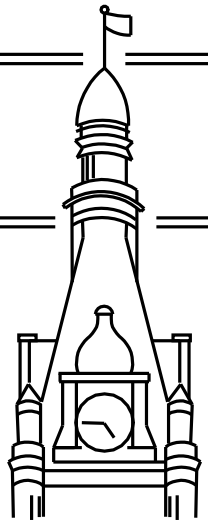

CITY OF MILWAUKEE

DEPARTMENT OF PUBLIC WORKS

INFRASTRUCTURE SERVICES DIVISION
STREET AND BRIDGES UNIT
STRUCTURAL DESIGN

REHABILITATION

OF THE

ST. PAUL AVENUE LIFT BRIDGE

OVER THE

MILWAUKEE RIVER

LOCATED IN

MILWAUKEE, WI

JOB NUMBER : BR100100106

OFFICIAL NOTICE NUMBER : 27 DATE : February, 2013

CITY OF MILWAUKEE, WISCONSIN

DEPARTMENT OF PUBLIC WORKS

INFRASTRUCTURE SERVICES DIVISION

Specifications

Governing

REHABILITATION
OF THE
ST. PAUL AVENUE LIFT BRIDGE
OVER THE
MILWAUKEE RIVER

Milwaukee, Wisconsin

Job No. BR100100106

FEBRUARY, 2013

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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, Frank P. Zeidler Municipal Building, Room 507, 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 American with Disabilities Act of 1990, 42 U.S.C. Section 12101, Et. Seq. the TDD Number for Public Works is (414) 286-2025.

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

All Contractors and subcontractors 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 516 of the Frank P. Zeidler Municipal Building.

Corporate surety will be required on performance and payment bonds for all projects listed in the following Official Notice. 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.

END SECTION 00 11 14

CITY OF MILWAUKEE SPECIFIC
OFFICIAL NOTICE NO. 27

Sealed bids will be opened on **April 18, 2013** at 10:30 A.M. for the **REHABILITATION OF THE ST. PAUL AVENUE LIFT BRIDGE OVER THE MILWAUKEE RIVER**, located in Milwaukee, Wisconsin 53202.

Bid Security Required:	Bond, Certified Check, Cashier's Check or Cash to accompany bid: 10% of Contractor's Base Bid
Bridge Closed to Traffic:	September, 3, 2013
Substantial Completion Date:	June 9, 2014
Contract Completion Date:	July 21, 2014

Liquidated Damages, per diem: $2,500.00

THE MINORITY, WOMAN, SMALL BUSINESS ENTERPRISE REQUIREMENT FOR THIS CONTRACT IS 20%. **(5.57% African-American, 0.50% WBE, 13.93% SBE)**

THE RESIDENT PREFERENCE PROGRAM PARTICIPATION REQUIREMENT FOR THIS PROJECT IS 20%.

THE APPRENTICESHIP REQUIREMENTS FOR THIS CONTRACT ARE TWO (2).

Plans and specifications will be furnished to the prospective bidders upon payment of a $10.00 non-refundable fee in Room 507, Frank P. Zeidler Municipal Building, 841 North Broadway, Milwaukee, Wisconsin 53202.

A $10.00 per set additional non-refundable fee is required to obtain bid documents by mail.

Contractor must comply with all provisions of the CITY OF MILWAUKEE GENERAL OFFICIAL NOTICE TO CONTRACTORS published above.

THE CONTRACTOR SHALL SPECIFICALLY NOTE THE MINORITY, WOMAN, SMALL BUSINESS ENTERPRISE, 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 for this project may be viewed in the Infrastructure Services Division, Structural Design Unit, Room 907, Frank P. Zeidler Municipal Building, 841 North Broadway, Milwaukee, Wisconsin.

END SECTION 00 11 17

SECTION 00 21 13 – INSTRUCTIONS TO BIDDERS

PART 1 – GENERAL

1.1 SUMMARY

A. 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.

1.2 BID FORM

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

B. Bids will not be accepted in any form except on the bid form included with these specifications.

C. 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.

1.3 CONTRACT AWARD

A. In case of discrepancy between the total Base Bid indicated in the proposal and that obtained by adding the products of the quantities of work and the unit prices, the unit prices shall govern. Any errors found in the total Base Bid indicated will be corrected, and the contract award shall be made to the lowest responsible bidder based on the corrected total Base Bid.

B. The Commissioner of Public Works will award the contract based on the Base Bid only.

1.4 CONTRACT BREAKDOWN

A. 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.

1.5 SITE VISIT

A. All Contractors shall visit the site, consult the drawings and specifications, be familiar with the work of other Contractors and determine for himself all conditions affecting the work.

B. 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 specifications and all City, State and Federal codes or regulations pertaining to the work.

1.6 TIME FOR COMPLETION

A. 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 St. Paul Avenue Lift Bridge.

This contract has two defined completion dates. The Substantial Completion date is further defined in Section 00 73 02 – Incentive/Disincentive for Substantial Completion of the Work. The Contract Completion date is when all construction contract work is complete.

