) determined by the Owner and Demolition Contractor as needing to be removed.
- C. Notify Architect / Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect / Engineer and Owner. Owner will remove hazardous materials under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect / Engineer.

- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 2. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
5. Dispose of demolished items and materials promptly.

B. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Protect items from damage during transport and storage (if applicable).
3. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect / Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. This section is also applicable for the cast-in-place concrete used in slab repairs.
- C. See Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
- D. See division 07 section "Traffic Coatings" for traffic-bearing membrane.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.
- C. Shop Drawings: Material test reports.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete."
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 3. ACI 302.1, "Guide for Concrete Floor and Slab Construction."
 - 4. ACI 304, "Guide for Measuring, Mixing, Transporting and Placing Concrete."
 - 5. ACI 305R, "Hot Weather Concreting."
 - 6. ACI 308R, "Guide to Curing Concrete."
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

- a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - e. Owners representative.
 - f. Architect and engineer.
2. Review concrete finishes and finishing, cold and hot weather concreting procedures, curing procedures, construction contraction and isolation joints, and concrete protection.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
 - 1. Epoxy-Coated Reinforcing Bars: ASTM A 775, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I
 - a. Fly Ash: ASTM C 618, Class C.
- B. Normal-Weight Aggregates: ASTM C 33, graded 3/8" nominal maximum coarse-aggregate size.
 - 1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94 and potable.
- D. Air-Entraining Admixture: ASTM C 260.

- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 3. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1 ½ - 2 inches.

2.4 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Product used must be compatible with traffic bearing water proofing membrane.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.

2.5 RELATED MATERIALS

- A. Expansion and Isolation Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

2.6 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Cementitious Materials: Fly ash may be used to reduce the total amount of Portland cement, which would otherwise be used, by not more than 25 percent.
- C. Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days (see also Material Design Properties on drawing S200).
 - 2. Maximum Water-Cementitious Materials Ratio: 0.40.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
 - 4. a) Air Content: 6 percent, plus or minus 1.5 percent at point of delivery.
b) Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
 - 5. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, as noted on drawings (see boxed note on plan drawings S100 and s100A).

2.7 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork according to ACI 301 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.4 JOINTS

- A. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks, but no more than 48 hours from time of placement.
- B. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated on drawing S200.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Prepare slab surface for placement of new topping slab. Clean the existing surface such that it is free of loose material, dust, dirt, grease, or other material that may be detrimental to attainment of proper bond.
- C. Provide a saturated surface dry condition prior to placement of new concrete. After most free water has evaporated or has been removed from the surface, a bonding grout should be scrubbed in. The bonding grout should be composed of one part cement, 1.5 parts fine sand passing the No. 8 sieve (2.36 mm), and sufficient water to achieve the consistency of thick paint. The grout should be applied to the floor in segments, keeping only a short distance ahead of the concrete topping placing operations that follow it.
- D. While the bonding grout is still tacky, deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated on drawing S200. Deposit concrete to avoid segregation.
 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
- E. Cold-Weather Placement: Comply with ACI 306.1.
- F. Hot-Weather Placement: Comply with ACI 301.
- G. Slope towards drains as noted on drawings S100 and s100A.

3.6 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R Section 8.3 recommendations for screeding, restraightening, and finishing operations for concrete surfaces. It is desired to attain a highly durable surface. Do not wet concrete surfaces. Do not overwork concrete.

3.7 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.8 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect/Engineer. Remove and replace concrete per Section 037300.

3.9 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
 - 1. Testing Services: Tests shall be performed according to ACI 301.

END OF SECTION 03 30 00

SECTION 037302: CONCRETE SURFACE REPAIR

1. SCOPE

Work in this section consists of furnishing all labor, materials, equipment and incidentals as necessary to complete concrete surface repair to delaminations and spalls areas located on the ceilings, columns, walls and floor.

A. Index

1. Scope
2. General
3. Materials
4. Surface Preparation
5. Application and Finish

2. GENERAL

- A. Remove deteriorated, unsound and spalled concrete on ceiling, walls, columns and floor in the Lower Parking Level. Locate unsound concrete by striking with hammer and listening for hollow sound. Inspect locations and mark areas requiring concrete repair in presence of Inspector. Sandblast clean any exposed reinforcing bars and prepare concrete for patching in accordance with manufacturer's printed instructions. Apply bonding agent/anti-corrosion coating to existing concrete prior to patching with repair mortar.
- B. Submit manufacturer's instructions for mixing, handling and placement of concrete repair mortar before starting repair work.

3. MATERIALS

- A. Concrete repair mortars are to be polymer-modified, Portland-cement, 2-component, fast-setting, trowel-grade patching mortar with corrosion inhibitor formulated for horizontal and vertical surfaces.
- B. Approved repair mortars are Sika Top 122 plus and Sika Top 123 plus by Sika Corporation, 875 Valley Brook Avenue, Linkhurst, New Jersey 07071, or approved equal.
- C. Approved bonding agent/anti-corrosion coating for bonding repair mortar to existing concrete and reinforcing steel while protecting reinforcing steel from corrosion is Sika Armatec 110 Epo Cem, or approved equal.

- D. Other repair mortars and bonding agent/anti-corrosion coating meeting or exceeding the performance criteria and test properties of the approved repair materials may be submitted for approval.
- E. The Contractor shall have a competent, technical representative of the manufacturer of the concrete repair products on the site at the beginning of the work to approve in writing that preparation and application of the materials is in accordance with the manufacturer's recommendations. Work shall not begin until such approval is submitted to the Engineer.

4. SURFACE PREPARATION

- A. Remove all deteriorated concrete, dirt, oil, grease, and all bond inhibiting materials from the surface. Be sure the repair area is not less than 1/8-inch in depth. Preparation work should be done by scabbler or other appropriate mechanical means to obtain an aggregate fractured surface with a minimum surface profile of $\pm 1/16$ -inch. Saw cut perimeter of repair area 1/2-inch deep maximum. "Pencil Point" chipping hammers shall not be used.
- B. Hand chip 0.75-inch minimum around and under exposed rebar if corrosion is present or if bar is exposed greater than 50% of its circumference after chipping. Either saw cut above rebar or hand chip a right angle cut 2-inch into sound concrete measured from last visible sign of rebar corrosion. Existing, exposed reinforcing bars shall be sandblasted clean and coated with Sika Armatec 110.

5. APPLICATION AND FINISH

- A. Existing rebar exposed shall be sandblasted clean and coated with Sika Armatec 110 to protect from corrosion. Apply to exposed rebar with stiff bristle brush or spray 10 mils thick covering all exposed steel. Cure to tack-free 2-3 hours. Apply a second coat at 10 mils. Allow to dry again before applying repair mortar.
- B. Pre-wet repair surface to saturated surface dry (SSD). The contractor shall continually wet the surface for 3 to 4 hours for the concrete to be considered SSD.

Pre-wet repair surface to saturated surface dry (SSD). The contractor shall continually wet the surface for 3 to 4 hours for the concrete to be considered SSD.

Apply Sika Armatec 110 as a bonding bridge between existing concrete and repair mortar. Apply by stiff bristle brush or spray apply with "Goldblatt" pattern pistol or equal equipment. Place repair mortar while Sika Armatec 110 is still wet or dry up to 24 hours.
- C. Repair area should not be less than 1/8-inch in depth. At the time of application surfaces should be SSD with no standing water. Mortar must be scrubbed into the substrate, filling all pores and voids. While scrub coat is still wet, apply Sika Top

122 or 12.

- D. For applications greater than 1-inch in depth, add a minus 1/2-inch or 3/8-inch coarse aggregate to Sika Top 122 to produce Sika Top concrete. The aggregate must be clean, well graded, and saturated surface dry. The addition rate must not exceed 42 lbs. of aggregate per unit of Sika Top 122. 42 lbs. of coarse aggregate is approximately 3.0-3.5 gallons by loose volume. The yield is increased to 0.75 cu. Ft. per unit with the addition of the aggregate. Do not use limestone aggregate.
- E. For applications greater than 1-1/2 inch in depth, apply Sika Top 123 in lifts. Score the top surface of each lift to produce a roughened surface for the next lift. Allow preceding lift to reach final set.
- F. Cure repair area using a fine mist of water, wet burlap or non-solvent, water based curing compound which has been pre-approved by the Engineer. To prevent freezing, cover with insulating material.
- G. Allow mortar or concrete to set to desired stiffness then finish with wood or sponge float for a smooth surface. Where rough finish is required, use a broom or burlap drag.

END OF SECTION 03 73 00

SECTION 07 18 00 - TRAFFIC COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes traffic coatings for the following applications:
 - 1. Vehicular traffic.
 - 2. Pavement markings.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-In-Place Concrete" for traffic-bearing toppings applied over base slabs or precast concrete units.

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Show extent of each traffic coating. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions.
- C. Samples for Verification: For each type of traffic coating required, prepared on rigid backing and of same thickness and material indicated for the Work.
 - 1. Provide stepped Samples on backing large enough to illustrate buildup of traffic coatings.
- D. Qualification Data: For Installer.
- E. Material Test Reports: For each traffic coating.
- F. Material Certificates: For each traffic coating, signed by manufacturers.
- G. Field quality-control test reports.
- H. Maintenance Data: For traffic coatings to include in maintenance manuals. Identify substrates and types of traffic coatings applied. Include recommendations for periodic inspections, cleaning, care, maintenance, and repair of traffic coatings.
- I. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of traffic coatings required for this Project.
- B. Source Limitations:
 - 1. Obtain traffic coatings from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide traffic coating materials with the fire-test-response characteristics as determined by testing identical products per test method below for deck type and slopes indicated by an independent testing and inspecting agency that is acceptable to authorities having jurisdiction.
 - 1. Class A roof covering per ASTM E 108 or UL 790.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels showing the following information:
 - 1. Manufacturer's brand name.
 - 2. Type of material.
 - 3. Directions for storage.
 - 4. Date of manufacture and shelf life.
 - 5. Lot or batch number.
 - 6. Mixing and application instructions.
 - 7. Color.
- B. Store materials in a clean, dry location protected from exposure to direct sunlight. In storage areas, maintain environmental conditions within range recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
- B. Do not install traffic coating until items that will penetrate membrane have been installed.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which traffic coating manufacturer agrees to repair or replace traffic coatings that deteriorate during the specified warranty period. Warranty does not include deterioration or failure of traffic coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new substrate cracks exceeding 1/16 inch in width, fire, vandalism, or abuse by snowplow, maintenance equipment, and truck traffic.

1. Deterioration of traffic coatings includes the following:
 - a. Adhesive or cohesive failures.
 - b. Abrasion or tearing failures.
 - c. Surface crazing or spalling.
 - d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.
2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Traffic Coatings: Complying with ASTM C 957.
- B. Material Compatibility: Provide primers; base, intermediate, and topcoats; and miscellaneous materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.2 TRAFFIC COATING

- A. Products: Subject to compliance with requirements, provide one of the following, or approved equal:
 1. BASF Construction Chemicals, LLC – Sonneborn; Sonoguard, Polyurethane Waterproofing, Traffic-Bearing Membrane System for Heavy Duty Traffic
 2. Carlisle Coatings & Waterproofing, Inc.; CCW-5123 Vehicular Traffic Deck System
 3. Neogard, Division of Jones-Blair; Auto-Gard Vehicular Traffic Coating
 4. Tremco Incorporated, Sealant/Waterproofing Division; Vulkem 350NF/345/346 Elastomeric, Waterproof Traffic Deck Coating System
- B. Primer: Manufacturer's standard factory-formulated primer as recommended or required for system, substrate and conditions indicated.
- C. Preparatory and Base Coats: Single-component, aromatic liquid urethane elastomer.
- D. Intermediate Coat: Single- or multi-component, aromatic liquid urethane elastomer or a single-component, aliphatic liquid urethane elastomer.
- E. Topcoat: Single-component, aliphatic liquid urethane elastomer.
 1. Color: As selected by Architect and Engineer from manufacturer's full range.
- F. Component Coat Thicknesses: As recommended by manufacturer for substrate and service conditions indicated, but not less than the following (measured excluding aggregate):
 1. Base Coat: 25-mils minimum wet film thickness.
 2. Intermediate Coat: 20-mils minimum wet film thickness.
 3. Topcoat: 20-mils minimum wet film thickness.

- G. Aggregate: Uniformly graded, washed silica sand of particle sizes, shape, and minimum hardness recommended in writing by traffic coating manufacturer.
 - 1. Spreading Rate: As recommended by manufacturer for substrate and service conditions indicated, but not less than the following:
 - a. Intermediate Coat: To refusal at approximately 30 – 50 lbs/100 square feet.
 - b. Topcoat: 7 – 10 lbs/100 square feet.

2.3 MISCELLANEOUS MATERIALS

- A. Joint Sealants: As specified in Division 07 Section "Joint Sealants."
- B. Sheet Flashing: Nonstaining.
 - 1. Minimum Thickness: 50 mils.
 - 2. Material: Sheet material recommended in writing by traffic coating manufacturer.
- C. Adhesive: Contact adhesive recommended in writing by traffic coating manufacturer.
- D. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic coating manufacturer.

2.4 PAVEMENT MARKINGS

- A. Pavement-Marking Paint: Alkyd-resin ready mixed, complying with AASHTO M 248, Type S.
 - 1. Color: White.
 - a. Use blue for spaces accessible to people with disabilities.
 - 2. Sizes and Types of Pavement Markings
 - a. Space Demarcation: 4" wide
 - b. Space Number: Individual numbers to be 3" wide x 24" high number, start 2'-6" from entrance side of space, centered in space width, facing entrance side – see Construction Documents for more information
 - c. Miscellaneous Lettering: 3" wide x 18" high, centered in space – see Construction Documents for more information.
 - d. Accessible Parking Symbol: 4" wide x 48" high, centered in both directions in parking space – see Construction Documents for more information
 - e. Accessible Parking Space Lettering: 2" wide x 12" high, centered in space width – see Construction Documents for more information
- B. Glass Beads: AASHTO M 247, Type 1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements and for other conditions affecting performance of traffic coatings.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 - 2. Verify compatibility with and suitability of substrates.
 - 3. Begin coating application only after minimum concrete curing and drying period recommended by traffic coating manufacturer has passed, after unsatisfactory conditions have been corrected, and after surfaces are dry.
 - 4. Verify that substrates are visibly dry and free of moisture.
 - a. Test for moisture vapor transmission by plastic sheet method according to ASTM D 4263.
 - 5. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Clean and prepare substrates according to ASTM C 1127 and manufacturer's written recommendations to produce clean, dust-free, dry substrate for traffic coating application.
- B. Mask adjoining surfaces not receiving traffic coatings, deck drains, and other deck substrate penetrations to prevent spillage, leaking, and migration of coatings.
- C. Concrete Substrates: Mechanically abrade concrete surfaces to a uniform profile according to ASTM D 4259. Do not acid etch.
 - 1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
 - 2. Remove concrete fins, ridges, and other projections.
 - 3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
 - 4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.

3.3 TERMINATIONS AND PENETRATIONS

- A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C 1127 and manufacturer's written recommendations.
- B. Provide sealant cants at penetrations and at reinforced and non-reinforced, deck-to-wall butt joints.
- C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.

- D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C 1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Comply with recommendations in ASTM C 1193 for joint-sealant installation.

3.5 TRAFFIC COATING APPLICATION

- A. Apply traffic coating material according to ASTM C 1127 and manufacturer's written recommendations.
 - 1. Verify that wet film thickness of each component coat complies with requirements every 100 sq. ft.
- B. Apply traffic coatings to prepared wall terminations and vertical surfaces to a height of 0'-4", and omit aggregate on vertical surfaces.
- C. Cure traffic coatings according to manufacturer's written recommendations. Prevent contamination and damage during application and curing stages.

3.6 PAVEMENT MARKINGS

- A. Do not apply traffic paint for striping and other markings until traffic coating has cured according to manufacturer's written recommendations.
- B. Apply traffic paint for striping and other markings with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates for a 15-mil minimum wet film thickness.

3.7 FIELD QUALITY CONTROL

- A. Final Traffic Coating Inspection: Arrange for traffic coating manufacturer's technical personnel to inspect membrane installation on completion.
 - 1. Notify Architect, Engineer and Owner 48 hours in advance of date and time of inspection.

3.8 PROTECTING AND CLEANING

- A. Protect traffic coatings from damage and wear during remainder of construction period.