1.7 CONSTRUCTION START DATE

A. Closure of any portion of the St. Paul Avenue Bridge to vehicular and pedestrian traffic cannot occur until Tuesday, September 3, 2013. Activities such as mobilization, placement of barges, or construction activities under the bridge or in the bridge house that do not affect vehicular/pedestrian traffic, navigation under the lift span, or bridge operations can begin prior to September 3, 2013 with approval of the City Engineer or his representative.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

PART 4 – MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 00 21 13

SECTION 00 72 00 – GENERAL CONDITIONS

PART 1 – GENERAL

1.1 DEPARTMENT OF PUBLIC WORKS GENERAL SPECIFICATIONS

A. Provisions of the Department of Public Works General Specifications dated January 31, 1992, and all subsequent addenda, shall apply to all contractors and subcontractors working on the project. Copies of the General Specifications may be obtained from the Department of Public Works General Office, Room 516, Frank P. Zeidler Municipal Building, 841 North Broadway, Milwaukee, Wisconsin.

1.2 DEFINITIONS

A. Commissioner: Commissioner of Public Works

B. Division: Infrastructure Services Division.

C. City Engineer: The City Engineer of the Infrastructure Services Division.

D. Project Inspector: The authorized representative of the Commissioner assigned to make detailed inspection of any or all portions of the work and materials thereof.

E. Addenda: Writing or graphic instruments issued prior to the execution of the contract which modify or interpret the bidding documents, including drawings and specifications by additions, deletions, clarifications or corrections. Addenda will become part of the contract documents when the contract is executed.

F. Contract Drawings: Drawings of the work to be done as listed hereafter in the List of Drawing Sheets.

G. Base Bid: Amount of money stated in the Bid Form as the sum of which the bidder offers to perform the work.

H. Additive Alternate: Additional amount of money stated in the Bid Form as the sum of which the bidder offers to perform the alternate work.

1.3 CONTROL OF WORK AND MATERIALS

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

B. Primary Lines and Grades: Will be established by the Contractor.

C. Construction Lines and Grades: The Contractor must bear sole responsibility for the correct transfer of all construction lines and grades from the primary lines and grade 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 City Engineer 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, casing, etc., when required, shall be done in the presence of the Commissioner's representative. The Contractor shall be responsible for eth 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.

1.4 SAMPLES AND TESTS

A. Method of Sampling: Samples of materials proposed or furnished for 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 of Testing and Materials. 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 and Materials, designated by that number, including all revisions in affect on the date of award of the contract. Should a revised or amended standard be issued by the American Society for Testing and Materials which, in the opinion of the Commissioner, conflict with or causes undesirable changes in the standards referred to herein, the Commissioner reserves the right, by means of addenda to the specifications, 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. Cost 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, or when such tests are permitted by A.S.T.M. Specification and approved by the Commissioner or subsequent tests ordered by the Commissioner will be made at the expense of the Contractor.

1.5 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. Contractor 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 specifications, 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.

1.6 TECHNICAL SPECIFICATIONS AND DRAWINGS

A. All contractors shall have complete sets of plans and specifications on the job site at all times.

B. 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 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 the City for decision. Said discrepancy shall <u>not</u> be adjusted by the contractor.

1.7 SAFETY REGULATIONS

A. All work shall be done in accordance with the safety requirements set up by the Wisconsin Administrative Code Rules and the Occupational Safety and Health Administration (OSHA).

1.8 CODE RULES

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

1. Wisconsin Administrative Code
2. Occupational Safety and Health Administration (OSHA)
3. Plumbing and Drainage Codes of the City of Milwaukee

4. City of Milwaukee Building Codes
5. Ordinances of the City of Milwaukee

1.9 APPROVALS

A. Wherever the words “or equal”, or “approved equal”, or similar terms are used, it shall mean as approved by the Commissioner of Public Works or his agent. All drawings, bulletins, and data necessary for an approval shall be submitted in quadruplicate to the City Engineer. Such approval shall apply to design only and shall in no way relieve this contractor from his responsibility for the full performance of his contract. Evaluation of “or equal” products will be made at the time of shop drawing submission.

1.10 GENERAL SPECIFICATIONS

A. When the General Specifications of the Department of Public Works are in conflict with any other specification referenced herein, the General Specifications of the Department of Public Works shall govern.

1.11 SAVINGS CLAUSE

A. If any clause, item or other part of these specifications shall be deemed illegal or in conflict with code only that item or clause shall be deemed null and void within the specifications. All other items will remain in effect.

1.12 CONSTRUCTION PROGRESS MEETINGS

A. The City reserves the right to schedule periodic construction progress meetings requiring the attendance of the contractors’ and subcontractors’ representatives as deemed necessary by the City.

1.13 MATERIAL HAULING

A. All trucks involved in the hauling of removals, granular backfill, crushed aggregate, bituminous concrete pavement or any other construction material subject to spillage, either by wind or vibration, to or from the project on any highway or street shall be equipped with tail gates, adequate sideboards and canvas covers which will seal the truck box against spillage.

B. The Contractor shall not perform work on nor haul materials of any kind along or across any portion of the project or adjacent streets on any holidays unless he shall notify and receive permission from the City Engineer.

1.14 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

A. The Contractor shall remove existing bridges, and other structures or parts thereof within the roadway right-of-way, which are replaced or which interfere with new construction, unless otherwise provided in the contract. Such removal shall be incidental to other bid items, unless a

separate bid is taken on removal of old structures as hereinafter provided, or unless portions of existing structure units fall within the limits of the excavation for structures.

B. Structures beyond the limits of the right-of-way shall remain in place unless otherwise specified in the contract.

1.15 PLANS AND WORKING DRAWINGS

A. The approved plans will be supplemented by such working drawings and computations as are necessary to adequately control the work. It is mutually agreed that all authorized alterations of the approved plans shall be in writing. No changes shall be made on any plan or drawing after the same has been approved by the City Engineer, except by direction of the City Engineer.

B. Working drawings for structures shall be furnished by the contractor and shall consist of such detailed plans and computations as may be required for the prosecution of the work and which are not included in the plans furnished by the engineer. Such working drawings shall be approved by the engineer. Plans may also be required and in such cases shall be likewise subject to approval, unless approval is waived by the City Engineer.

C. It is expressly understood, however, that approval by the City Engineer of the contractor's working drawings does not relieve the contractor of any responsibility for accuracy of dimensions and details or conformity of his working drawings with the approved plans and specifications.

D. The contract price shall include the cost of furnishing all working drawings and the contractor will be allowed no extra compensation for such drawings.

1.16 CONFORMITY WITH PLANS AND SPECIFICATIONS

A. All work performed and all materials furnished will be in reasonably close conformity with the lines, grades, cross sections, dimensions and material requirements shown on the plans or indicated in the specifications. It shall be finished to produce quality work and appearance within limits of precision reasonably expected of good construction.

B. Specific specification values and prescribed tolerance amounts or limits or minimum or maximum values may be specified. Whenever such tolerances or ranges are specified, the production and processing of material or performance of the work shall be so controlled that the material or work will substantially meet the specific value or fall substantially within the specified range or limits and shall only occasionally be of borderline quality or dimensions.

C. Whenever tolerances, limits or minimum and maximum values are not specified, reasonable and accepted standards or established manufacturing or construction tolerances will be permitted.

D. The lines, grades, typical sections, and dimensions shown on the plans are subject to adjustment by the engineer during construction, but any deviation of a character not contemplated or provided for in the plans, specifications or working drawings that may be required by the exigencies of construction or otherwise will be determined by the engineer and authorized by him in writing.

E. In the event the engineer finds materials which are incorporated in the work, or the finished product in which the materials are used, to be not within reasonably close conformity with the plans and specifications, he will then make a determination whether or not reasonably acceptable work has been produced and can be accepted and remain in place. If the engineer determines that reasonably acceptable work has been produced and can be accepted and remain in place, he will document the basis of acceptance by contract modification or as provided elsewhere in these specifications which will provide for an appropriate adjustment in the contract price for such work or materials, either as he deems necessary to conform to his determination based on engineering judgment, or as specifically provided for elsewhere in these specifications.

F. In the event the engineer finds that the materials, the finished product in which the materials are used, or the work performed are not in reasonably close conformity with the plans and specifications and have resulted in an inferior or unsatisfactory product, the work or materials shall be removed and replaced or otherwise corrected by and at the expense of the contractor.

1.17 COORDINATION OF PLANS, SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS AND SPECIAL PROVISIONS

A. These specifications, the supplemental specifications, the plans, special provisions and all supplemental documents are essential parts of the contract and a requirement occurring in one is binding as though occurring in all. They are intended to be cooperative, to describe and provide for a complete work. In the event of a discrepancy between the drawing and the figured dimensions thereon, the figured dimensions, unless obviously incorrect, shall govern over scaled dimensions. In the case of a discrepancy between the supplemental specifications and these specifications, the supplemental specifications shall govern; between the plans and these specifications or the supplemental specifications, the plans shall govern; and between the special provisions and these specifications, supplemental specifications or the plans, the special provisions shall govern.

B. The contractor shall take no advantage of any apparent error or omission in the plans or specifications, and the engineer shall be permitted to make such corrections and interpretations, as may be deemed necessary for the fulfillment of the intent of the plans and specifications.

1.18 PERSONAL LIABILITY OF PUBLIC OFFICIALS

A. In carrying out any of the provisions of this contract or in exercising any power or authority granted to them thereby, there shall be no personal liability upon the Department, its agents and employees, it being understood that in such matters they act as agents and representatives of the City. Any right of action by the contractor against the Department, or its agents or employees, is hereby expressly waived.

1.19 CONTRACTOR'S RESPONSIBILTIY FOR UTILITY PROPERTY AND SERVICES

A. The contractor shall give notice to the proper authorities in charge of street, gas and water pipes, electric and other conduits, railroad, poles, manholes, catch basins, sewers and all other property that may be affected by the contractor's operations, at least three days excluding Saturday, Sunday and legal holidays, before breaking ground.

B. The contractor shall not hinder or interfere with any persons in the protection of such property, or with the operations or utilities, at any time. The contractor must obtain all necessary information in regard to existing utilities. He shall protect such utilities from damage and unnecessary exposure.

C. The contractor must also obtain all necessary information in regard to the planned installation of new utilities and make proper provision and give proper notification so that new utilities can be installed at the proper time without delay to the contractor or unnecessary inconvenience to the owner. The location of new underground utilities, planned to be installed concurrently with the highway improvements, shall not be covered with pavement prior to the installation of such facilities.

1.20 MEASURMENT OF QUANTITIES

A. General: All work completed under the contract will be measured by the engineer according to United States standard measure. The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

The completed work will be measured for final payment by the engineer, as specified for the various items elsewhere in these specifications, to determine the quantities of such items of work performed, except when agreements have been made providing for compensation on the basis of plan quantities as hereinafter provided or when contract change orders have been executed providing for other methods of measurement. The contractor will be paid for the actual amount of work performed in accordance with the contract, as shown by the final measurements or upon the basis of plan quantities.