- B. Clean spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 18 00

SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes the following for:
 - 1. Preparing sealant substrate surfaces.
 - 2. Sealant and backing.
 - 3. Preformed compressible gasket sealants.

1.2 RELATED SECTIONS

- A. Division 07 Traffic Coatings.

1.3 REFERENCES

- A. ASTM C834 - Standard Specification for Latex Sealants.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- D. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
- E. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
- F. SWI (Sealing and Waterproofers Institute) - Sealant and Caulking Guide Specification.

1.4 SUBMITTALS

- A. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- B. Samples: Submit two samples illustrating sealant colors for selection.
- C. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years experience.
- B. Applicator: Company specializing in applying the work of this Section with minimum three years experience and approved by sealant manufacturer.

1.6 WARRANTY

- A. Include coverage for installed sealants and accessories failing to achieve airtight seal, watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

PART 2 PRODUCTS

2.1 SEALANTS

A. TYPE 1 JOINT SEALANT

1. Multi-component, Nonsag, Urethane Joint Sealant: ASTM C920, Type M, Grade NS, Class 50, for Use NT.
 - a. Tremco Incorporated; Dymeric 240/240 FC.
 - b. Pecora Corporation; Dynatrol II.
 - c. Sonneborn; Sonolastic NP 2.

B. TYPE 2 JOINT SEALANT

1. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, fore Use NT.
 - a. Dow Corning Corporation; 790.
 - b. Pecora Corporation; 301 NS.
 - c. Tremco Incorporated; Spectrem 1, Spectrem 3, Spectrem 4.
 - d. Sika Corporation, Construction Products Division; SikaSil-C990.

C. TYPE 3 JOINT SEALANT

1. Multi-Component Self-Leveling Urethane: ASTM C920, Type M, Grade P, Class 25, for Use T; self-leveling, multi-component, chemical curing, non-staining, non-bleeding, color as selected from the manufacturers full line.
 - a. Tremco Incorporated; THC-900/901.
 - b. Pecora Corporation; NR-2000 Urexpan Sealant.
 - c. Sonneborn; Sonolastic Paving Joint Sealant.

2.2 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.
- B. Examine all surfaces that are to receive sealant work for conditions detrimental to the proper completion of this work. Do not proceed with this work until such conditions have been corrected.
- C. Do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion) has successfully demonstrated that sealant bond is not impaired by coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surface before installing sealant.
- D. Beginning of installation means installer accepts existing surfaces.

3.2 PREPARATION

- A. Clean and prime joints in accordance with manufacturer's instructions.
- B. Remove loose materials and foreign matter that might impair adhesion of sealant. Joint surfaces to receive sealant shall be clean, smooth, dry and free of all visible contaminants.
- C. Verify that joint backing and release tapes are compatible with sealant.
- D. Perform preparation in accordance with ASTM C804 for solvent release and C790 for latex base sealants.
- E. Protect elements surrounding the work of this Section from damage or disfiguration.
- F. Where an irregular surface or sensitive joint border exists, apply masking tape at edges of joint prior to priming or sealing. Remove tape after joint has been tooled.

3.3 INSTALLATION

- A. Install sealant in accordance with manufacturer's instructions. Apply sealant within recommended temperature range. Force sealant into joint and against sides of joint to make uniform. Fill sealant space completely with sealant.
- B. Measure joint dimensions and size materials to achieve required width/depth ratios.
- C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
- D. Install bond breaker where joint backing is not used.

- E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. After joints have been completely filled, tool them neatly to shape or profile required. Remove excess sealant from adjacent surfaces of joint.

3.4 CLEANING AND REPAIRING

- A. Immediately clean adjacent work that has been soiled; leave work in a neat, clean condition. Use only those cleaning materials recommended by sealant manufacturer.
- B. Repair and correct defects in work due to faulty materials, methods or workmanship; and repair and correct adjacent work damaged by such defects.
- C. Repair or replace defaced or disfigured finishes caused by work of this Section.
- D. The following types of failure will be adjudged defective work and shall be corrected: Breakage, cracking, crumbling, melting, shrinking, running, hardening, staining of adjacent surfaces, adhesive failure and cohesive failure.

3.5 PROTECTION OF FINISHED WORK

- A. Protect sealants until cured.

3.6 COLOR

- A. Sealant, generally, shall be the color of the adjacent material that lies in the same plane as the sealant. Sealant Joints that run through different materials may be multiple colors, to be chosen at the discretion of the Architect / Engineer. All colors shall be selected by the Architect / Engineer from the manufacturer's full range prior to installation.

3.7 SEALANT SCHEDULE

- A. Carefully study the Drawings and furnish and install the proper sealant and caulking at each point where indicated on the Drawings plus at all other points where sealants and caulking are essential in maintaining the continued integrity of the weather-tight barrier.
- B. Joint locations and conditions not covered in the schedule below shall be brought to the attention of the Architect / Engineer. The contractor shall propose, in writing, sealant types for each joint location and condition in question, to the Architect for approval prior to sealant installation.
- C. Provide the following sealant types at locations scheduled unless otherwise indicated on drawings
 - 1. Interior Parking Garage and Exterior Joints:
 - a. Control joints in wall surfaces - Type 1.
 - b. Perimeters of openings where frames meet the building facade – Type 2.
 - c. Perimeters of mechanical and electrical items that penetrate the parking garage walls / exterior building facade - Type 2.
 - d. Reglet joints where flashing is inserted into masonry or concrete walls Type 2.
 - e. Sill and coping joints (horizontal and vertical) – Type 1.
 - f. Expansion and control joints in horizontal wearing surfaces - Type 3.

END OF SECTION 07 92 00

SECTION 08 36 23 – HIGH SPEED DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes high-speed roll-up doors.

1.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance: Exterior high-speed roll-up doors shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Wind Loads: Door to have the ability to withstand wind loads of up to 100 mph.

1.3 REFERENCES

- A. NEMA – National Electrical Manufacturers Association.
- B. LED – Light Emitting Diode.

1.4 SUBMITTALS

- A. Product Data: For each type and size of high-speed roll-up door and accessory.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

- B. Product Qualifications: Specific door model used must have a proven track record of successful installations in similar applications of no less than 5 years. References must be available by request of the Architect / Engineer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Door Panel: Double-walled, aluminum slats, 6 inches high by 1-3/16" thick.
 - 1. Door slats to be insulated with closed-cell polystyrene insulation.
 - 2. Integral rubber weather-seal between each individual door slat.
 - 3. Door slats to be connected by hinge system to provide additional rigidity, support and security to door curtain.
- B. Side Frames: 11 gauge, galvanized steel side frames with 14 gauge, galvanized covers.
 - 1. Dual, full height weather-seal to seal against both side of the door panel.

2.2 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Overhead tracks to roll back and travel horizontally to the floor. Track configuration to be low-headroom.
- B. Control Software: Software to incorporate a self-adjusting limit feature. Software to monitor the door position and adjust the limits as required to maintain a proper seal.

2.3 TRAVEL LIMITS

- A. General: Door to use an absolute rotary encoder to regulated door travel limits.
 - 1. Limits to be adjustable without the use of tools from floor level at the control panel.
 - 2. Control software to incorporate a self-adjusting limit feature, the software monitors the door position and adjusts the limits as required to maintain a proper seal.

2.4 COUNTERBALANCE MECHANISM

- A. Counterbalance: Up to six extension springs in each side column, depending on the size of the door. Mechanical release lever on side column to allow door to be opened in the event of a power failure.

2.5 DRIVE SYSTEM AND ELECTRICAL CONTROLS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door specified.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door-Operator Type: As specified by the Basis-of-Design Product.
- D. Drive System: Three-phase, variable speed AC drive. Minimum 2 HP.
- E. Electrical Controls: Basis-of-Design, **Rytec, System 3** controller with self-diagnostic system and LCD display.
 - 1. Two- line, 32-character LCD display provides self-diagnostic and status messaging as well as quick, straightforward installation and control adjustments.
 - 2. 12 programmable inputs and 3 programmable outputs to accommodate control applications without the need for additional electrical components.
 - 3. Tamperproof cycle counter viewable without opening enclosure.
 - 4. Programming and adjustments made using touchpad on face of control box.
- F. Travel Speed: Up to 60” per second opening and 30” per second closing.
 - 1. Both opening and closing travel speed to be independently adjustable using a touchpad on the face of the control box.
- G. Obstruction Detection Device: Equip doors with two (2) automatic safety devices capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction. Provide self-monitoring capability designed to interface with door-operator control circuit to detect damage to or disconnection of sensor device.
 2. Edge Sensor: Full-width, electric reversing edge along the bottom of the door.
- H. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 4, Type 1 enclosure.
 2. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- I. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- J. Emergency Operation Disconnect Device: Mechanical release lever on the side column to allow for manual operation of the door in the event of a power failure.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

2.6 DOOR SYSTEM AND OPERATIONAL REQUIREMENTS

- A. High-Speed Aluminum Roll-Up Door: Door slats formed with hinged sections.
1. Basis-of-Design Product: Subject to compliance with requirements, provide **Rytec, Spiral LH** or comparable product by one of the following:
 - a. Overhead Door Corporation.
 - b. Wayne-Dalton Corp.
- B. Operation Cycles: Not less than 40,000 per year.
- C. Door Sections: Solid panels and Full vision panels with manufacturer's standard, nonglazed panels across bottom section of door.
- D. Electric Door Operator:
1. Usage Classification: Heavy duty, 60 to 90 cycles per hour.
 2. Operator Type: As specified by the Basis-of-Design product above.
 3. Motor Exposure: Interior.
 4. User Control: Card access at the exterior (entrance), loop detection at the interior (exit). See item #6 for remote-control station locations.
 5. Emergency Manual Operation: Push-up type.
 6. Remote-Control Station: Exterior (key operated) and interior (push button) locations chosen by Owner in the field.

- E. Door Finish:
 - 1. Aluminum Finish: Anodized color as selected by Architect / Engineer from manufacturer's full range.
 - 2. Finish of Interior Facing Material: Match finish of exterior face.

2.7 SCHEDULED MAINTENANCE

- A. No lubrication of any kind required anywhere on the door or its components for the life of the door.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install high-speed roll-up doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks: Provide bracing and reinforcement as required for rigid installation of track and door-operating equipment. Repair galvanized coating on tracks according to ASTM A 780.
- C. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion. Adjust doors and seals to provide weathertight fit around entire perimeter.

3.2 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 08 36 13

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Door thresholds.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed finish.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by product manufacturer.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide new thresholds (only where they are existing) for each door within or adjacent to the work area (9 possible locations) to comply with requirements in this Section.
- B. Designations: Products are identified by using door hardware designations, as follows:
 - 1. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.2 THRESHOLDS

- A. Standard: BHMA A156.21.
- B. Accessibility Requirements: Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.
- D. Manufacturers:
 - 1. National Guard Products (NGP).
 - 2. Pemko Manufacturing Co. (PEM).
 - 3. Reese Enterprises (RE).

2.3 FABRICATION

- A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of existing thresholds and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- B. Fasteners: Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Comply with NFPA 80 for fasteners of door hardware in fire-rated applications.
- C. Finishes: BHMA A156.18, as indicated in door hardware sets.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

END OF SECTION 08 71 00

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
 - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
 - 2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. Sound Transmission Characteristics: For STC-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 2. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch diameter wire, or double strand of 0.0475-inch diameter wire.

- B. Hanger Attachments to Concrete:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to **5** times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Postinstalled, expansion anchor.
 - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to **10** times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; 640-C Fire Front 650-C Drywall Furring System.
 - c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.0209 inch (25 gauge)
- B. Slip-Type Head Joints: Where indicated, provide the following:
 - 1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Steel Network Inc. (The); VertiClip SLD Series.
 - 2) Superior Metal Trim; Superior Flex Track System (SFT).
- C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0179 inch
- D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base Metal Thickness: 0.0179 inch
 2. Depth: 7/8 inch and 1-1/2 inches where indicated on drawings.
- E. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

- A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
1. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 2. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

3.2 INSTALLING SUSPENSION SYSTEMS

- A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- B. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Do not attach hangers to steel roof deck.
 4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 6. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- C. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.3 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install tracks (runners) at structure above and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- C. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- D. Z-Furring Members:
1. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 2. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16

SECTION 09 24 00 - PORTLAND CEMENT PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior portland cement plasterwork on metal lath.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

C. Samples: For each type of factory-prepared finish coat indicated.

1.3 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Sound-Transmission Characteristics: Where indicated, provide portland cement plaster assemblies identical to those of assemblies tested for STC ratings per ASTM E 90 and classified according to ASTM E 413 by a qualified testing agency.

1.4 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 METAL LATH

A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.

1. Diamond-Mesh Lath: Flat, 3.4 lb/sq. yd.

2. 3/8-Inch Rib Lath: 4 lb/sq. yd.

2.2 ACCESSORIES

- A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Metal Accessories:
 1. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
 2. Cornerbeads: Fabricated from zinc-coated (galvanized) steel.
 - a. Style; Match existing unless otherwise indicated.
 3. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.

2.3 MISCELLANEOUS MATERIALS

- A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in portland cement plaster.
- C. Bonding Compound: ASTM C 932.
- D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.
- E. Fasteners for Attaching Metal Lath to Substrates: Complying with ASTM C 1063.
- F. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter, unless otherwise indicated.
- G. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- H. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants"

2.4 PLASTER MATERIALS

- A. Portland Cement: ASTM C 150, Type II.

1. Color for Finish Coats: White.
- B. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
- C. Sand Aggregate: ASTM C 897.
 1. Color for Job-Mixed Finish Coats: White.
- D. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.

2.5 PLASTER MIXES

- A. General: Comply with ASTM C 926 for applications indicated.
 1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.
- B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
 1. Portland Cement Mixes:
 - a. Scratch Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
 - b. Brown Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect adjacent work (including existing built-in items, furniture, files, equipment, etc.) from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.2 INSTALLATION, GENERAL

- A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
- B. Sound Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

- C. Acoustical Sealant: Where required, seal joints between edges of plasterwork and abutting construction with acoustical sealant.

3.3 INSTALLING METAL LATH

- A. Expanded-Metal Lath: Install according to ASTM C 1063.
 - 1. Partition Framing and Vertical Furring: Install flat diamond-mesh lath.
 - 2. Flat-Ceiling and Horizontal Framing: Install 3/8-inch rib lath.

3.4 INSTALLING ACCESSORIES

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External Corners:
 - 1. Install cornerbead at interior locations.

3.5 PLASTER APPLICATION

- A. General: Comply with ASTM C 926.
- B. Walls; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 3/4-inch thickness.
 - 1. Portland cement mixes.
- C. Ceilings; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 1/2 inch thick.
 - 1. Portland cement mixes.
- D. Plaster Finish Coats: Apply to provide finish to match existing adjacent plaster surfaces.

3.6 PLASTER REPAIRS

- A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

END OF SECTION 09 24 00

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples:

1. For each type indicated, provide manufacturer's standard sample board.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

2.2 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. PABCO Gypsum.
7. Temple-Inland.
8. USG Corporation.

- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Locations: Where required to match existing for patching and repair,

2. Thickness: 5/8 inch
3. Long Edges: Tapered

C. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Locations: Where required to match existing for patching and repair.
2. Core: 5/8 inch , Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: aluminum-coated steel sheet or rolled zinc steel sheet.
 - a. Cornerbead.
 - b. L-Bead: L-shaped; exposed long flange receives joint compound.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

2.5 AUXILIARY MATERIALS

A. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) FS-HH-I-521; preformed mineral wool, 3 1/2" thick, friction fit type without integral vapor barrier membrane.

D. Acoustical Joint Sealant: ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings as demonstrated by testing according to ASTM E 90.

1. Products: Subject to compliance with requirements provide one of the following:

- a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
2. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. Install trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
 1. Control Joints: Install control joints according to ASTM C 840
- E. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 1. Level 1: Ceiling plenum areas and concealed areas
 2. Level 4: Walls and ceilings exposed to view
- H. Protect adjacent surfaces from drywall compound and texture finishes and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- I. Remove and replace panels that are wet, moisture damaged, and mold damaged.

3.2 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners
 - 2. L-Bead: Use where indicated

END OF SECTION 09 29 00

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes suspended metal grid ceiling system, perimeter trim and acoustic tile.

1.2 REFERENCES

- A. ASTM C635 - Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- C. ASTM C665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- D. ASTM E580 - Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
- E. CISCA (Ceilings and Interior Systems Contractors Association) - Acoustical Ceilings: Use and Practice.
- F. UL (Underwriters Laboratories, Inc.) - Fire Resistance Directory.

1.3 PERFORMANCE REQUIREMENTS

- A. Suspension System: Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1:360.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system. Indicate method of suspension where interference exists.
- B. Product Data: Submit data on metal grid system components and acoustic units.
- C. Samples: Submit two samples illustrating material and finish of acoustic units.
- D. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

- A. Conform to CIRCA requirements.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustic unit installation.

1.8 SEQUENCING

- A. Sequence Work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Install acoustic units after interior wet work is dry.

1.9 EXTRA MATERIALS

- A. Furnish extra tiles for the owner's use:
 - 1. Acoustical Ceiling Tile: Full-size units equal to 2 percent of amount installed for each type indicated.

PART 2 PRODUCTS

2.1 SUSPENSION SYSTEM MATERIALS

- A. Manufacturers:
 - 1. Armstrong World Industries.
 - 2. USG Interiors.
- B. Typical Grid:
 - 1. Match Existing.
- C. Perimeter Trim:
 - 1. Match Existing.

2.2 SUSPENDED ACOUSTICAL TILE

- A. Manufacturers:
 - 1. Armstrong World Industries.
 - 2. USG Interiors.

- B. Materials:
 - 1. ACT 1: Match Existing
- C. Locations
 - 1. Where existing ACT ceiling are damaged or require replacement due to work associated with the Lower Level Parking Restoration.

2.3 ACCESSORIES

- A. Touch-up Paint: Type and color to match acoustic and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify layout of hangers will not interfere with other work.

3.2 INSTALLATION

- A. Lay-In Grid Suspension System:
 - 1. Install suspension system in accordance with ASTM C636 and as supplemented in this section.
 - 2. Locate infill portions to align with existing ACT system.
 - 3. Install after major above ceiling work is complete. Coordinate location of hangers with other work.
 - 4. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
 - 5. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.
 - 6. Do not eccentrically load system, or produce rotation of runners.
 - 7. Perimeter Angle Molding:
 - a. Install edge molding at intersection of ceiling and vertical surfaces.
 - b. Use longest practical lengths.
 - c. Miter corners.
 - d. Install at junctions with other interruptions.

3.3 ERECTION TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 12 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION 09 51 00

SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
1. Basement: Exposed interior items and surfaces where damaged or modified by work that is part of this project. Where a wall or ceiling is replaced or repaired, paint the entire wall or ceiling. ***PLEASE NOTE: ALL NEW PAINT OVER EXISTING PAINTED SURFACES SHALL MATCH THE EXISTING PAINT SCHEME INCLUDING NUMBER OF COLORS AND DESIGN***
 2. Lower Level Parking: Walls, ceilings, columns, exterior corner guards at overhead doors and interior and exterior hollow metal doors and frames. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment. ***PLEASE NOTE: ALL NEW PAINT OVER EXISTING PAINTED SURFACES SHALL MATCH THE EXISTING PAINT SCHEME INCLUDING NUMBER OF COLORS AND DESIGN***
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect / Engineer will select from standard colors and finishes available.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork and casework.
 - b. Metal toilet enclosures.
 - c. Elevator entrance doors and frames.
 - d. Elevator equipment.
 - e. Finished mechanical and electrical equipment.
 - f. Light fixtures.
 - g. Distribution cabinets.
 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Ceiling plenums.
 - d. Utility tunnels.
 - e. Pipe spaces.

- f. Duct shafts.
 - g. Elevator shafts.
3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper.
 - e. Bronze and brass.
 4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
 5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.2 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
 3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
 4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
 5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.3 SUBMITTALS

- A. Product Data: For each paint system specified.
 1. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
 2. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
- B. Samples for Verification: Provide three samples of each color and material to be applied, with texture to simulate actual conditions.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.7 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
 - 1. Quantity: Furnish the Owner with an additional 1 gallon of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products in the paint schedules.
 - 1. Benjamin Moore & Co. (Moore).
 - 2. PPG Industries, Inc. (PPG).
 - 3. Pratt & Lambert, Inc. (P & L).
 - 4. Sherwin-Williams Co. (S-W).

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Color and sheen to be selected by the Architect / Engineer from the manufacturer's full range. In basement areas, all colors and sheens to match existing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
 - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
1. Notify the Architect / Engineer about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime.
 2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
 3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
 - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.

- b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
- 4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 - 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Paint colors, surface treatments, and finishes will be determined in the field by the Architect / Engineer.
 - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 - 3. Provide finish coats that are compatible with primers used.
 - 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 - 5. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 - 6. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 - 1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as

- recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports.
 2. Heat exchangers.
 3. Tanks.
 4. Ductwork.
 5. Insulation.
 6. Motors and mechanical equipment.
 7. Accessory items.
- F. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
 2. Switchgear.
 3. Panelboards.
- G. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- H. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

- I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect / Engineer.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 EXTERIOR PAINT SCHEDULE

- A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
 - 1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a rust-inhibitive primer.
 - a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.
 - 1) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
 - 2) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
 - 3) P & L: S/D 1009 Suprime "9" Interior/Exterior Alkyd Metal Primer.
 - 4) S-W: Pro-Cryl Universal Acrylic Primer
 - b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.
 - 1) Moore: MoorGlo Latex House & Trim Paint #096.
 - 2) PPG: 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.

- 3) P & L: Z/F 3100 Series Aqua Royal Latex House & Trim Finish. Retain the paint system below for a full-gloss, alkyd-enamel finish over exterior ferrous metal subject to normal use and moderate environments.
 - 4) S-W: Sher-Cryl High-Performance Acrylic
- B. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces:
1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a galvanized metal primer.
 - a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
 - 1) Moore: IronClad Galvanized Metal Latex Primer #155.
 - 2) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
 - 3) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
 - 4) S-W: Pro-Cryl Universal Acrylic Primer.
 - b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.
 - 1) Moore: MoorGlo Latex House & Trim Paint #096.
 - 2) PPG: 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.
 - 3) P & L: Z/F 3100 Series Aqua Royal Latex House & Trim Finish.
 - 4) S-W: Sher-Cryl High-Performance Acrylic.

3.7 INTERIOR PAINT SCHEDULE

- A. Concrete Masonry Units – ***BASEMENT ONLY***: Provide the following finish systems over interior concrete masonry block units:
1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a block filler.
 - a. Block Filler: High-performance, latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 5.0 mils.
 - 1) Moore: Moorcraft Interior & Exterior Block Filler #173.
 - 2) PPG: 6-7 Speedhide Interior/Exterior Masonry Latex Block Filler.
 - 3) P & L: Z 98 Pro-Hide Plus Latex Block Filler.
 - 4) S-W: Preprite Block Filler.
 - b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.
 - 1) Moore: Moore's Regal AquaVelvet #319.
 - 2) PPG: 89 Line Manor Hall Eggshell Latex Wall and Trim Enamel.

- 3) P & L: Z/F 4000 Series Accolade Interior Velvet. Retain the paint system below for an acrylic-latex-based, semigloss enamel finish over interior concrete masonry block units subject to normal use and moderate environments. This finish is an alternative to solvent-based, semigloss enamels.
 - 4) S-W: Promar 200
- B. Concrete Masonry Units – **LOWER LEVEL PARKING ONLY**: Provide the following finish systems over interior concrete masonry block units:
1. Semi-Gloss / High Luster Finish (Water Base) Epoxy: 2 finish coats over a block filler.
 - a. Block Filler: High-performance, latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 10.0 mils wet.
 - 1) S-W: Heavy Duty Block Filler, B42W46 (Basis of Design)
 - b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 4-6 mils dry.
 - 1) S-W: Pro Industrial HB / Water Based Epoxy, B71W111 / B71W100 Series (Basis of Design)
- C. Cast-In-Place Concrete – **LOWER LEVEL PARKING ONLY**: Provide the following finish systems over cast-in-place concrete:
1. Semi-Gloss / High Luster Finish (Water Base) Epoxy: 2 finish coats.
 - a. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 4-6 mils dry.
 - 1) S-W: Pro Industrial HB / Water Based Epoxy, B71W111 / B71W100 Series (Basis of Design)
- D. Ferrous Metal: Provide the following finish systems over ferrous metal:
1. Semigloss, Acrylic-Enamel Finish: One finish coat over an enamel undercoater and a primer.
 - a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
 - 1) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
 - 2) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
 - 3) P & L: S 4551 Tech-Gard High Performance Rust Inhibitor Primer.
 - 4) S-W: Pro-Cryl Universal Acrylic Primer.

- b. Undercoat: Alkyd, interior enamel undercoat or semigloss, acrylic-latex, interior enamel, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.
 - 1) Moore: Moore's Alkyd Enamel Underbody #217.
 - 2) PPG: 6-6 Speedhide Interior Quick-Drying Enamel Undercoater.
 - 3) P & L: Z/F 4100 Series Accolade Interior Semi-Gloss.
 - 4) S-W: Sher-Cryl High-Performance Acrylic.
- c. Finish Coat: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.
 - 1) Moore: Moore's Regal AquaGlo Vinyl-Acrylic Latex Enamel #333.
 - 2) PPG: 88-110 Satinhide Interior Enamel Wall & Trim Lo-Lustre Semi-Gloss Latex.
 - 3) P & L: Z/F 4100 Series Accolade Interior Semi-Gloss. Retain the paint system below for a semigloss, alkyd-enamel finish over interior ferrous metal subject to normal use and moderate environments.
 - 4) S-W: Sher-Cryl High-Performance Acrylic.

E. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal:

- 1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.
 - a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
 - 1) Moore: IronClad Galvanized Metal Latex Primer #155.
 - 2) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
 - 3) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
 - 4) S-W: Sher-Cryl High-Performance Acrylic.
 - b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.
 - 1) Moore: Moore's Regal AquaGlo Vinyl-Acrylic Latex Enamel #333.
 - 2) PPG: 88-110 Satinhide Interior Enamel Wall & Trim Lo-Lustre Semi-Gloss Latex.
 - 3) P & L: Z/F 4100 Series Accolade Interior Semi-Gloss. Retain the paint system below for a semigloss, alkyd-enamel finish over interior galvanized metal subject to normal use and moderate environments.
 - 4) S-W: Pro-Cryl Universal Acrylic Primer.

F. Gypsum Board and Portland Cement Plaster – **BASEMENT ONLY**: Provide the following finish systems over interior gypsum board surfaces:

1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.
 - a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
 - 1) Moore: Regal First Coat Interior Latex Primer & Underbody #216.
 - 2) PPG: 17-10 Quick-Drying Interior Latex Primer-Sealer.
 - 3) P & L: Z/F 1004 Suprime "4" Interior Latex Wall Primer.
 - 4) S-W: Preprite High Build Interior Latex Primer/Surfacer.
 - b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.
 - 1) Moore: Moore's Regal AquaVelvet #319.
 - 2) PPG: 89 Line Manor Hall Eggshell Latex Wall and Trim Enamel.
 - 3) P & L: Z/F 4000 Series Accolade Interior Velvet.
 - 4) S-W: Promar 200.

END OF SECTION 09 91 00

**SECTION 15890
METAL AND FLEXIBLE DUCT**

PART 1 -GENERAL

1.1 SCOPE OF WORK

- A. Duct and duct-associated materials and procedure in this section include:
1. Sheet metal materials
 2. Single-wall rectangular ducts and fittings
 3. Single-wall round ducts and fittings
 4. Flexible ducts
 5. Sealants and gaskets
 6. Hangers and supports
- B. Products/material specified under other Divisions but installed under this section:
1. Duct-mounted smoke detectors

1.2 DEFINITIONS

- A. Duct Size: Duct sizes indicated herein or on associated drawings shall be the inside clear dimensions of actual air path for both unlined and lined ducts.
- B. Pressure Class: A "SMACNA -HVAC Duct Construction Standards, Metal and Flexible" pressure classification system designating static pressure values (in inches w.g.) equal to the maximum operating pressure to which the ductwork can safely be subjected.

1.3 CODES AND STANDARDS

- A. ASTM A 36/A 36M-97a: Specification for Carbon Structural Steel
- B. ASTM A 366/A 366M-97: Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
- C. ASTM A 480/A 480M-98a: Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
- D. ASTM A 653/A 653M-99a: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- E. ASTM B 209-96: Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- F. ASTM C 411-97: Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
- G. ASTM C 534-94: Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
- H. ASTM C 916-85 (Reapproved 1996): Specification for Adhesives for Duct Thermal Insulation
- I. ASTM C 920-98: Specification for Elastomeric Joint Sealants

- J. ASTM C 1071-98: Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material)
- K. ASTM E 84-00a: Test Method for Surface Burning Characteristics of Building Materials
- L. NFPA 90A-99: Installation of Air Conditioning and Ventilating Systems (ANSI)
- M. NFPA 90B-99: Installation of Warm Air Heating and Air Conditioning Systems (ANSI)
- N. NFPA 96-98: Ventilation Control and Fire Protection of Commercial Cooking Operations (ANSI)
- O. NAIMA AH124-98: Fibrous Glass Duct Liner Standard
- P. SMACNA: Duct Cleanliness for New Construction, 2000
- Q. SMACNA: HVAC Air Duct Leakage Test Manual, 1985
- R. SMACNA: HVAC Duct Construction Standards-Metal and Flexible, 1995 (excluding all amendments and proposed revisions).
- S. UL 181-96 (Rev. 98): Factory-Made Air Ducts and Air Connectors
- T. UL 723-96 (Rev. 98): Test for Surface Burning Characteristics of Building Materials

1.4 QUALITY ASSURANCE

- A. Construct ductwork to NFPA 90A standards.
- B. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall, at a minimum, comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," excluding all amendments and proposed revisions, and performance requirements and design criteria indicated.
 - 1. All further references to conformance with the requirements of SMACNA's "HVAC Duct Construction Standards -Metal and Flexible" shall always mean with the exclusion of all amendments and proposed revisions.
 - 2. Where the requirements of this specification exceed the requirements of the SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," the specifications shall govern.
- C. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.
- D. Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards -Metal and Flexible."

1.5 SUBMITTALS

- A. Product Data: Submit for each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets: submit manufacturer's data sheets including performance data, pressure ratings, surface burning characteristic and installation instruction.

B. Duct Testing Submittals and Reports:

1. Submit duct pressure testing plan with duct shop drawings, including list of ducts to be tested and duct testing schedule.
2. Submit documentation of duct performance testing and submit performance testing result reports within two weeks of testing.
3. Contractor shall be responsible for any corrective action required due to a failed duct leakage test.

C. Manufacturer's Installation Instruction: Submit manufacturer's installation instructions for all manufactured ductwork.

D. Field record drawings:

1. During the construction process, the Contractor shall maintain a set of drawings showing the exact routing and location of duct systems being installed. The drawings shall be updated neatly by hand on a daily basis and account for routing modifications made in the field. Contractor shall use these drawings as a basis for generating the project as-built drawings.

E. As-built drawings:

1. Upon completion of project, Contractor shall furnish as-built drawings showing in scale the exact routing and locations of all newly installed ductwork systems. Submit in both hard-copy and electronic AutoCAD format.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Protect new duct interiors from moisture, construction debris and dust, and other foreign materials. If inside of new duct becomes dirty, Contractor shall clean duct per Duct Cleaning specifications.
- B. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

1.7 WARRANTY

- A. One year warranty on products and complete installation commencing at the time of Substantial Completion.

PART 2 -PRODUCTS

2.1 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
1. Galvanized Sheet Steel: Comply with ASTM A 653. Lock forming quality with G-90 galvanized coating designation (not less than 1.25 oz. of zinc on each side of each square foot of sheet).
 2. Paint Grip Steel; mill-phosphatized "Paintgrip" or "Zincgrip" finish suitable for field painting.

3. Minimum ducts gauges shall be in accordance with the following table. This table shall be used in conjunction with SMACNA table for application of appropriate reinforcement in accordance with proper pressure class.

(1) Galvanized steel -rectangular duct:

Maximum Duct Dimension (in.)	Minimum Duct Gauge	Comments
Up to 10	26	pressure class 2" w.g.
Up to 10	24	pressure class greater than 2" w.g.
12 through 29	24	
30 through 53	22	
54 through 84	20	
Over 84	18	
Duct located out-of-doors	18	

(2) Galvanized steel -round duct:

Maximum Duct Dimension (in.)	Minimum Duct Gauge	
Up to 10	26	pressure class 2" w.g.
Up to 10	24	pressure class greater than 2" w.g.
11 thru 17	24	
18 thru 27	22	
28 thru 35	20	
35 thru 52	18	

2.2 SINGLE WALL RECTANGULAR DUCTS AND FITTINGS (SHOP AND FACTORY FABRICATED)

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lindab Inc.
 2. McGill AirFlow LLC.
 3. SEMCO Incorporated.
 4. Shop fabricated duct is acceptable for ducts with a pressures class rating of 6" w.g. or less provided compliance with the requirements herein are met.
- B. General Fabrication Requirements:
1. Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
 2. Comply with SMACNA's "Industrial Duct Construction Standards" where indicated.

- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible" except as otherwise noted.
 - 1. No duct shall be constructed to less than 2" w.g.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 1-5, "Longitudinal Seams Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," except at otherwise noted:
 - 1. Button Punch Snap Lock is not acceptable.
- E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," except as otherwise noted.

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS (FACTORY AND SHOP-FABRICATED)

- A. Acceptable Manufacturers:
 - 1. Lindab Inc.
 - 2. McGill AirFlow LLC.
 - 3. SEMCO Incorporated.
 - 4. Shop fabricated ducts are acceptable for all positive pressure ducts and negative pressure ducts with ratings of -1" w.g. to -4" w.g.
- B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. All round ducts must utilize spiral lock seam except:
 - a. Ducts up to and including 12" diameter with a positive pressure class of 2" w.g. and less may utilize longitudinal lock seam construction.
- C. SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 3-2, "Transverse Joints -Round Duct," for static-pressure class, applicable sealing requirements, and materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards -Metal and Flexible."
 - 1. Transverse joints in ducts larger than 60" in diameter shall be flanged.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 3-1, "Seams -Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support

intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards -Metal and Flexible."

1. Fabricate round ducts larger than 48" in diameter with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards -Metal and Flexible."

2.4 FLEXIBLE DUCTS

A. Acceptable Manufacturers:

1. Buckley Associates, Inc.
2. Flexmaster USA
3. McGill AirFlow LLC.
4. Thermaflex

B. Quality Assurance:

1. Factory fabricated UL listed under UL-181 as Class 1 duct, meeting requirements of NFPA 90A with a flame spread rating of 25 or less and smoke development rating of 50 or less, unless otherwise noted.
2. Only factory-insulated flexible duct is acceptable. No field-insulated flexible duct is allowed.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a quick-release worm-gear action, to suit duct size. Nylon or other nonmetallic draw bands are not acceptable.

2.5 SEALANT AND GASKETS

A. Acceptable Manufactures for Duct Sealant:

1. Hardcast
2. United McGill
3. Ductmate

B. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

C. Duct Sealant:

1. Water-based non hardening, water resistant, mold and mildew resistant sealant classified compounded specifically for sealing joints and seams in ductwork.

- a. Maximum Static-Pressure Class: 10" w.g., positive and negative.
 - b. Service: Indoor or outdoor.
 - c. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets for specific applications.
2. Duct tapes are not allowed.
- D. Flanged Joint Sealant: Comply with ASTM C 920. General: Single-component, acid-curing, silicone, electrometric. Type S, Grade NS, Class 25, Use O.
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- 1. Gaskets used in chemical, laboratory, or process exhaust duct systems shall be suitable for exposure to substances in the air stream. Contractor shall verify the compatibility with Engineer prior to installation.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Dry or Non-corrosive Environments: Cadmium-plated steel rods and nuts.
- B. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- C. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 -EXECUTION

3.1 APPLICATION

- A. Install duct with duct material for pressure class as per the following table:

Duct System and Location	Material	Pressure Class
VAV supply system: duct from RTU discharge to inlet of air terminal units	Galvanized steel (G90)	+4"
VAV supply system: duct downstream of air terminal units	Galvanized steel (G90)	+2"
Constant volume supply: all duct	Galvanized steel (G90)	+3"
Outside air and exhaust plenums	Galvanized steel (G90)	-2"
Return system with air terminal units: duct from air terminal units to inlet of return fan	Galvanized steel (G90)	-4"
Return system with air terminal units: duct from return grille to terminal unit	Galvanized steel (G90)	-2"
Return system with no air terminal units: all duct	Galvanized steel (G90)	-2"
Air relief and transfer	Galvanized steel (G90)	+2"

B. Utilize the following flexible ducts for the applications as outlined below:

Duct System and Location	Flexible Duct Type
VAV supply system: duct from RTU discharge to inlet of air terminal units	Insulated corrugated metal flexible duct
Return system with no air terminal units: all duct	Noninsulated aluminum laminate flexible duct

3.2 INSTALLATION

A. General

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Where interferences develop in field, offset or reroute ductwork as required for clearing such interference.
2. Contactor shall modify specified duct sizes as required to fit. Modified duct size shall have cross-sectional area and pressure drop equivalent to that of the specified duct size.
3. All ducts shall be airtight and free from pulsation and vibration at normal operating conditions.
4. Contractor shall submit sheet metal shop drawings to the Test and Balance Contractor for review, and provide any additional volume dampers that the Test and Balancing Contractor needs to perform final balancing.
5. Install round ducts in maximum practical lengths.

6. Install ducts with fewest possible joints.
7. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
8. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
9. Install ducts with a minimum clearance of 1", plus allowance for insulation thickness.
10. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
11. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
12. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1½".
13. Where ducts pass through fire and smoke rated interior partitions and exterior walls, install fire, smoke, and/or combination fire/smoke dampers. Contractor shall obtain a copy of architectural drawings showing the fire and smoke rated partitions and exterior walls at the time of bid and provide the appropriate damper (at all ducts penetrating fire and smoke rated partitions and walls whether shown on mechanical plans or not). Comply with requirements in Division 15 Section "Duct Accessories" for fire and smoke dampers.
14. Provide openings in ducts where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage. Where openings are provided in insulated ducts, install insulation material inside a metal ring.
15. Fabricate continuously welded medium and high pressure round duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4" cemented slip joint, brazed or electric welded. Prime coat welded joints.
16. Install duct-mounted smoke detectors.
17. Where ducts of different metals meet, joint shall use a gasket, seal or compound to prevent the two different metals from coming in contact.
18. Galvanized surfaces altered or damaged (including the damage due to welding) shall be painted with a galvanized paint.
19. For paint grip steel ducts, place identification stickers in side ducts off of the surface to be painted.
20. Gaskets shall not protrude into airstream.
21. Elbows:
 - a. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction

Standards -Metal and Flexible," Figure 2-2, "Rectangular Elbows."

- (1) For supply duct:
 - (a) Use Radius Type RE 1 with minimum 1.5 radius-to diameter ratio.
 - (b) If space does not allow the use of a Radius Type RE1, provide a square-throated elbow with turning vanes. Turning vanes shall comply with the requirements of Division 15 Section "Duct Accessories".

(2) For return and exhaust duct:

- (a) Use Radius Type RE 1 with minimum 1.5 radius-to diameter ratio.
 - (b) If space does not allow the use of a Radius Type RE1, provide a square throated elbow with vanes. Turning vanes shall comply with the requirements of Division15 Section "Duct Accessories."
- b. Round Duct, excluding laboratory (fume handling) exhaust duct: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 3-3, "Round Duct Elbows."

(1) Use minimum 1.5 radius-to-diameter ratio.

- (a) 12" and Smaller in Diameter: Stamped (pleated not acceptable)
- (b) 14" and Larger in Diameter: Standing seam or welded five-piece 90 degree turning elbows (three-piece elbows not acceptable for 90 degree elbow).
- (c) 45 degree elbows shall meet the requirements for 90 degree elbows and shall be die stamped up to 12" and three piece construction of sized greater than 12".

22. Branch Configurations:

a. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 2-6, "Branch Connections."

- (1) Rectangular main to rectangular branch: 45-degree entry.
- (2) Rectangular main to round branch: Bellmouth connection; spin in connections are allowed only on supply duct downstream of air terminal units and return ducts upstream of air terminal units.
- (3) No straight tap, butt flange or cinch lock is allowed

b. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees."

- (1) Provide 45-degree lateral tap; conical taps are allowed only on supply duct downstream of air terminal units and return ducts upstream of air terminal units.

- (2) Saddle taps are permitted only for new connection in existing duct.
 - (3) No 90 degree taps are allowed.
- 23. Offsets and transitions: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 2-7, "Offsets and Transitions."
 - a. Transitions:
 - (1) Increase duct sizes gradually, not exceeding 15 degrees on each side for a concentric transition or 30 degrees on one each side for an eccentric transition.
 - (2) Decrease duct sized not exceeding 22.5 degrees on each side for a concentric transition or 45 degrees on one side for an eccentric transition.
 - b. Offsets:
 - (1) Provide smooth radius offset with the radius equal to the duct dimension.
 - (2) Mitered offset Type 2 is acceptable provided the offset angle no greater that 15 degrees.
- 24. Easements for obstructions:
 - a. Provide easements where ductwork conflicts with piping and structure.
 - b. Where easements exceed 10% duct area, split into two ducts maintaining original duct area.
- 25. Seam and joint sealing:
 - a. For all new ducts, all transverse joints, longitudinal seams and connections shall be sealed in conformance with SMACNA Class A sealing requirements as defined in the 1995 SMACNA HVAC Duct Construction Standards -Metal and Flexible, Second Edition.
- 26. Hangers and supports: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Chapter 4, "Hangers and Supports."
 - a. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - (1) Where practical, install concrete inserts before pouring concrete.
 - b. Support ducts using traverse steel and threaded rods or 1" wide straps of 16 gauge galvanized steel. Wire or perforated straps of any kind are not acceptable.
 - c. No hangers and supports shall be attached to ducts with sheet metal screws that penetrate any part of ducts.
 - d. Round duct shall be suspended on prefabricated circular single loop or two-

piece bands completely encircling ducts.

- e. Hanger Spacing: Except where requirements herein exceed, comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct,"
 - (1) Provide duct supports at a maximum of 6 foot intervals, within 24" of each elbow, and within 24" of each branch intersection.
 - (2) Provide vertical ducts supports at a maximum of 10 foot intervals.
- f. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

27. Flexible Duct:

- a. Aluminum Laminate or Acoustic CPE Flexible Duct (Insulated or Noninsulated):
 - (1) Connect diffusers to low pressure ducts with a maximum of five feet of flexible duct.
 - (2) Each connection shall be a single piece of flexible duct. No splicing is allowed.
 - (3) Support flexible duct at a maximum of 2 feet on center, with no portion lying on suspended ceiling system or other horizontal surface.
 - (4) Flexible ducts shall not pass through any partition, wall, floor or ceiling.
 - (5) Connect fabric type flexible ducts to diffuser collars or duct with stainless steel draw bands with quick release. Position draw bands behind collar beads if applicable. Connection shall be airtight; seal if required for airtight connection.
- b. Corrugated Metal Flexible Duct Installation:
 - (1) Terminal units may be connected to medium pressure duct mains directly or with a maximum of one foot of Insulated Corrugated Metal Flexible Duct.
 - (2) Do not use Corrugated Metal Flexible Duct to change direction.
 - (3) Connect Corrugated Metal Flexible Duct with sealant and clamps; connection shall be airtight.
- c. For all insulated flexible ducts, pull back insulation and connect internal duct to collar with stainless steel draw band. Then pull insulation and vapor barrier jacket over liner connection and secure with a second draw band. Tape insulation end with three wraps of compatible vapor barrier tape to seal

insulation.

- d. For termination of flexible duct at externally insulated duct, secure flexible duct jacket to duct insulation with three wraps of compatible vapor barrier tape.

-- END OF SECTION -

**SECTION 15910
DUCTWORK ACCESSORIES**

PART 1 -GENERAL

1.1 SCOPE OF WORK

A. Accessories addressed in this section include:

1. Manual volume dampers
2. Control dampers
3. Insulated low leakage control dampers
4. Turning vanes
5. Duct access doors
6. Flexible connectors

1.2 DEFINITIONS

Not Applicable

1.3 CODES AND STANDARDS

- A. AMCA 500 -Test Methods for Louvers, Dampers and Shutters.
- B. AMCA 511 -Certified Ratings Program for Air Control Devices.
- C. NFPA 90A -Installation of Air Conditioning and Ventilating Systems, 2002
- D. SMACNA -HVAC Duct Construction Standards-Metal and Flexible, 1995

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
- B. Ductwork specialties shall be designed and manufactured to conform to the same pressure class as the duct in which they are located, unless otherwise indicated to exceed.

1.5 SUBMITTALS

- A. Product Data: Provide manufacturer's literature and illustrations for all components indicating materials, construction, quantities, size, dimensions and configuration.
- B. Submit a request for substitution if not providing the listed Acceptable Manufacturers for any given product.
- C. Shop Drawings: Provide details of equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection for all products.
- D. Submit operation and maintenance data under provisions of Section 15010.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Section 01600.
- B. Deliver products to site in containers with manufacturer's and UL stamp affixed.
- C. Protect products against dirt, water, chemical and mechanical damage before, during and after installation. Damage to products prior to final acceptance of the Work shall be repaired or replaced at no additional cost to the City.

1.7 WARRANTY

- A. Provide one year warranty.

PART 2 -PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, except where otherwise indicated to exceed the requirements of the Standard.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation. For uninsulated ducts with surfaces exposed to view, provide paint grip steel; mill-phosphatized "Paintgrip" or "Zincgrip" finish suitable for field painting.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4" minimum diameter for tie rod lengths of 36" or less; 3/8" minimum diameter for tie rod lengths longer than 36".

2.2 MANUAL VOLUME DAMPERS

- A. Acceptable Manufacturers:
 - 1. Air Balance, Inc.
 - 2. Nailor Industries, Inc.
 - 3. Ruskin Company
 - 4. Vent Products Company, Inc.
- B. Quality Assurance:
 - 1. Include leakage, pressure drop, and maximum pressure data with submittals.
 - 2. Damper pressure drop ratings shall be based on tests and procedures performed in accordance with AMCA500.
 - 3. Field or shop fabricated manual volume dampers are not acceptable.
- C. Standard Manual Volume Damper:
 - 1. Factory fabricated, rectangular or round damper with required hardware and accessories. Single-blade or multiple-opposed-blade design, with linkage outside airstream, and suitable for horizontal or vertical applications.
 - 2. Performance data:

- a. Capacity: Demonstrate damper capacity to withstand HVAC system operating conditions.
 - (1) Closed position: Maximum pressure of 3" w.g.
 - (2) Open position: Maximum air velocity of 1,500 fpm.
 - b. Pressure drop:
 - (1) Rectangular dampers: Maximum 0.10" w.g. at 1,500 fpm across a 24" x 24" damper.
 - (2) Round dampers: Maximum 0.02" w.g. at 1,500 fpm across a 20" diameter round damper.
 - 3. Rectangular Damper Construction:
 - a. Frame: Hat-shaped, galvanized sheet steel channels, minimum 16 gauge (0.064" thick), with mitered and welded corners; frames with flanges where required for attaching to walls and flangeless frames for installing in ducts.
 - b. Blades: Minimum 16 gauge (0.064" thick), galvanized steel. For ducts 10" in height and less, single blade dampers are acceptable. For ducts over 10" in height, provide multiple blades of 8" maximum width.
 - c. Basis of Design: Ruskin Company Model: MD35.
 - 4. Round Damper Construction:
 - a. Frame: Minimum 0.036" thick galvanized steel with flanges where indicated for attaching to walls.
 - b. Blades: Minimum 20 gauge (0.040" thick) galvanized steel, maximum 16" diameter.
 - c. Basis of Design: Ruskin Company Model MDRS25.
- D. Jackshaft: 1" diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
- 1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- E. Damper Hardware:
- 1. Hand-Operated Damper Regulator:
 - a. For all manual dampers provide a locking type hand quadrant operator with lever handle, position indicator and lock nut for all dampers.
 - b. Provide a minimum of a 2" hand-quadrant stand-off elevated platform where damper is located in insulated ducts.
 - 2. Remote-Operated Damper Regulator:

- a. Where manual dampers are located in inaccessible areas, provide remote type operator complete with stainless steel cable in copper tubing, geared mechanism, and indicator dial for "Open" and "Closed," brushed chrome wall plate and knob and deep wall box. Model 700 manufactured by Young Regulator.

2.3 CONTROL DAMPERS

- A. Control dampers are furnished by the Temperature Control Contractor and are specified under Specification 15950 – Automatic Temperature Controls.

2.4 INSULATED LOW LEAKAGE CONTROL DAMPERS

- A. Insulated low leakage control dampers are furnished by the Temperature Control Contractor and are specified under Specification 15950 – Automatic Temperature Controls.