If the contractor and the engineer agree in writing that the quantities of certain items or portions of items of work as set forth in the contract or on the plans, as originally drawn or subsequently corrected or revised, are in substantial agreement with the actual quantities of work performed, compensation therefore will be made based on the quantities set forth in the contract or on the plans, as originally drawn or subsequently corrected or revised, without measurement thereof, and the contractor shall accept such compensation as full payment for such items or portions of items.
When standard manufactured items are specified such as fences, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gage, unit weight, sections dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.

B. Volume: All materials which are specified for measurement by the cubic yard in the vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. No allowance will be made for the settlement of material in transit.

The measurement of the material, the type and size of vehicle, the determination of capacity and the marking of the vehicle for identification shall conform to the requirements of Subsection 617.2 of the standard specification.

When permitted elsewhere in these specifications, or in the special provisions, material specified to be measured by the cubic yard may be weighed and the weights will be converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the engineer and shall be agreed to by the contractor before such method of measurement of pay quantities is used.

C. Weight: All aggregates and bituminous mixtures which are specified for measurement by the ton (2,000 lbs.) shall be weighed on platform scales or other approved scales, furnished by and at the expense of the contractor. Said scales shall be satisfactory to the engineer and they shall be tested by the engineer or by authorized testing firms or agencies as often as the engineer may deem necessary to ensure their accuracy.

When materials are weighed in the hauling vehicle, gross weights shall be measured by the ton may be measured by the cubic yard and the cubic yards will be converted to tons for payment purposes. Factors for conversion from volume measurement to weight measurement will be determined by the engineer and shall be agreed to by the contractor before such method of measurement of pay quantities is used.

1.21 GUARANTEE

A. The 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 by the operator due to faulty equipment, poor installation or poor construction. The City shall also receive any extended guarantees or warranties normally supplied by any vendor or manufacturer for material or equipment incorporated in the work.

1.22 ENVIRONMENTAL PROTECTION

A. The Contractor shall establish and carry out a program for immediate removal of debris during the bridge rehabilitation in order to prevent the accumulation of unsightly, deleterious and/or potentially polluting materials in the river

B. Utilize construction methods which will minimize local erosion or siltation.

C. Place excess dredged or excavated materials in a confined area in such a manner as to preclude the return of polluted materials to the river by surface runoff or by leaching.

D. Place excess dredged or excavated materials in a confined area in such a manner as to preclude the return of polluted materials to the river by surface runoff or by leaching.

E. Take special care to avoid any spillage of oil, fuels, or any other types of pollutants while working within or along the banks of the river.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

PART 4 – MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 00 72 00

SECTION 00 73 01 - INSPECTION CHARGES

PART 1 – GENERAL

1.1 INSPECTION CHARGES

A. The Contractor will be charged a fee for inspection for each and every day such inspection is required after the time allowed for Contract Completion has expired.

B. The amount of the fee for inspection shall be $500 per day.

C. The date of Contract 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 site.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

PART 4 – MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 00 73 01

SECTION 00 73 02 – INCENTIVE/DISINCENTIVE FOR SUBSTANTIAL COMPLETION OF WORK

PART 1 – GENERAL

1.1 SCOPE

A. This item shall consist of either an incentive payment or a disincentive pay reduction as specified in this section.

B. The Contractor shall complete all of the work necessary for substantial completion of the St. Paul Avenue Lift Bridge without restrictions to any portion of bridge prior to 12:01 AM June 9, 2014, or within such extended time as may be allowed.

C. The completion time allowed for this contract is based on an expedited work schedule.

D. Under this Incentive/Disincentive plan, no time extensions will be granted for adverse weather conditions; for delays in material deliveries; or for labor disputes unless it can be shown that such disputes are industry wide.

E. Each day shall be defined as a twenty-four (24) hour period beginning at 12:01 AM.

F. Incentive payments will not be considered as part of the money value of the work completed for computing time extensions.

1.2 DEFINITION OF SUBSTANTIAL COMPLETION

A. Completion of all work necessary to permanently reopen four lanes of traffic and both sidewalks for pedestrian use.

B. The center channel under the lift span between Pier 2 and Pier 3 is open to marine traffic. The fixed spans between the west abutment and Pier 2 and the fixed spans between Pier 3 and the east abutment are allowed to have marine restrictions in accordance with the Coast Guard permit.

C. All final testing of hydraulic, mechanical, and electrical components shall be successfully completed and accepted in accordance with the contract documents. The St. Paul Bridge must operate successfully from the local bridge control desk and also be able to remotely operate the Michigan Street Bridge.

D. Training of city personnel for full bridge operation and maintenance has been completed allowing the City to operate the bridge.

E. All punch list work requiring closure of the bridge to vehicular, pedestrian, or marine traffic must be completed.

F. Upon acceptance of the bridge after final walk through of the elements needed to open the bridge to traffic and final bridge operational testing, if a problem is later discovered that required closure of the bridge to vehicular, pedestrian, or marine traffic, this would be considered warranty work.

G. The City will allow work to continue under the bridge that does not affect vehicular, pedestrian, or lift span navigational channel traffic, or bridge operations. This work could consist of painting of the approach spans, concrete surface repairs to the piers and abutments, and concrete staining of the piers and abutments. All work, equipment and staging would need to be in accordance with the Coast Guard permit. Riverwalk temporary closure is allowable in accordance with the contract specifications and special provisions.