2.5 TURNING VANES

- A. Acceptable Manufacturers:

1. Aero/Dyne Industries
2. Ductmate Industries, Inc.
3. Carlisle Harcast, Inc

- B. Quality Assurance:

1. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" for vanes and vane runners or provide Aero/Dyne HEP vanes. Vane runners shall automatically align vanes.
2. Vanes shall be factory fabricated on common base rail. Field fabricated vanes are not acceptable.

- C. Construction:

1. 2" or 4½" double-vane, curved blades of galvanized sheet steel set ¾" on center; support with bars perpendicular to blades set a maximum of 2" on center; and set into vane runners suitable for duct mounting.
2. Minimum 24 gauge vanes for ducts less than 30" wide.
3. Minimum 22 gauge vanes for ducts 30" wide and greater.

2.6 FLEXIBLE CONNECTORS

- A. Acceptable Manufacturers:

1. Duro Dyne Corp.
2. Ventfabrics, Inc.

- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

- C. Metal-Edged Connectors: Factory fabricated with a fabric strip minimum 4" wide attached to two strips of 2¾" wide, 24 gauge (0.028" thick), galvanized sheet steel or 0.032" thick aluminum

sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz/sq yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: -40F to +200F.

2.7 DUCT ACCESS DOORS

A. Acceptable Manufacturers:

1. Air Balance, Inc.
2. FlexmasterUSA
3. Greenheck
4. McGill AirFlow Corporation
5. Nailor Industries, Inc.

B. Access Door Construction:

1. General: Fabricate doors airtight and suitable for duct pressure class.
2. Doors shall be rectangular, close-fitting doors of galvanized steel with sealing gaskets, edge protection and quick fastening locking devices suitable for duct pressure class. Access doors with sheet metal screw fasteners are not acceptable.
3. Access doors located in insulated ductwork shall be double wall with insulation fill. Provide a minimum thickness of 1½" insulation fill or thicker insulation as necessary to match the insulation thickness on duct in which the access door is located.
4. Provide number of hinges and locks as follows:
 - a. Up to 18" square: Two hinges and two sash locks.
 - b. Up to 24" x 48": Three hinges and two compression latches with outside handles.
 - c. Sizes 24" x 48" and larger: One additional hinge.
5. Provide viewing port for all access doors 24" x 48" and larger and where indicated.

PART 3 -EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General

1. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" except where otherwise noted to exceed the requirements of this Standard.
2. Provide duct accessories of materials suited to duct materials; use galvanized steel

accessories in galvanized-steel, paint grip steel accessories in paint grip steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

3. Install accessories in accordance with manufacturer's instructions.

B. Manual Volume Dampers

1. Utilize standard volume dampers for:
 - a. supply airflow balancing downstream of terminal units,
 - b. return and exhaust airflow balancing applications further than 30 feet from the return or exhaust fan.
2. Provide manual volume dampers for balancing at all points on supply, return and exhaust systems where branch ducts are taken from larger ducts and at duct or flexible take-offs to supply and return diffusers or registers.
3. Install at a minimum of two duct widths from branch takeoff.
4. When installing volume dampers in ducts with liner; avoid damage to and erosion of duct liner.
5. When installing volume dampers in insulated duct, install regulator with elevated platform such that damper is accessible and adjustable without imparting damage to the insulation.
6. Close duct penetrations for damper components to seal duct consistent with pressure class.
7. Provide remote operated volume control dampers regulator(s) for inaccessible volume dampers.

C. Control Dampers

1. Install control dampers (furnished by the Temperature Control Contractor and specified under Specification 15950 – Automatic Temperature Controls) per manufacturer's instructions.

D. Insulated Low Leakage Control Dampers

1. Install insulated low leakage control dampers (furnished by the Temperature Control Contractor and specified under Specification 15950 – Automatic Temperature Controls) per manufacturer's instructions.

E. Turning Vanes

1. Utilize 2" radius double wall airfoil vanes in:
 - a. Supply distribution ductwork located downstream of air terminal units that is less than or equal to 18" wide.
 - b. Return exhaust distribution ductwork less than or equal to 18" wide.
 - c. Toilet and general exhaust distribution ductwork less than or equal to 18" wide.

2. Utilize 4½" double wall airfoil vanes in:
 - a. Supply distribution ductwork located downstream of air terminal units and greater than 18" wide.
 - b. All supply ductwork located upstream of air terminal units.
 - c. Return distribution ductwork greater than 18" wide.
 - d. Toilet and general exhaust distribution ductwork greater than 18" wide.
3. Install turning vanes for all rectangular square throat elbows, except in transfer air ducts. Install in accordance with SMACNA Standards and manufacturer's recommendations.
4. Install tuning vanes tangential to airflow.

F. Flexible Connectors

1. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators. Installed width shall be not less than 4".
2. For fans developing static pressures of 5" w.g. and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

G. Duct Access Doors

1. Review locations prior to fabrication.
2. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows and anywhere that provisions for maintenance or service of duct-mounted equipment is required
 - a. Before and after filters.
 - b. Before and after coils, including reheat coils. Where a reheat coil is provided integral with a terminal unit, provide an access door after terminal unit coil.
 - c. Downstream from, motorized control dampers and turning vanes.
3. Provide duct access doors sufficient for required inspecting, adjusting and maintenance but not less than the dimension shown below (the duct dimension given is that in which the access door is to be located):
 - a. For duct dimension up to 12": 8"x8"
 - b. For duct dimension 14 " to 21": 12"x12"
 - c. For duct dimension 22" to 48": 18"x18"
 - d. For ducts over 48": 2 doors at 18"x18"

H. Instrument Test Holes

1. Provide duct test holes where indicated and required for testing and balancing purposes.

2. Provide only factory fabricated instrument test holes in ductwork with a pressure rating greater than 2" or less than -2" .
3. Install visible above insulation.

3.2 TESTING, INSPECTIONS AND ADJUSTING

A. Manual Volume Dampers

1. Operate manual control dampers to verify full range of movement is possible. Correct any situation in which dampers cannot travel their full range of movement.
2. Adjust final positioning of manual-volume dampers as specified in Section 15990, "Testing, Adjusting, and Balancing."
3. Operate remote manual volume damper operators to verify full range of movement of operator and damper.

B. Turning Vanes

1. Inspect turning vanes for proper and secure installation.

C. Duct Access Doors

1. Inspect locations of access doors and verify that purpose of access door can be performed.

--END OF SECTION--

SECTION 220511

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Floor drains.
 - 2. Miscellaneous sanitary drainage piping specialties.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
- B. Coordinate size and location of roof penetrations.

PART 2 PRODUCTS

2.1 FLOOR DRAINS

- A. Cast-Iron Floor Drains **FD-1**:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide product by the following:
 - a) Mifab, Inc. Model F1000-3-3M-5
 - 3. Standard: ASME A112.6.3.
 - 4. Pattern: Round floor drain.
 - 5. Body Material: Cast Iron.
 - 6. Top or Strainer Material: Stainless steel.

7. Body Finish: 3M Epoxy finish
8. Top Shape: Round
9. Dimensions of Top or Strainer: 8"
10. Top Loading Classification: Heavy Duty
11. Options: Sediment bucket
12. Options: Coring plug

2.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

2.3 PROTECTION

- A. Protect drains utilizing disposable temporary coring plug as provided, during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 220511

SECTION 221300

FACILITY SANITARY AND VENT PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7]

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements herein for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. CISPI, Hubless-Piping Couplings:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a) MIFAB, Inc.
 - b) Tyler Pipe.
 2. Standards: ASTM C 1277 and CISPI 310.
 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- D. Heavy-Duty, Hubless-Piping Couplings:
 1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a) MIFAB, Inc.
 - b) Tyler Pipe.
 2. Standards: ASTM C 1277 and ASTM C 1540.
 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solvent Cement: ASTM D 2564.
1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
 - a) Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Fernco Inc.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping.

- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- N. Install aboveground PVC piping according to ASTM D 2665.
- O. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Solvent Drainage System: Comply with ASSE 1043 and solvent fitting manufacturer's written installation instructions.
 - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors.
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

- E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.
- F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- G. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- I. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.3 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.

3.4 IDENTIFICATION

- A. Identification markers or strips shall be placed on all exposed and uncovered pipes at 50'-0" intervals and at all branches and on both sides of walls where pipes pass through. Use standard ASME 13.1 for colors.

3.5 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 4. Prepare reports for tests and required corrective action.

3.6 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains utilizing coring plugs during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.7 PIPING SCHEDULE

- A. Aboveground, soil and waste piping NPS 4 4" and smaller shall be of the following:

1. Hubless, cast-iron soil pipe and fittings, hubless-piping couplings; and coupled joints.
 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- B. Aboveground, vent piping NPS 4 4” and smaller shall be of the following:
1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings and coupled joints;
 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 221300

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 – GENERAL

1.1 WORK INCLUDED IN THE ELECTRICAL CONTRACT

- A. The mention of any Article, operation or method required that the Contractor shall provide same and perform each operation in complete accordance with the conditions stated. The Contractor shall provide all material, labor, equipment and transportation as necessary to complete the project in compliance with the Contract Documents. In general, this work includes everything essential for a complete electrical system in operating order as shown on the drawings and indicated in the specifications.
- B. All work shall be installed in accordance with all State and Local Inspection Authorities having jurisdiction together with the recommendations of the manufacturer whose equipment is to be supplied and installed under this Contract.
- C. Before submitting a bid, each bidder shall examine the drawings relating to their work and shall become fully informed as to the extent and character of the work required and its relation to other work in the building.
- D. The Contractor, in conjunction with the Architect's/Engineer's representative, shall establish exact locations of all materials and equipment to be installed. Consideration shall be given to construction features, equipment of other trades and requirements of the equipment proper.
- E. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for deliver, erection and installation of all equipment and apparatus required to be installed by the Contractor. All such equipment shall be removed by the Contractor upon completion of the project.
- F. The Contractor shall provide all necessary temporary lighting, distribution and electrical service as required for project.
- G. The Contractor shall be responsible for all work identified on the plans and in Division 26 and include all costs in bid.

1.2 DEFINITIONS

- A. The Owner: The individual who the Owner selects as the project representative.
- B. The Architect: Eppstein Uhen Architects, Milwaukee, Wisconsin.
- C. The Engineer: Powrtek Engineering, Inc., Consulting Engineers, Waukesha, Wisconsin.
- D. This Contractor: The Electrical or Cathodic Protection Contractor, also referred to as "The Contractor".
- E. Provide: Furnish, install and wire complete and ready for service.
- F. Exposed: Exposed to view in any room, corridor or stairway.
- G. Code: National, State and Local Electrical codes including OSHA requirements.

- H. Equals: Manufacturers or methods listed by name in the specifications, on the drawings or in an addendum are considered to be equals.
- I. Substitution: Any manufacturer or method other than those listed by name in these specifications, on the drawings, or in an addendum.
- J. NEC: National Electrical Code.
- K. Signal Voltage: NEC class 1, 2, or 3 remote control, signaling or power limited circuits.
- L. Low Voltage: 50 to 600 volts.
- M. Medium Voltage: 601 to 35,000 volts.
- N. High Voltage: 35,001 volts and greater.

1.3 PERMITS AND LICENSES

- A. The Contractor shall prepare and submit all applications and working drawings, as required, to authorities having jurisdiction over the project. All licenses and permits required shall be secured and paid for by the Contractor.
- B. Pay for all fees incident thereto.
- C. Comply with local ordinances, laws, regulations and codes in effect at job site.
- D. Pay all applicable taxes associated with electrical work.

1.4 STANDARDS AND CODES

- A. All work shall be installed in accordance with National, State and Local codes, ordinances, laws and regulations. Comply with applicable OSHA regulations.
- B. All materials shall have a UL or ETL label where a UL or ETL Standard and/or test exist.

1.5 DIMENSIONS AND DEFINITE LOCATIONS

- A. The drawings depicting electric work are diagrammatic and show, in their approximate location, symbols representing electrical equipment and devices. The exact location of such equipment and devices shall be established in the field in accordance with instructions from the Architect/Engineer and/or established by manufacturer's installation drawings and details.
 - 1. The Contractor shall refer to shop drawings and submittal drawings for all equipment requiring electrical connections to verify rough-in and connection locations.
 - 2. Unless specifically stated to the contrary, no measurement of an electric drawing derived by scaling shall be used as a dimension to work by. Dimensions noted on the electric drawings are subject to measurements of adjacent and previously completed work. All measurements shall be performed prior to the actual installation of equipment.

1.6 DRAWINGS

- A. The Contractor shall keep a detailed up-to-date record, of the manner and location in which all installations are actually made, indexing each feeder, pull box and protective device.
- B. The contractor shall provide final as-built (record) drawings at completion of project to the Engineer. The record drawings shall indicate device locations, equipment as-circuited, all interior feeder and significant branch circuit runs and junction boxes, exterior circuit runs and pull boxes. All interior feeders and exterior circuits shall include conductors/conduits installed information.
- C. In the event of a conflict between the drawings and specifications, this Contractor shall base their bid on the greater quantity, cost or quality of the item in question, unless such conflict is resolved by an addendum. The Contractor shall be responsible for all existing field conditions, review existing field conditions prior to bid and shall take into account in bid proposal. No additional compensation will be allowed due to Contractor's failure to include all necessary work in the bid proposal.
- D. Provide 100 percent complete and operational electrical systems and subsystems as specified herein and as shown on the drawings. Electrical systems shall include all materials, labor, taxes, mark-ups, overhead, profit, equipment, accessories and incidentals. All materials shall be new and not discontinued.
- E. The drawings and specifications are schematic and scope in nature. All required devices, conduit, wiring, supports, etc., shall be included in the base bid to accommodate actual field conditions. Final locations of all electrical work shall be coordinated in the field and installed where directed by the Architect/Engineer. The Contractor shall follow the intent of the plans and specifications when bidding and completing the design of the required building electrical systems.

1.7 MATERIALS AND EQUIPMENT

- A. All materials and equipment required shall be new.
- B. All equipment supplied shall be based on materials and equipment of manufacturers specified. No substitutions will be allowed except as permitted in this specification.
- C. All items specified shall be the latest type or model produced by the manufacturer specified. If descriptive specification or model number is obsolete, substitute the current product.

1.8 SUBSTITUTIONS

- A. In any case where the Contractor wishes to use equipment or methods other than those listed by name, such equipment shall be considered a substitution and must be approved by the Engineer. To gain approval for substitutions, the Contractor shall submit the following to the Engineer for his review.
 - 1. Documentation from the equipment manufacturer indicating where this equipment meets and does not meet the specifications or drawings as written. This documentation shall state all exceptions taken to the specification and the reasons for such exceptions. All documentation relative to the request for substitution shall be submitted on the manufacturer's letterhead and signed by a representative of the manufacturer.

2. Manufacturer's Cut Sheets: Cut sheets shall be originals as are contained in the manufacturer's catalog. Photocopies of these sheets will not be accepted for review (Furnish 3 copies).
 3. The Contractor shall provide samples of the proposed equipment for the Engineer's review, if requested by the Engineer.
 4. The Contractor shall furnish any other information or materials as requested by the Engineer to establish equality.
 5. The Contractor shall acknowledge that they have reviewed the submission criteria for the request for substitution by stamping the submission with a review stamp or acknowledgment by an accompanying letter.
 6. Equipment and materials submitted for review without proper documentation will be rejected without review.
- B. Any substitution submittal, including samples, shall be received in the Engineer's office a minimum of ten days prior to the Bid due date to allow adequate time for review.
- C. Materials, equipment or methods of installation other than those named, will be accepted only if such articles are in accordance with the general requirements and are similar in composition, dimension, construction, capacity, aesthetics, finish and performance.