1.3 INCENTIVE PAYMENT

A. The contractor shall be entitled to an incentive payment for substantial completion of all work as defined in Section 00 73 02 Part 1.2 prior to 12:01 AM, June 9, 2014 or such extended time as may be allowed. All work requiring closure of the bridge to vehicular, pedestrian, or marine traffic must be complete.

B. The incentive payment shall be paid at a rate of $10,000 per calendar day for each day or portion thereof, of completion prior to 12:01 AM, June 9, 2014. The maximum amount of incentive payment shall not exceed $140,000.

1.4 DISINCENTIVE PAY REDUCTION

A. Should the contractor fail to substantially complete the work as defined in Section 00 73 02, Part 1.2 prior to 12:01 AM, June 9, 2014 or within such extended time as may be allowed, the contractor shall be liable to the City of Milwaukee for a pay reduction in the amount of $10,000 per day or portion thereof, for each calendar day after 12:01 AM, June 9, 2014 that work remains incomplete.

B. If contract time expires prior to substantial completion of the work as defined in Section 00 73 02 Part 1.2, liquidated damages as given in bidding requirements (Section 00 11 17) will be affixed in addition to the disincentive pay reduction.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

PART 4 – MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 00 73 02

6/15/11

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.

NOTICE TO ALL CONTRACTORS AND SUBCONTRACTORS:

EFFECTIVE 1/1/2010, DUE TO CHANGES IN WISCONSIN PREVAILING WAGE LAW, SEC. 66.0903 -

IN ADDITION TO THE PREVAILING WAGE REPORTING REQUIREMENTS ALREADY IN PLACE FOR CITY OF MILWAUKEE DPW CONTRACTS:

ALL CONTRACTORS AND SUBCONTRACTORS ON A PREVAILING WAGE PROJECT ARE *ALSO* REQUIRED TO FILE CERTIFIED PAYROLLS OR COLLECTIVE BARGAINING AGREEMENTS ELECTRONICALLY WITH THE STATE OF WISCONSIN DEPARTMENT OF WORKFORCE DEVELOPMENT (DWD)

INSTRUCTIONS AND FURTHER DETAILS CAN BE FOUND ON THE DWD'S WEBSITE EXPLAINING THE REQUIREMENTS
http://dwd.wisconsin.gov/er/prevailing_wage_rate/default.htm

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PREVAILING WAGE RATE DETERMINATION

Issued by the State of Wisconsin
Department of Workforce Development
Pursuant to s. 66.0903, Wis. Stats.
Issued On: 01/10/2013
Amended On: 02/18/2013

DETERMINATION NUMBER:	201300081
EXPIRATION DATE:	Prime Contracts MUST Be Awarded or Negotiated On Or Before 12/31/2013. If NOT, You MUST Reapply.
PROJECT NAME:	ALL PUBLIC WORKS PROJECTS UNDER SEC 66.0903, STATS - CITY OF MILWAUKEE
PROJECT LOCATION:	MILWAUKEE CITY, MILWAUKEE COUNTY, WI
CONTRACTING AGENCY:	CITY OF MILWAUKEE-DEPT OF PUBLIC WORKS

CLASSIFICATION:	Contractors are responsible for correctly classifying their workers. Either call the Department of Workforce Development (DWD) with trade or classification questions or consult DWD's Dictionary of Occupational Classifications & Work Descriptions on the DWD website at: dwd.wisconsin.gov/er/prevailing_wage_rate/Dictionary/dictionary_main.htm.
OVERTIME:	Time and one-half must be paid for all hours worked: - over 10 hours per day on prevailing wage projects - over 40 hours per calendar week - Saturday and Sunday - on all of the following holidays: January 1; the last Monday in May; July 4; the 1st Monday in September; the 4th Thursday in November; December 25; - The day before if January 1, July 4 or December 25 falls on a Saturday; - The day following if January 1, July 4 or December 25 falls on a Sunday. Apply the time and one-half overtime calculation to whichever is higher between the Hourly Basic Rate listed on this project determination or the employee's regular hourly rate of pay. Add any applicable Premium or DOT Premium to the Hourly Basic Rate before calculating overtime. A DOT Premium (discussed below) may supersede this time and one-half requirement.
FUTURE INCREASE:	When a specific trade or occupation requires a future increase, you MUST add the full hourly increase to the "TOTAL" on the effective date(s) indicated for the specific trade or occupation.
PREMIUM PAY:	If indicated for a specific trade or occupation, the full amount of such pay MUST be added to the "HOURLY BASIC RATE OF PAY" indicated for such trade or occupation, whevenever such pay is applicable.
DOT PREMIUM:	This premium only applies to highway and bridge projects owned by the Wisconsin Department of Transportation and to the project type heading "Airport Pavement or State Highway Construction." DO NOT apply the premium calculation under any other project type on this determination.
APPRENTICES:	Pay apprentices a percentage of the applicable journeyperson's hourly basic rate of pay and hourly fringe benefit contributions specified in this determination. Obtain the appropriate percentage from each apprentice's contract or indenture.
SUBJOURNEY:	Subjourney wage rates may be available for some of the trades or occupations indicated below with the exception of laborers, truck drivers and heavy equipment operators. Any employer interested in using a subjourney classification on this project MUST complete Form ERD-10880 and request the applicable wage rate from the Department of Workforce Development PRIOR to using the subjourney worker on this project.

This document **MUST BE POSTED** by the **CONTRACTING AGENCY** in at least one conspicuous and easily accessible place **on the site of the project** . A local governmental unit may post this document at the place normally used to post public notices if there is no common site on the project. This document **MUST** remain posted during the entire time any worker is employed on the project and **MUST** be physically incorporated into the specifications and all contracts and subcontracts. If you have any questions, please write to the Equal Rights Division, Labor Standards Bureau, P.O. Box 8928, Madison, Wisconsin 53708 or call (608) 266-6861.

The following statutory provisions apply to local governmental unit projects of public works and are set forth below pursuant to the requirements of s. 66.0903(8), Stats.

s. 66.0903 (1) (f) & s. 103.49 (1) (c) "PREVAILING HOURS OF LABOR" for any trade or occupation in any area means 10 hours per day and 40 hours per week and may not include any hours worked on a Saturday or Sunday or on any of the following holidays:

1. January 1.
2. The last Monday in May.
3. July 4.
4. The first Monday in September.
5. The 4th Thursday in November.
6. December 25.
7. The day before if January 1, July 4 or December 25 falls on a Saturday.
8. The day following if January 1, July 4 or December 25 falls on a Sunday.

s. 66.0903 (10) RECORDS; INSPECTION; ENFORCEMENT.
(a) Each contractor, subcontractor, or contractor's or subcontractor's agent performing work on a project of public works that is subject to this section shall keep full and accurate records clearly indicating the name and trade or occupation of every person performing the work described in sub. (4) and an accurate record of the number of hours worked by each of those persons and the actual wages paid for the hours worked.

s. 66.0903 (11) LIABILITY AND PENALTIES.
(a) 1. Any contractor, subcontractor, or contractor's or subcontractor's agent who fails to pay the prevailing wage rate determined by the department under sub. (3) or who pays less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor is liable to any affected employee in the amount of his or her unpaid wages or his or her unpaid overtime compensation and in an additional amount as liquidated damages as provided under subd. 2., 3., whichever is applicable.
2. If the department determines upon inspection under sub. (10) (b) or (c) that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the department shall order the contractor to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages within a period specified by the department in the order.
3. In addition to or in lieu of recovering the liability specified in subd. 1. as provided in subd. 2., any employee for and in behalf of that employee and other employees similarly situated may commence an action to recover that liability in any court of competent jurisdiction. If the court finds that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the court shall order the contractor, subcontractor, or agent to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages.
5. No employee may be a party plaintiff to an action under subd. 3. unless the employee consents in writing to become a party and the consent is filed in the court in which the action is brought. Notwithstanding s. 814.04 (1), the court shall, in addition to any judgment awarded to the plaintiff, allow reasonable attorney fees and costs to be paid by the defendant.

BUILDING OR HEAVY CONSTRUCTION

Includes sheltered enclosures with walk-in access for the purpose of housing persons, employees, machinery, equipment or supplies and non-sheltered work such as canals, dams, dikes, reservoirs, storage tanks, etc. A sheltered enclosure need not be "habitable" in order to be considered a building. The installation of machinery and/or equipment, both above and below grade level, does not change a project's character as a building. On-site grading, utility work and landscaping are included within this definition. Residential buildings of four (4) stories or less, agricultural buildings, parking lots and driveways are NOT included within this definition.

SKILLED TRADES

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer Future Increase(s): Add $.75/hr on 6/3/2013. Add $1.25/hr on 6/2/2014.	32.93	19.81	52.74
102	Boilermaker	31.09	27.23	58.32
103	Bricklayer, Blocklayer or Stonemason Future Increase(s): Add $1.45/hr on 6/01/2013 Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	35.80	16.87	52.67
104	Cabinet Installer Future Increase(s): Add $.75/hr on 6/3/2013. Add $1.25/hr on 6/2/2014.	32.93	19.81	52.74
105	Carpenter Future Increase(s): Add $.75/hr on 6/3/2013. Add $1.25/hr on 6/2/2014. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.93	19.81	52.74
106	Carpet Layer or Soft Floor Coverer	33.43	19.21	52.64
107	Cement Finisher	32.57	17.03	49.60
108	Drywall Taper or Finisher	29.87	18.79	48.66
109	Electrician Future Increase(s): Add $1.60/hr on 6/1/2013. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.20	21.71	53.91
110	Elevator Constructor	41.71	23.88	65.59
111	Fence Erector	28.00	4.50	32.50
112	Fire Sprinkler Fitter	37.45	19.30	56.75

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
113	Glazier	34.19	18.25	52.44
114	Heat or Frost Insulator	33.93	23.26	57.19
115	Insulator (Batt or Blown)	27.47	19.16	46.63
116	Ironworker	31.31	21.99	53.30
117	Lather	33.43	19.31	52.74
118	Line Constructor (Electrical)	37.05	16.94	53.99
119	Marble Finisher	20.00	0.00	20.00
120	Marble Mason	35.58	16.37	51.95
121	Metal Building Erector	18.50	3.20	21.70
122	Millwright	28.28	24.19	52.47
123	Overhead Door Installer	27.30	3.28	30.58
124	Painter	29.27	18.18	47.45
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver Future Increase(s): Add $.75/hr on 6/3/2013. Premium Increase(s): Add $.65/hr for Piledriver Loftsman; Add $.75/hr for Sheet Piling Loftsman. DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	29.06	25.46	54.52
127	Pipeline Fuser or Welder (Gas or Utility)	31.18	19.29	50.47
129	Plasterer	32.06	17.68	49.74
130	Plumber Future Increase(s): Add $1.00/hr 6/1/2013; Add $1.00/hr 6/1/2014.	36.47	19.47	55.94
132	Refrigeration Mechanic	37.76	19.99	57.75
133	Roofer or Waterproofer	29.40	15.55	44.95
134	Sheet Metal Worker Future Increase(s): Add $1.41/hour 6/1/2013; Add $1.56/hour 6/1/2014.	36.17	18.00	54.17
135	Steamfitter	37.76	19.99	57.75
137	Teledata Technician or Installer Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	24.75	16.08	40.83