1.9 SHOP DRAWINGS AND EQUIPMENT BROCHURES

- A. Submit to Engineer for review, the manufacturer's shop drawings and/or equipment brochures in quantities determined by the Architect for the following:
1. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
 2. Section 26 05 33 – Raceways and Boxes for Electrical Systems
 3. Section 26 42 00 – Cathodic Protection System
- B. Shop drawings shall be submitted in advance of construction and installation so as to not cause delay in other Contractor's work.
- C. All data submitted for Engineer's review shall be numbered consecutively, shall be noted to correlate with the electrical drawings and shall bear:
1. The name and location of the project.
 2. The name of the Contractor.
 3. The date of submittal.
 4. The date of the drawings and the date of each correction and revision.
 5. If more than one type of material is on a submitted sheet, the proposed equipment shall be conspicuously identified by the Contractor.
- D. Shop drawings for different systems and equipment shall be bound separately by specification section. Submittals which contain different systems bound together shall be returned un-reviewed for re-submittal.
- E. The Contractor shall examine shop drawings and equipment brochures prior to submission. The Contractor shall verify that the materials and equipment depicted will properly fit into the construction. The Contractor shall also review all previously completed work related to the installation of the equipment depicted to insure that it has been properly installed.
- G. No materials or equipment subject to prior review by the Engineer shall be fabricated or installed by the Contractor, without approval. The Engineer's review of shop drawings shall not relieve the Contractor of responsibility for deviations from the requirements of

the drawings and specifications, unless prior approval for such deviations has been granted.

1.10 MAINTENANCE MANUALS

- A. The Electrical Contractor shall assemble and submit to the Architect/Engineer for subsequent submission to the Owner, three complete sets of a Manual of Operation and Maintenance for each of the electrical and communications systems.
- B. Each manual shall consist of a loose leaf bound volume instructing the Owner's personnel in the use, operation and maintenance of the system in question. The manual shall cover all phases of operation of the equipment and shall be illustrated with photographs, drawings, wiring diagrams, etc. Manuals shall accurately describe the operation, construction and adjustable features of the complete system and its component parts. The manual shall be complete with an equipment parts listing to facilitate the ordering of spare and replacement parts.
- C. Each manual shall contain two sets of final shop drawings depicting equipment as installed.

1.11 CLEANING AND PAINTING

- A. All rubbish resulting from this work shall be removed and disposed of on a daily basis in such manner as to be acceptable to the Architect.
- B. The Contractor shall clean all exposed equipment, the interior and exterior of cabinets and pull boxes, etc., and remove all rubbish and debris resulting from the work.
- C. Where painted surfaces of equipment have been damaged or rusted during construction, the Contractor shall paint same to match final.
- D. Clean other equipment as indicated in other sections of the specification for specific equipment.

1.12 TESTS AND ACCEPTANCE

- A. The operation of the equipment and electrical systems does not constitute an acceptance of the work by the Owner. The final acceptance is to be made after the Contractor has adjusted his equipment and demonstrated that it fulfills the requirements of the drawings and the specifications.
- B. Upon completion of the installation, the Contractor shall furnish certificates of approval from all authorities having jurisdiction. The Contractor shall demonstrate that all work is complete and in perfect operating condition, with race way and conduit system properly grounded, all wiring free from grounds, shorts, and that the entire installation is free from any physical defects.
- C. In the presence of the Engineer and the Owner, the Contractor shall demonstrate the proper operation of all miscellaneous systems.
- D. Perform other test as specifically directed in other sections of the specifications for specific equipment.

1.13 GUARANTEE

- A. All work shall be provided with a one year materials and labor warranty. Warranty period shall begin after the Owner's final acceptance of the work.
- B. See other Division 26 specification sections for equipment with extended warranties.
- C. See General Conditions.

1.14 ACCESS PANELS

- A. All access panels required by code or otherwise to electrical service equipment shall be supplied and installed by Electrical Contractor.

1.15 OWNER TRAINING

- A. The contractor shall give the Owner's personnel verbal and written operating instructions for all electrical systems.

1.16 COORDINATION BETWEEN TRADES

- A. Coordination Meetings: Attend coordination meetings with the construction manager and all other trades for the purpose of coordinating the locations of all structural, plumbing and electrical work for the entire project. The goal of these meetings is to avoid conflicts between trades in the field and to assure that all necessary power and control requirements are accounted for.
- B. Conflicts Between Trades: Resolve all conflicts between trades at no additional cost to the Owner or Architect.

1.17 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate and integrate the various elements of electrical systems, materials and equipment. Comply with the following requirements:
 - 1. Coordinate electrical systems, equipment and materials installation with other building components, including transferring of 'overlay' plans to verify clearances, etc.
 - 2. Verify all dimensions by field measurements.
 - 3. Arrange for chases, slots and openings in other building components during progress of construction, to allow for electrical installations.
 - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. All pipes passing through cast-in-place concrete walls and floors shall be sleeved.
 - 5. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 - 6. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible.
 - 7. Install systems, materials and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

8. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. Install electrical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
10. Units concealed behind finished surfaces shall be installed behind an access panel or door as required.
11. Install systems, materials and equipment giving right-of-way priority to systems required to be installed at a specified slope.

1.18 CUTTING AND PATCHING

A. General: Perform cutting and patching; the following requirements apply:

1. Perform cutting, fitting and patching of electrical equipment and materials required to:
 - a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in existing structures.
 - f. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.
2. Cut, remove and legally dispose of selected electrical equipment, components and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
3. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
4. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installer's qualifications refer to the materials and methods required for the surface and building components being patched.
5. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END OF SECTION 26 05 00

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.1 SCOPE

- A. Provide conductors and connectors as specified herein.

1.2 RELATED WORK

- A. Section 26 05 26 – Grounding and Bonding for Electrical Systems
- B. Section 26 05 33 – Raceways and Boxes for Electrical Systems
- C. Section 26 05 53 – Identification for Electrical Systems

1.3 QUALITY ASSURANCE

- A. Reference Standards of the following associations:
 - 1. National Electrical Contractor's Association (NECA) – Standard of Installation.
 - 2. Insulated Cable Engineers Association (ICEA).
 - 3. National Fire Protection Association (NFPA) 70 – National Electrical Code (NEC) and Wisconsin amendments thereto.

PART 2 – PRODUCTS

2.1 CONDUCTORS

- A. Copper Conductor only.
- B. Insulated with 600 V insulation and color code conductors for low voltage (secondary feeders and branch circuits) as required by code.
- C. Type THHN Solid or Stranded: Single conductor No. 10 AWG and smaller, No. 12 AWG minimum.
- D. Type THHN Stranded: Single conductor No. 8 AWG and larger. Conductor triple rated for use as types THHN, THWN and MTW is approved.
- E. Conductors installed in exterior wet locations, underground and areas with high humidity shall be type XHHW-2.
- F. Conductors shall not be installed at temperatures below the manufacturer's minimum

2.2 JOINTS, TAPS AND SPLICES

- A. Interior Conductors No. 10 AWG and Smaller: Standard wire connectors.
- B. Interior Conductors No. 8 AWG and Larger: NSI Polaris or equal Insulated multi-cable connector blocks.
- C. Exterior Conductors No. 10 AWG and Smaller: King Silicon Filled ProLine Underground/direct bury rated wire connectors.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Run conductors in conduit unless otherwise indicated on drawings.
- B. Install in accordance with manufacturer's written instructions and in accordance with recognized industry practices.

3.2 INSPECTION

- A. Examine areas and conditions under which feeders and branch circuits are to be installed and notify Engineer, in writing, of conditions detrimental to proper and timely completion of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.3 JOINTS, TAPS AND SPLICES

- A. Cable splices shall be made only in distribution and junction boxes.

3.4 BRANCH CIRCUITS

- A. Conductors shall be size 12 AWG minimum (unless otherwise noted) for branch circuit wiring, including motor circuits.
- B. Size 120V branch circuits for length of run on following basis:
 - 1. 0 to 75 feet run from panelboard to first outlet: No. 12 AWG minimum.
 - 2. 75 to 125 feet run: increase one wire size, i.e. No. 12 AWG becomes No. 10 AWG.
 - 3. 126 to 200 feet run: increase two wire sizes, i.e. No. 12 AWG becomes No. 8 AWG.
 - 4. 201 and above: wiring to be sized for 3% maximum voltage drop.
- C. Provide individual neutral conductors for branch circuits serving isolated ground receptacles and computer equipment (No common neutrals for these circuits).
- D. Voltage drop for branch circuits and feeder circuit combined shall not exceed requirements of NEC Article 215.
- E. Route branch circuits and switch legs as dictated by construction, these specifications, or instructions from the Engineer.
- F. Size conduit, outlet boxes and other raceway system components in accordance with NEC requirements as minimum.
- G. Do not draw conductor into conduits until building is enclosed and watertight, and work which may cause conductor damage has been completed.

3.5 EQUIPMENT WIRING

- A. Furnish and install motor circuits in accordance with schedules on drawings and code requirements, from source of supply to associated motor starter, and from starter to motor terminal box, including necessary and required intermediate connections.
- B. Obtain manufacturer's wiring diagrams and shop drawings for equipment requiring electrical connections.
- C. Check drawings and specifications of other divisions of work for equipment and work which shall be included in order to provide a complete electrical installation.

END OF SECTION 26 09 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SCOPE

- A. Provide all material, labor and incidentals necessary for the completion of this section of the work.

1.2 RELATED WORK

- A. Section 26 05 00 – Common Work Results for Electrical
- B. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables

1.3 QUALITY ASSURANCE

- A. Follow the requirements of the following regulatory agencies:
 - 1. National Fire Protection Association (NFPA, NFPA-70 - National Electrical Code (NEC) and Wisconsin amendments thereto.
 - 2. Local Codes and Ordinances

1.4 REFERENCE STANDARDS

- A. Conform to the standards of the National Electrical Contractors Association (NECA), Standard of Installation.

PART 2 – PRODUCTS

2.1 GROUND WIRES

- A. Copper only.
- B. Size as shown on drawings, or as required by NEC.

PART 3 – EXECUTION

3.1 GENERAL

- A. Ground electrical systems and equipment as required by code, utility, local ordinances and to requirements herein.
- B. Install separate code rated grounding conductors to special equipment and activity areas as required by code.
- C. Bond all metallic piping systems and service equipment as required by NEC.
- D. Cable connections and joints shall be exothermic welded.

3.2 EQUIPMENT GROUND

- A. Bond metallic conduits, supports, cabinets and other equipment so ground will be electrically continuous from service to outlet boxes.
- B. Install grounding conductor in nonmetallic and flexible conduit to complete equipment ground continuity. Ground wire shall be bonded at equipment and at first junction box of conduit system on line side of flexible conduit to the system.
- C. Install an insulated equipment grounding conductor in each conduit. Conduit will not be relied upon as the grounding path.
- D. Connections shall be accessible for inspection and checking. No insulation shall be installed over ground connections.
- E. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SCOPE

- A. Provide equipment for the support of electrical equipment as detailed or indicated on the drawings and as specified herein.

1.2 QUALITY ASSURANCE

Reference standards of the following agencies:

- A. National Electrical Contractors Association (NECA), Standard of Installation.
- B. National Electrical Manufacturers Association (NEMA).
- C. American National Standards Institute (ANSI).

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Kindorf
- B. Elcen Co.
- C. Steel City
- D. Unistrut
- E. B-Line

2.2 GENERAL

- A. Metal supporting devices shall be zinc galvanized or cadmium plated steel or malleable iron.

2.3 SUPPORTING STRUCTURES

- A. Rack supports of galvanized steel channel sections with adequate feet to allow secure mounting.
- B. Weld sections, do not use bolts.

2.4 MOUNTING PANELS

- A. Size mounting panels to mount necessary equipment, of ¾" exterior grade painted plywood.
- B. Provide unistrut or mounting panels for all surface mounted electrical cabinets and enclosures.

2.5 CONDUIT SUPPORTS

- A. Two hole galvanized steel straps.
- B. Continuous slot or T-slot galvanized steel concrete insert channel.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Install hangers, supports and anchors only after structural work, where work is to be installed, has been completed. Correct inadequacies such as proper placement of inserts, anchors and other building structural attachments.
- B. Examine areas and conditions under which equipment and associated components are to be installed and notify Architect/Engineer, in writing, of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BUILDING ATTACHMENTS

- A. Install building attachments at required locations within concrete or on to structural steel or raceway and equipment support.
- B. Install additional building attachments where support is required for additional concentrated loads.
- C. Install concrete inserts before concrete is placed

3.3 INSTALLATION OF ANCHORS

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31 and to prevent the transfer of loading and stresses to connected equipment.
- B. Installation methods shall conform with the manufacturer's recommendations for maximum holding power, but in no case shall the depth of hole be less than four bolt diameters. Minimum distance between the center of any expansion anchor and an edge of exterior corner of concrete shall be not less than 4½ times the diameter of the hole in which it is installed.

3.4 SUPPORT OF CONDUIT

- A. Fasten conduit to structural parts of building in a manner acceptable to Engineer.
- B. Do not use perforated hanger iron.
- C. Install concrete insert channel as required, with spacings as recommended by manufacturer. Install with anchor and caps, insert joiner clips and closer seals as required.

D. Support conduit as follows:

1. Single Conduit Runs
 - a. Vertical Surfaces: Galvanized, heavy duty, sheet steel straps; back straps to be provided for all exposed conduit and conduit on exterior walls.
 - b. Horizontal Surfaces: Galvanized, heavy duty, 2-hole steel pipe straps.
2. Multiple Conduit Runs
 - a. Vertical Surfaces: Horizontal or vertical rack channel with conduit straps as required.
 - b. Horizontal Surfaces: Single or double rack channel trapeze, complete with conduit straps as required; all supported with threaded hanger rods.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SCOPE

- A. Provide conduit systems, boxes and fittings for all power wiring and communication systems as specified.

1.2 RELATED WORK AND REQUIREMENTS

- A. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
- B. Section 26 05 26 – Grounding and Bonding for Electrical Systems
- C. Section 26 06 29 - Hangers and Supports for Electrical Systems
- D. Section 26 42 00 – Cathodic Protection System

1.3 QUALITY ASSURANCE

- A. National Electrical Contractor's Association (NECA) Standard of Installation
- B. National Electrical Code (NEC) including State of Wisconsin and local supplements.

PART 2 – PRODUCTS

2.1 ELECTRICAL METALLIC TUBING (EMT)

- A. Standard lengths and sizes.
- B. Minimum conduit size shall be ½ inch.
- C. Connectors and Couplings
 - 1. Threaded.
 - 2. Insulated throat.
 - 3. Gland compression type.
 - 4. Steel.
- D. Colors (factory finished):
 - 1. Red – Fire Alarm Systems
 - 2. Blue – Emergency power systems.

2.2 POLYVINYL CHLORIDE CONDUIT (PVC)

- A. Standard lengths and sizes.
- B. Minimum size ½", unless indicated on the plans.
- C. Schedule 40, rigid plastic (PVC) conduit manufactured to NEMA TC-2 standards, UL listed and as required by NEC. Sunlight resistant.

- D. Connectors and Couplings
 - 1. To match conduit.
- E. PVC conduit is NOT allowed to be run in any area that is in direct sunlight.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Galvanized spiral strip flexible steel.
- B. Standard conduit sizes.
- C. Heavy wall sunlight resistant PVC jacket.
- D. Minimum size ½ inch.
- E. Connectors and Couplings
 - 1. Liquid-tight.
 - 2. Suitable for grounding.
 - 3. Suitable for wet locations.
 - 4. Tapered threaded hub.
 - 5. Non-metallic materials.

2.4 CONDUIT BODIES

- A. Galvanized or cadmium plated or non-metallic to match conduit.
- B. Threaded hubs.
- C. Removeable cover with gasket.
- D. Corrosion-resistant screws.

2.5 INTERIOR WALL OUTLET BOXES – SURFACE MOUNTED – DRY LOCATION

- A. In public areas: Cast malleable aluminum with threaded conduit hubs. Two inches deep minimum. Internal mounting ears. Boxes shall be coated with electroplated zinc, a dichromate coating and an aluminum polymer enamel finish.
- B. Other areas: Stamped steel, four-inch square, 2-1/2" deep, with round corners. Provide rounded corner raised box covers with openings as required for devices being installed.

2.6 INTERIOR WALL OUTLET BOXES-SURFACE MOUNTED-DAMP OR WET LOCATION

- A. Cast malleable aluminum with threaded conduit hubs. Two inches deep minimum. Internal mounting ears. Boxes shall be coated with electroplated zinc, a dichromate coating and an aluminum polymer enamel finish.

2.7 COMPOSITE BOXES

- A. Boxes shall be constructed of a composite material as shown on the plans. The composite boxes shall be constructed of polymer concrete and reinforced by a heavy-weave fiberglass as manufactured by Quazite or approved equal. The pull boxes shall be rated for 15,000 lbs. over a 10" x 10" area at a temperature of -50°F and be UL listed.

- B. The box shall be furnished with a cover having a skid resistant surface with a minimum coefficient of friction of .5 and concrete gray color. The cover fasteners shall be stainless steel captive 3/8-inch hex head bolts with stainless steel inserts.