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
138	Temperature Control Installer	37.31	19.49	56.80
139	Terrazzo Finisher Future Increase(s): Add $ .80 on 6/1/2013	26.57	16.50	43.07
140	Terrazzo Mechanic	29.51	17.63	47.14
141	Tile Finisher	22.27	6.52	28.79
142	Tile Setter	29.70	16.05	45.75
143	Tuckpointer, Caulker or Cleaner	34.35	11.13	45.48
144	Underwater Diver (Except on Great Lakes)	34.16	15.31	49.47
146	Well Driller or Pump Installer Future Increase(s): Add $.20/hr on 06/01/2013.	25.32	15.45	40.77
147	Siding Installer	37.20	17.01	54.21
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	28.24	15.10	43.34
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	29.64	14.64	44.28
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	25.94	13.57	39.51
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.08	12.96	37.04
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	24.00	11.57	35.57

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	33.32	17.60	50.92
203	Three or More Axle	18.00	9.50	27.50
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add $0.75/hour 6/3/2013; Add $1.00/hour 6/2/2014; Add $1.50/hour 6/1/2015; Add $1.60/hour 5/30/2016.	33.52	17.60	51.12
205	Pavement Marking Vehicle	20.85	11.02	31.87
207	Truck Mechanic	18.00	9.50	27.50

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Premium Increase(s): Add $.11 for mortar mixer, fork lift operator, air and electric equipment and power buggy operators; Add $.22 for jackhammer operator, certified welder, gunite machineman.	28.82	16.11	44.93
302	Asbestos Abatement Worker	18.00	0.00	18.00
303	Landscaper	11.00	3.97	14.97
310	Gas or Utility Pipeline Laborer (Other Than Sewer and Water)	19.69	16.03	35.72
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.24	15.03	32.27
314	Railroad Track Laborer	14.50	3.53	18.03
315	Final Construction Clean-Up Worker	28.82	15.61	44.43

HEAVY EQUIPMENT OPERATORS
SITE PREPARATION, UTILITY OR LANDSCAPING WORK ONLY

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
501	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Milling Machine; Boring Machine (Directional, Horizontal or Vertical); Backhoe (Track Type) Having a Mfgr's Rated Capacity of 130,000 Lbs. or Over; Backhoe (Track Type) Having a Mfgr's Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Crane, Shovel, Dragline, Clamshells; Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Grader or Motor Patrol; Master Mechanic; Mechanic or Welder; Robotic Tool Carrier (With or Without Attachments); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Tractor (Scraper, Dozer, Pusher, Loader); Trencher (Wheel Type or Chain Type Having Over 8 Inch Bucket). Future Increase(s): Add $0.75/hour 6/3/2013; Add $1.00/hour 6/2/2014; Add $1.50/hour 6/1/2015; Add $1.60/hour 5/30/2016.	33.82	17.60	51.42

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
502	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Environmental Burner; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Jeep Digger; Screed (Milling Machine); Skid Rig; Straddle Carrier or Travel Lift; Stump Chipper; Trencher (Wheel Type or Chain Type Having 8 Inch Bucket & Under). Future Increase(s): Add $0.75/hour 6/3/2013; Add $1.00/hour 6/2/2014; Add $1.50/hour 6/1/2015; Add $1.60/hour 5/30/2016.	33.52	17.60	51.12
503	Air Compressor (&/or 400 CFM or Over); Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Forklift; Generator (&/or 150 KW or Over); Greaser; High Pressure Utility Locating Machine (Daylighting Machine); Mulcher; Oiler; Post Hole Digger or Driver; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add $0.75/hour 6/3/2013; Add $1.00/hour 6/2/2014; Add $1.50/hour 6/1/2015; Add $1.60/hour 5/30/2016.	33.52	17.60	51.12
504	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	37.45	19.45	56.90
505	Work Performed on the Great Lakes Including Crane or Backhoe Operator; Assistant Hydraulic Dredge Engineer; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder; 70 Ton & Over Tug Operator. Future Increase(s): Add $2.19/hr on 01/01/2013; Add $2.00/hr on 01/01/2014. Premium Increase(s): Add $.50/hr for Friction Crane, Lattice Boom or Crane Certification (CCO).	38.80	20.17	58.97
506	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery. Future Increase(s): Add $2.08/hr on 01/01/2013; Add $2.00/hr on 01/01/2014.	34.50	20.04	54.54
507	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; Off Road Trucks - Great Lakes ONLY. Future Increase(s): Add $1.88/hr on 01/01/2013; Add $2.00/hr on 01/01/2014.	28.70	19.86	48.56