2.8 INTERIOR GENERAL PURPOSE JUNCTION AND PULL BOXES

- A. Fabricated from code gauge galvanized steel with covers held in place by corrosion resistant machines screws.
- B. Size as required by code for number of conduits and conductors entering and leaving box.
- C. Provide with welded seams, where applicable and equip with corrosion-resistant nuts, bolts, screws and washer.

PART 3 – EXECUTION

3.1 GENERAL

- A. Interior conduits for wiring systems rated 0 to 600 volts shall be electrical metallic tubing (EMT). Exceptions to the requirements stated above are as follows.
 - 1. Poured concrete: PVC.
 - 2. Corrosive locations only: PVC.
 - 3. Damp/wet areas (i.e. crawl spaces): PVC.
- B. Conduits below the building slab shall be heavy wall schedule 40 PVC.

3.2 PROCEDURES AND PRACTICES

- A. All conduits shall be routed concealed in finished spaces and shall not be visible at any point within the finished space or from the building's exterior. This requirement also applies to new conduits installed in existing construction. Exposed raceway may be used only where physically impossible to route concealed in construction. In such cases where exposed raceway is allowed it shall be surface type in public areas as dictated by the wiring quantities. In each case the specific raceway type and routing shall be submitted to the Architect/Engineer for approval. Where allowed, the general installation requirements are as follows:
 - 1. Raceways shall be routed horizontally along the corners of walls and ceilings, directly above edges of base molding at floors, or along the tops of window and door frames.
 - 2. Raceways shall be routed vertically along corners of adjacent walls and along the edges of window and door frames.
 - 3. Raceways shall not be routed down or across open wall surfaces except in portions of runs not exceeding 12" in length.
 - 4. Raceways shall be painted to match wall finishes. Electrical Contractor is responsible for painting of all raceways.
 - 5. Fittings and boxes used with raceways shall be specifically designed and approved for use with the raceways.
- B. Cut joints shall be square, reamed smooth and drawn up tight.
- C. Keep conduit plugged, clean and dry during construction.

- D. Cap spare conduits.
- E. Provide riser clamps around all conduits 1-1/4" or larger that are routed between floors. Provide conductor support in vertical risers greater than 20' as appropriate.
- F. Provide a watertight conduit system where installed in wet locations such as underground, or where embedded in concrete.
- G. Route conduit runs above suspended acoustical ceilings so as not to interfere with ceiling tile removal. Conduit supports shall be attached to building structural elements. Conduits shall not be supported by or attached to the suspension systems for dropped ceiling systems unless specifically detailed on the drawings.
- H. Conduits may be routed exposed in mechanical equipment rooms and utility rooms.
- I. Route all conduits (including conduits routed above ceilings) parallel to or at right angles with lines of the building construction and structural members except conduit runs routed concealed in pour-in-place concrete floor slabs may be run in direct line from source load.
- J. Make bends and offsets without kinking or destroying smooth bore of conduit. Arrange bends and offsets in parallel conduits to present a neat symmetrical appearance.
- K. Secure conduits in place with malleable corrosion-proof alloy straps or hangers. Conduit straps used in corrosive areas shall be PVC coated.
- L. The use of perforated strapping as a conduit hanging method is not approved.
- M. Conduit runs that extend through areas of different temperature or atmospheric conditions shall be sealed, drained and installed in a manner that will prevent drainage of condensed or entrapped moisture into cabinets and equipment enclosures.
- N. Route conduits within poured concrete construction parallel to each other and spaced on center of at least three times conduit trade diameter with minimum two (2) inches of concrete covering. Conduits over 1 1/4" may not be installed in slab without the approval of the Architect/Engineer. Conduits embedded in a structural frame slab shall comply with applicable provisions of American Concrete Institute (ACI), Standard 318. Conduits used for feeders shall not be embedded in concrete floor slabs.
- O. Install bushings with ground lugs and integral plastic linings at equipment with open bottom conduit entrances.
- P. Install conduit expansion fittings where conduits cross expansion joints.
- Q. Install No. 12 pull wire in empty conduit.
- R. All wiring in raceways shall be provided with a separate green grounding conductor.
- S. All conduits that terminate in free air (no connection to equipment or box) shall be provided with an insulated bushing.
- T. All wiring in walls shall have a raceway within the wall with an enclosed outlet box regardless if the remaining portion of the particular system is installed in raceway or free-air.

3.3 FIRE STOPS AND PENETRATION SEALS

- A. All penetrations through fire rated floors and walls due to the electrical installation shall be sealed with CHASE-FOAM PR-855 Fire Resistant Foam Sealant, to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after a fire. The fire rating of the penetration seal shall be at least that of the floor or wall into which it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code. Equivalent foam sealant manufactured by Dow Corning approved.
- B. The sealant shall remain soft and pliable to allow for the removal and/or addition of cables without the necessity of drilling holes. It shall adhere to itself perfectly to allow any repairs to be made with the same material. It shall permit the vibration, expansion and/or contraction of anything going through the penetration without the seal cracking or crumbling.
- C. When damming materials are to be left in place after the seal is complete then all such materials shall be non-flammable.
- D. When sealant is injected into a penetration, the foam shall expand to surround all the items within the penetration and maintain pressure against the walls of the penetration. The foam shall cure within five minutes and be fire resistant at that time. No heat shall be required to further expand the foam to block the passage of fire and smoke or water.
- E. All wall or floor penetrations openings shall be as small as possible.
- F. The foam sealant shall meet all fire test and hose stream test requirements of ASTM E119-73 and shall be UL Classified as a Wall Opening Protective Device.
- G. All penetrations through non-fire rated walls shall be sealed with an appropriate sealant based on the material being penetrated.

3.4 CUTTING AND PATCHING

- A. Provisions for opening, holes and clearances through walls, floors, ceilings and partitions shall be made in advance of construction.
- B. Provide cutting, patching and painting necessary for the installation of electrical systems.
- C. Where conduits need to penetrate concrete or masonry construction below grade, the Electrical Contractor shall install PVC sleeves with integral waterstop, one (1) inch larger in diameter than the conduit being installed. Install sleeves before walls and/or slabs are poured or constructed.
- D. Where conduits need to penetrate concrete or masonry construction above grade, the Electrical Contractor shall install 22 gauge galvanized steel pipe sleeves, one (1) inch larger in diameter than the conduit being installed. Sleeves shall extend 2" above and below the floor slab penetrated. Install sleeves before walls and/or slabs are poured or constructed.
- E. The Electrical Contractor shall prepare drawings indicating size and location of all anticipated floor sleeves for the installation of electrical conduits. Such drawings shall be made available to the General Contractor 10 days prior to any scheduled concrete work.

3.5 RESTRICTIONS

- A. Conduits routed parallel to steam lines, hot water pipes, high temperature piping or ducts shall be routed at least 12" from such and shall be a minimum of 12" clear when crossing same.
- B. Do not route conduit over boiler, incinerator or other high temperature equipment.
- C. Where conduits must cross or follow the same path as water, steam or other fluid piping, run electrical conduits above such piping wherever possible.

3.6 ADJUSTMENT AND CLEANING

- A. Restore damaged areas on PVC jacketed, rigid conduit with spray type touch-up coating compound or as directed by manufacturer.
- B. Pull cleaning plug through conduits to clear of dirt, oil and moisture.

3.7 CONDUIT SYSTEMS

- A. Where raceways are required, separate raceway systems shall be provided for each wiring system as follows:
 - 1. 208 volt normal power wiring systems.
 - 2. Cathodic protection systems.

3.8 CONDUIT FITTINGS

- A. Install electrical fittings in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that fittings serve intended purposes.
- B. Rigidly secure connectors at cabinets and boxes with galvanized lock nut and bushing.
- C. Seal conduits that run through different temperature or atmospheric conditions to prevent condensation or moisture from entering electrical equipment and devices.
- D. Install wall entrance seal where conduits or direct burial conductors pass through foundation walls below grade.
- E. Install conduit expansion fittings complete with bonding jumper in following locations:
 - 1. Conduit runs which cross a structural expansion joint.
 - 2. Conduit runs where movement perpendicular to axis of conduit may be encountered.
- F. Locate conduit bodies so as to assure accessibility of electrical wiring.
- G. Install fittings designed for use with flexible liquid-tight conduit to ensure continuity of ground throughout the fittings and conduit, and prevent entrance of moisture.
- H. Exposed PVC runs, subject to temperature changes of more than 20 degrees, and longer than 10 feet shall have an expansion fitting (long or short type as appropriate) installed in middle of run.

3.9 BOX INSTALLATION

- A. Install electrical boxes as indicated in compliance with NEC requirements, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that the boxes serve the intended purposes.
- B. Seal conduit at entrance to weatherproof boxes for interior and exterior locations exposed to weather or moisture.
- C. Install knockout closures to cap unused knockout holes where blanks have been removed.
- D. Locate boxes so as to assure accessibility of electrical wiring. Relocate boxes rendered inaccessible by the installation of work by other trades.
- E. Secure boxes rigidly to the substrate upon which they are being mounted or solidly embed boxes in concrete or masonry. Do not support from conduit.
- F. Set boxes, in concealed conduit runs, flush with wall surfaces, with or without covers, as required.
- G. Do not install boxes back to back or through wall. Offset outlet boxes on opposite sides of wall a minimum of 12 inches.
- H. Set outlet boxes parallel to construction, securely mounted and adjusted to set true and flush with the finished surface.
- I. Do not burn conduit holes, use knock-out punches or hole saws.
- J. Use "no-bolt" studs where specifically detailed on the drawings.
- K. Boxes shall be sized per code to accommodate the number and size of conduit entrances to the box and to accommodate the number of conductors, splices, fittings, etc., within the box. Do not use box extensions to create additional volume to meet NEC requirements for the number of conductors contained in a box.

3.10 EXPOSED OUTLET AND JUNCTION BOXES

- A. Install non-rusting metal weatherproof cover on recessed junction box in new walls or non-rusting surface mounted metal junction boxes on existing walls outdoors and in any area where drawings show weatherproof (WP) or weatherproof-while-in-use (WPIU) wiring devices. Provide non-rusting metal WPIU covers anywhere required by code, even if not indicated on plans.

END OF SECTION 26 05 33

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Labels.

1.2 RELATED WORK

- A. Section 26 05 00 – Common Work Results for Electrical

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Nameplates:
 - 1. Engraved three-layer laminated plastic, white letters on a black background. Emergency system shall use white letters on a red background.
- B. Tape (phase identification only):
 - 1. Scotch #35 tape in appropriate colors for system voltage and phase.
- C. Adhesive type labels shall be typed with black text on white background for boxes in non-public areas and black text on clear background for wiring device faceplates.
- D. Embossed tape is not permitted.

PART 3 – EXECUTION

3.1 GENERAL

- A. Where mixed voltages are used in one building (e.g. 4160 volt, 480 volt, 208 volt) each switch, switchboard, junction box, equipment, etc., on each system shall be labeled for voltage in addition to the other requirements listed herein.
- B. All branch circuit and power panels shall be identified with the same name used at the main distribution panel.
- C. Handwriting is not acceptable for any identification, including any additional identification required by inspectors or other code officials.

3.2 INSTALLATION

- A. Clean and degrease surfaces to receive labels or nameplates.
- B. Install nameplates parallel to equipment lines.
- C. Secure nameplates to equipment using screws, rivets or adhesive.
- D. Provide nameplate for each equipment enclosure.
 - 1. Identification shall be on the exterior of the unit, except for flush equipment in public areas which shall have the identification inside the door or cover.
- E. Label each end of empty conduit runs to indicate the use of the conduit and the location of opposite end and plug conduit ends. Use room numbers that are permanently assigned.

3.3 EQUIPMENT IDENTIFICATION

A. TYPICAL EQUIPMENT

- 1. Identify using nameplates for equipment: ½ inch: identify equipment designation (upper line); ¼ inch: identify voltage rating and source (lower line).

3.4 JUNCTION BOX/PULL BOX IDENTIFICATION

A. Junction Boxes and Pull Boxes for power distribution systems:

- 1. Normal Power: Cover shall indicate voltage using ½" text; source(s) and circuit(s) contained within using ½" text. Identification shall be by means of adhesive labels.
- 2. Emergency Power: Cover shall be painted red; cover shall indicate voltage with "EM" added (i.e. 120EM) using ½" text; source(s) and circuit(s) contained within using ½" text. Identification shall be by means of adhesive labels.

3.5 CONDUCTOR IDENTIFICATION

- A. Install label tags on conductors in junction boxes, pull boxes, wireways, pole handholes and wiring gutters of panels.
- B. Line voltage conductors shall be identified by panel and circuit number using sleeve type adhesive markers.
- C. Each phase conductor of each feeder shall be identified at both ends and at all accessible locations with colored plastic tape, as well as typed identification labeling. Each phase shall be identified by a different color per industry standards. Painted identification is not acceptable.
- D. Where wires of different system junction in a common box each cable shall be grouped with its own system and identified using tags or identification strips.

3.6 BRANCH CIRCUIT IDENTIFICATION

- A. Each distribution and lighting panel shall be equipped with a typewritten directory describing the loads served. Directory **shall be** contained in a steel frame mounted on the inside face of the panel's door and shall be covered with a sheet of clear plastic.
- B. Circuit descriptions shall be complete and include device/equipment type and relative location.
- C. Minimum font size shall be 10pt.

END OF SECTION 26 05 53

SECTION 26 42 00 - CATHODIC PROTECTION SYSTEM

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. UL - Underwriters Laboratories, Inc.

1.3 SYSTEM DESCRIPTION

- A. This item involves the installation of an impressed current cathodic protection system for reinforced concrete structures. The purpose of the cathodic protection system is to protect the steel embedded in the concrete from corroding by passing a small DC current from the anode to the steel.
- B. The cathodic protection system consists of an anode system, rectifier, DC wiring, conduit, and all associated electrical connections. In addition, the Contractor shall be responsible for furnishing a complete AC electric feed to the rectifier location shown on the plans.

1.4 SYSTEM REQUIREMENTS

- A. The design of the cathodic protection system and the installation schedule shall reflect the staging for the construction sequences as shown on the plans and as specified herein.
- B. The structure shall be subdivided into separately controlled cathodic protection zones as shown on the plans. The maximum zone size shall not exceed 4,000 ft².
- C. The design current density shall not be less than 1.5 mA/ft² (16 mA/m²) of reinforcing steel surface. Both top and bottom mats of steel shall be taken into account.
- D. Maximum allowable anode current density shall be 10 mA/ft² (107.6 mA/m²).
- E. In order to assure uniform current distribution, the anode voltage drop shall not exceed 300 mV from the power feed point to the furthest point from the power feed. The wiring size shall be increased from what is shown on the plans at no additional cost.
- F. The power wiring shall be sized according to the National Electric Code. The power cable for the anode and the power cable for the system ground shall be taken into consideration.
- G. Each anode zone on the structure shall have at least two system negative connections. Any embedded steel besides the reinforcing steel (i.e., scuppers, conduit, piping, support bolts, etc.) must be made continuous with, or completely isolated from the cathodic protection system as determined by the Engineer.
- H. At least two current distributors and two current feed points shall be provided for each zone.

- I. Each zone shall contain as a minimum, two reference electrodes and associated ground wire to monitor the potential of the reinforcing steel. The reference cell wiring shall terminate at the rectifier.

1.5 INSTALLER REQUIREMENTS

- A. The system installer shall be a company that specializes in the construction of cathodic protection systems with at least 10 years' experience in protecting reinforcing and at least 500,000SF of installed systems in parking structures.

1.6 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Sections apply to the Section:
 1. 26 05 00 – Common Work Results for Electrical
 2. 26 05 33 – Raceways and Boxes for Electrical Systems

1.7 SUBMITTALS

- A. Submit under provisions of Section 26 05 00.
- B. Shop Drawings:
 1. Complete shop drawings of all custom-fabricated or assembled products, including wiring diagrams.
 2. Drawings identifying all terminals and illustrating all device wiring connections.
 3. Bill of materials listing all components and devices.
 4. Product Data: Provide electrical characteristics and typical connection requirements.
 5. All and any information and data (such as drawings showing device locations and types, riser diagrams, wiring diagrams, approvals, test data, etc.) required by local authorities.
- C. Test Reports: Indicate satisfactory completion of required tests and inspections.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation and starting of products.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 26 05 00.
- B. Record actual locations of all devices.

1.9 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, or the testing firm acceptable to authority having jurisdiction, as suitable for purpose specified and indicated.

1.10 GUARANTEE

- A. The contractor shall guarantee all wiring and terminal equipment to be free from inherent and mechanical defects due to workmanship and materials used for a period of one (1) year from date of accepted installation.
- B. Warranty service for the equipment shall be provided by the system supplier's trained representative during normal working hours, Monday through Friday, excluding holidays. Emergency service provided at times other than as stipulated above shall be available from the same source at additional cost to the Owner.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. The anode system shall consist of ELGARD catalyzed titanium anode mesh, current distributors, and plastic fasteners, as supplied by Corpro Companies, Inc, 1055 West Smith Road, Medina, Ohio, 44256 (ph: 330-723-5082) or its agents and distributors or approved equal
- B. The rectifier shall be as supplied by LP Hoying LLC, PO Box 258, Ft. Loramie, Ohio, 45845 (ph: 970-209-4708) or approved equal.

2.2 ANODE SYSTEM

- A. ELGARD 210 Anode Mesh: The specified anode shall consist of a precious metal oxide catalyst sintered to a Grade 1 titanium substrate. The anode mesh shall be provided in rolls, 250 ft. in length. The mesh shall have a nominal width of 4 ft. with a diamond dimension of 1-1/3" x 3". The anode mesh shall be rated at a concrete current density of 2.22 mA/ft², with a nominal anodic current density of 10 mA/ft².
- B. The anode sample shall be subjected to a lifetime equivalent of 3,580 amp-hours/ft² (38,500 amp-hours/m²) in accordance with the National Association of Corrosion Engineers (NACE International) Standard TM0294-2007 "Testing of Embeddable Anodes for Use in Cathodic Protection of Atmospherically Exposed Steel-Reinforced Concrete." The anode must function for at least a 180-day period under the test conditions to be acceptable indicating a minimum 40 year design life. The anode mesh to be used on this project shall have demonstrated at least ten years successful performance as a cathodic protection anode on a reinforced concrete structure.
- C. Current Distributor Bar: The current distributor bar is a solid Grade 1, 0.5 in. (12.7 mm) uncoated titanium bar. The current distributor shall be provided in rolls, 250 ft. (76 m) in length. Thickness shall be a minimum of 0.035 in. (0.889 mm).
- D. Plastic Fastener: The plastic fastener shall be a nylon panel fastener suitable for this application. The plastic fastener shall be Fastex Part No. 354-260300-00-0078 or equal.

2.3 REFERENCE ELECTRODES

- A. Reference electrodes shall be silver/silver chloride (Ag/AgCl) and suitable for installation in reinforced concrete structures. Each electrode shall have a No. 10 AWG copper conductor with HMWPE insulation attached to the electrode at the factory. The ground wire shall also be No. 10 AWG HMWPE.

2.4 ELECTRICAL

- A. The junction boxes shall be molded PVC and suitably weatherproofed for outdoor installation. The minimum size shall be 6" (152 mm) x 6" (152 mm) x 4" (102 mm). Anchors shall be encased in a nonmetallic expansion shield approved by the Engineer.
- B. The conduit for the DC circuitry shall be PVC Schedule 40. The conduit shall be sized in accordance with the latest revision of the National Electrical Code (NEC) for wire fill. Exposed conduit shall be mounted securely by suitable nonmetallic hangers or straps with the maximum spacing of supports not greater than indicated by Article 347(8) of NEC. Expansion joints shall be installed in accordance with the manufacturer's recommendations for temperature change of 73° C. Anchors shall be encased in a nonmetallic expansion shield approved by the Engineer.

2.5 WIRING

- A. Power wiring, which will be encased in the concrete overlay, shall be No. 10 AWG with HMW/PE insulation. Power wiring in the conduit run shall be at least No. 10 AWG with THHN insulation. Reference electrode wiring in conduit shall be No. 18 AWG shielded twisted pair with PVC outer jacket.

2.6 CONNECTIONS

- A. The system negative and electrical continuity bonding connections to the reinforcing steel shall be made by exothermic welding or resistance spot welding as approved by the Engineer. No mechanical connections will be accepted. All exothermic weld connections shall be coated with a non-conductive epoxy.
- B. The system negative connections and reference electrode wire connections in the junction boxes shall require the use of a mechanical crimp connection, which is subsequently sealed from the environment with a suitable insulating material. The system positive connections shall require the use of a crimp connection, which is subsequently sealed from the environment by a suitable insulating material. The mechanical and crimp connections shall be IIsco Part No. CT-8 or equivalent. The insulating material shall be Hysol Epoxi-Patch, 3M Scotch EZ Seal 2200 Alpha FIT-700 heat shrink, or equivalent.

2.7 RECTIFIER

- A. AC input shall be 120 Volts, 60 Hertz, single phase. A separate breaker, of proper rating, shall be provided. Variation in the AC input from 5% below to 10% above rated line values shall not damage any components.
- B. Cooling shall be by natural air convection. Operating ambient temperature shall range from -40 to +45° C.
- C. The power supply shall include an individual, isolated circuit for each anode zone. Total number of zones, including a spare if needed, shall be specified on a purchase order for the rectifier.
- D. Each rectifier circuit shall have a primary circuit breaker as well as a DC fuse rated at 120% of the circuit capacity. Three spare fuses shall be provided with the rectifier and secured inside the enclosure.
- E. The unit shall be furnished with upgraded lightning protection on the AC input to the rectifier as well as on the DC output side of individual circuits.

- F. The rectifying elements shall be silicon type.
- G. Each circuit shall have a filtered DC output.
- H. Each power supply circuit shall be capable of operation in constant current mode with adjustments for both output voltage and current and include an indicator light showing when the circuit is operating in constant current mode. The DC output shall be regulated to within 1% of its setting.
- I. The power supply shall have a non-conductive front panel with engraved functions and a digital panel meter for monitoring the rectifier DC voltage and current output for each zone. A DC shunt shall be provided for each circuit. The shunts shall be mounted on the front panel, and have non-insulated ring tongue terminals, positioned for connection of test equipment to the calibrated test points.
- J. Terminal blocks for positive and negative shall be provided for termination of the reference electrode wiring from each zone.
- H. The rectifier cabinet shall be NEMA type 3R, and constructed from 14 Ga. steel finished in 3-5 mils polyester powder coat paint. The color shall be gray. The housing door shall include a latch and padlock hasp. A bronze padlock with three keys shall be supplied by others.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which the cathodic protection system is to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Receive equipment at job site; verify applicable components and quantity delivered.
- B. Handle equipment to prevent internal components' damage and breakage, as well as denting and scoring of enclosure finish.
- C. Do not install damaged equipment.
- D. Store equipment in a clean, dry space and protect from dirt, fumes, water, construction debris and physical damage.
- E. After installation, protect equipment from damage by work of other trades.

3.3 ANODE MESH SYSTEM

- A. The spacing between the anode and reinforcing steel in the structure shall be a minimum of 1/2".
- B. The anode shall be installed in accordance with the manufacturer's instructions. A general procedure for installing the anode mesh panels and anode mesh strips is given below:

1. The current distributor bar shall be placed on the structure as shown on the plans. The first width of mesh shall be installed longitudinally at the edge of the electrical zone. One end of the roll of anode mesh shall be fastened to the concrete surface using plastic fasteners. The mesh shall be placed on the structure, tensioned slightly, and fastened to the surface about every 10 ft. (3 m.). The mesh shall lie flat on the structure. At the edge of the zone, the mesh shall be cut and fastened in place. Each successive width of mesh shall be placed adjacent to the last until the entire zone is covered. The mesh shall be spot welded to the current distributor bar. After all of the mesh has been installed, additional fasteners shall be installed as directed by the Manufacturer's technical representative. Mesh shall be fastened sufficiently to prevent significant movement during placement of the overlay.
2. All titanium-to-titanium connections shall be metallurgical bonds made by resistance welding with equipment supplied by the anode manufacturer and used in accordance with the manufacturer's instructions. Prior to commencing welding, the equipment settings shall be tested by welding current distributor test strips, to ensure that a satisfactory weld will be obtained.

3.4 SYSTEM NEGATIVE CONNECTIONS

- A. The reinforcing steel shall be connected to the cathodic protection system by exothermic welding a No. 10 AWG wire with HMWPE insulation to the rebar. Approximately 1/2" (13 mm) of insulation shall be removed from the end of the wire. The steel surface shall be wire brushed to remove any material, which could interfere with a good bond. The batting is placed over the cleared area and the sleeved wire located in the hollow. The mold is placed over the hollow such that 1/8" of the wire is exposed. The exothermic charge is loaded and ignited. The exothermic charge used shall be an Erico CA-25 or equivalent. All exothermic weld connections shall be coated with a 100% solids non-conductive epoxy.

3.5 ANODE MESH CURRENT DISTRIBUTION BAR

- A. The current distributor bars are installed according to the anode manufacturer's recommendations. To obtain a desired length, or to make splices between stages, the titanium strips can be resistance welded together. This weld is made by overlapping the ends approximately 76 mm (3") and making spot welds every 1/2" (13 mm). If the resulting length is longer than required, the current distributor can be cut to fit with tin snips.
- B. A factory fabricated anode connector with 1/8" (3.175 mm) dia. titanium rod may be installed on the deck to facilitate connection between the current distributor and positive anode cable in the junction box. The anode lead connector is spot welded to the titanium rod in the factory, and then spot-welded to the current distributor in the field. At least six spot welds shall be provided between the anode connector and the current distributor. Once the titanium rod is inserted down the access hole to the junction box, the hole shall be filled with a non-conductive, waterproofing material, such as acrylic latex caulking.

3.6 REFERENCE ELECTRODES

- A. Reference electrodes shall be installed in areas of sound concrete having high half cell potential readings (i.e. >-350 mV CSE) in accordance with ASTM C876, or at alternate locations as approved by the Engineer. Prior to excavating, the Contractor shall locate the reinforcing steel patterns in the area of the excavation using a pachometer or other similar rebar locator. Contractor shall cut a slot, about 3" (76 mm) wide x 7" (178 mm) long, between the reinforcing steel bars for placement of the reference electrode. The depth of the slot shall be such that the reference electrode is situated at the same depth as the reinforcing steel. Care shall be taken not to expose the reinforcing steel in the reference electrode excavation.

- B. The reference electrode shall be placed in the prepared excavation and the lead wire routed to the appropriate junction box. Any excess cable shall be cut once it has been properly routed to the junction box. An identification tag shall be affixed to the end of the cable indicating the reference electrode location and number.
- C. A ground wire shall be connected to the reinforcing steel using the exothermic weld procedure, or other approved method. The ground wire connection point shall be coated with a 100% solids epoxy. One ground wire shall be provided for each reference electrode. The ground wire connection shall be at least 24" from the reference electrode excavation.
- D. The reference electrode excavation, ground wire excavation and lead wire slot shall be patched with standard Portland Cement grout or concrete. Just prior to backfilling, the cap shall be removed and discarded. Care shall be taken to fully encapsulate the reference electrode with backfill material. The backfill material shall completely fill the slots and excavations with no voids. All slots and excavations shall be visibly free of dirt, grease, oil, asphalt, and other foreign material prior to placing the backfill material. The Portland Cement grout or concrete shall not contain any purposely-added salt, admixtures such as fly ash, latex or silica fume, or any other material, which could significantly increase the backfill resistivity.

3.7 RECTIFIER (POWER SUPPLY)

- A. The Power Supply shall be located as required by the Engineer.

3.8 TESTING REQUIREMENTS

- A. The installation of a cathodic protection system requires that some specialized tests be performed. The activity chart below outlines the tests required, the phase of construction during which these tests normally takes place, the responsible party for each test, and the approval required before further activity can occur. Witten/electronic verification shall be provided to Engineer.

<u>Required Testing</u>	<u>Phase</u>	<u>Responsibility</u>	<u>Approval</u>
Steel Continuity	1	A, B, or C	C
Depth of Cover Survey	1	A, B, or C	C
Anode-Steel Isolation	2, 3	A, B, or C	C
Initial Energization	3	C	C

Legend

- 1 Before anode installation
- 2 After anode installation
- 3 After concrete overlay has cured

- A General Contractor
- B Cathodic Protection Subcontractor
- C Engineer

3.9 STEEL CONTINUITY

- A. The purpose of the steel continuity check is to ensure that all of the embedded steel is continuous. If the embedded steel is discontinuous, it will not receive cathodic protection current. The reinforcing steel shall be checked for electrical at a minimum 5 locations per 1,000 ft² (93 m²) and between all exposed rebars during the delamination repair stage, scuppers, expansion joints and other metallic members by using the DC millivolt technique. Testing shall be conducted during the delamination repair stage, so as to

alleviate unwanted excavation. Test equipment for this procedure consists of a standard digital DC voltmeter, test leads and wire reel. The millivolt drop between the steel is measured. Readings greater than 1.0 mV indicate electrical discontinuity.

- B. All reinforcing steel which is found to be discontinuous must be electrically bonded to the continuous steel with one No. 10 AWG wire with HMWPE insulation using exothermic welding or by resistance spot welding a 1/16" (1.5 mm) diameter steel wire to the steel. The contractor shall include twelve (12) locations in the bid that will require re-bar to be made continuous.

3.10 DEPTH OF COVER SURVEY

- A. Prior to installing the anode, the depth of the steel shall be checked to ensure that at least 0.5" (13 mm) of concrete cover exists. Should any area be found with less than 0.5" (13 mm) cover, then provisions must be taken to prevent the anode from touching the surface. Review existing information included in bid documents.
- B. The depth of cover survey shall be checked with an M-100 metal locator or a pachometer. Where an area is found having less than 0.5" (13 mm) of concrete cover, it shall be noted with spray paint and the area further detailed using a pachometer. All areas found to have "high steel" shall be corrected prior to anode installation by one of the following methods:
 1. Apply a nonconductive epoxy to the concrete surface directly above the steel. The maximum width of this application shall be 2" (50 mm). Sand shall be applied to the uncured epoxy to improve bonding to the overlay. All excess sand shall be removed from the cured epoxy.
 2. Lift the anode off the deck surface using a plastic spacer mesh. The spacer mesh shall be approved by the Engineer.
- C. A plan of the concrete deck surface, preferably the existing drawings of the structure, shall be marked-up to show all areas of high steel and the method used to prevent the near shorts. The results shall be submitted to the Engineer in writing prior to anode installation.

3.11 ANODE-STEEL ISOLATION CHECK

- A. After each length of anode has been installed, a check shall be made to ensure that the anode is discontinuous from the steel so that the cathodic protection system will function as intended. Isolation checks shall be conducted prior to, during and after the overlay application.
- B. Isolation testing shall be conducted using a DC and an AC resistance meter. Prior to taking the readings, the steel must be cleaned to a bright metal condition at each test location. The connection to the anode may be made at any convenient location. The results of this testing will be dependent on the size of the zone as well as other variables. The readings shall be approved by the Cathodic Protection System Technical Representative before proceeding with the concrete placement. Alternately, a DC voltmeter can be used. If the voltage drops to zero immediately, then a short has occurred.
- C. Should the anode and steel be continuous, the location of the short must be found and corrected by lifting up the anode material and allowing concrete to settle beneath, or by using one of the techniques described under the Depth of Cover Survey. The Engineer shall approve the repair technique selected.

3.12 ENERGIZATION TEST

- A. The acceptance testing is done to assure that the steel is adequately protected. Cathodic protection functions by forcing sufficient current to the steel to change the surface condition of the steel such that it no longer corrodes. This surface condition corresponds to a change in the electrical potential of the steel.
- B. The potential of the steel is monitored by using the embedded reference electrodes. The criterion for adequate current shall be a depolarization of at least 100 mV after a minimum of 4 hours. This test shall be made by measuring the steel potential immediately after the current is turned off and monitoring the change in the potential with time. If the depolarization is less than 100 mV, then the voltage setting on the power supply must be increased. The Cathodic Protection System Technical Representative shall conduct these tests. **Follow-up tests/adjustments shall occur on a monthly basis till the zones achieve the 100mV threshold, not to exceed 6 months.** The results of the depolarization testing shall be submitted in writing.

3.13 INSTALLATION

- A. Provide system power with 120 volt, 20 amp, 2 wire + ground, 60 HZ dedicated circuit.
- B. Install conduit for system wiring.

3.14 TRAINING

- A. System supplier is to provide a minimum of 4 hours of owner system training/system explanation.

3.15 ADJUSTMENT AND CLEANING

- A. Clean system equipment and enclosures of dirt and debris.

END OF SECTION 26 42 00