HEAVY EQUIPMENT OPERATORS
EXCLUDING SITE PREPARATION, UTILITY, PAVING LANDSCAPING WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
508	Boring Machine (Directional); Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic. Premium Increase(s): Crane Operators with CCO certification add $.50/hr. Cranes with boom length over 200 ft. not exceeding 300 ft. OR lifting capacity over 200 ton not exceeding 300 ton add $.50/hr. Over 300 ton OR 300 ft. add $.01/hr. per foot OR ton whichever is greater.	39.16	19.10	58.26
509	Backhoe (Track Type) Having a Mfgr's Rated Capacity of 130,000 Lbs. or Over; Boring Machine (Horizontal or Vertical); Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Pile Driver; Versi Lifts, Tri-Lifts & Gantrys (20,000 Lbs. & Over). Premium Increase(s): Crane Operators with CCO certification add $.50/hr.	38.66	19.10	57.76
510	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Dredge (NOT Performing Work on the Great Lakes); Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Hydro-Blaster (10,000 PSI or Over); Milling Machine; Skid Rig; Traveling Crane (Bridge Type). Premium Increase(s): Crane Operators with CCO certification add $.50/hr.	38.16	19.10	57.26

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
511	Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Environmental Burner; Gantrys (Under 20,000 Lbs.); Grader or Motor Patrol; High Pressure Utility Locating Machine (Daylighting Machine); Manhoist; Material or Stack Hoist; Mechanic or Welder; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tining or Curing Machine; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket).	37.47	19.10	56.57
512	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Grout Pump; Hoist (Tugger, Automatic); Industrial Locomotives; Jeep Digger; Lift Slab Machine; Mulcher; Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames. Future Increase(s): Add $0.75/hour 6/3/2013; Add $1.00/hour 6/2/2014; Add $1.50/hour 6/1/2015; Add $1.60/hour 5/30/2016.	33.82	17.60	51.42
513	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Boatmen (NOT Performing Work on the Great Lakes); Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Elevator; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Forklift; Generator (&/or 150 KW or Over); Greaser; Heaters (Mechanical); Loading Machine (Conveyor); Oiler; Post Hole Digger or Driver; Prestress Machine; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Robotic Tool Carrier (With or Without Attachments); Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.	30.44	19.10	49.54
514	Gas or Utility Pipeline, Except Sewer & Water (Primary Equipment). Future Increase(s): Add $2/hr on 1/1/2013.	34.89	20.59	55.48
515	Gas or Utility Pipeline, Except Sewer & Water (Secondary Equipment). Future Increase(s): Add $1.60/hr on 06/01/2013; Add $1.60/hr on 06/01/2014; Add $1.65/hr on 06/01/2015	32.26	17.95	50.21
516	Fiber Optic Cable Equipment	20.00	7.88	27.88

SEWER, WATER OR TUNNEL CONSTRUCTION

Includes those projects that primarily involve public sewer or water distribution, transmission or collection systems and related tunnel work (excluding buildings).

SKILLED TRADES

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason Future Increase(s): Add $1.45/hr on 6/01/2013 Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	35.80	16.87	52.67
105	Carpenter Future Increase(s): Add $.75/hr on 6/3/2013. Add $1.25/hr on 6/2/2014. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.93	19.81	52.74
107	Cement Finisher	30.68	16.75	47.43
109	Electrician Future Increase(s): Add $1.60/hr on 6/1/2013. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.20	21.71	53.91
111	Fence Erector	28.00	4.50	32.50
116	Ironworker	30.90	19.11	50.01
118	Line Constructor (Electrical)	37.05	16.94	53.99
125	Pavement Marking Operator	28.10	15.00	43.10
126	Piledriver	29.56	24.96	54.52
130	Plumber	36.97	17.66	54.63
135	Steamfitter	38.26	19.49	57.75
137	Teledata Technician or Installer	24.65	15.67	40.32
143	Tuckpointer, Caulker or Cleaner	34.35	11.13	45.48
144	Underwater Diver (Except on Great Lakes)	37.45	19.45	56.90
146	Well Driller or Pump Installer	21.00	2.23	23.23

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	28.24	15.10	43.34
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	29.64	14.64	44.28
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	25.94	13.57	39.51
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.08	12.96	37.04
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	11.90	33.65

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	25.87	13.00	38.87
203	Three or More Axle	18.00	0.00	18.00
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	31.89	17.98	49.87
205	Pavement Marking Vehicle	20.85	11.02	31.87
207	Truck Mechanic	17.00	0.00	17.00

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Premium Increase(s): Add $1.92 for bottomman; Add $2.03 for concrete manhole builder, bracer, jointman, or pipelayer; Add $4.83 for blaster. Add $2.00 for all tunnel work under 15 lbs. compressed air; Add $2.00 for 0-30 lbs. compressed air; Add $3.00 for over 30 lbs. compressed air.	28.95	16.11	45.06
303	Landscaper	26.92	12.51	39.43
304	Flagperson or Traffic Control Person	23.55	13.45	37.00
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.24	15.03	32.27
314	Railroad Track Laborer	14.50	3.53	18.03

HEAVY EQUIPMENT OPERATORS
SEWER, WATER OR TUNNEL WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
521	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Master Mechanic; Pile Driver. Future Increase(s): Add $1/hr on 6/2/2013. Premium Increase(s): Add $.50/hr for >200 Ton / Add $1/hr at 300 Ton / Add $1.50 at 400 Ton / Add $2/hr at 500 Ton & Over.	35.12	18.46	53.58
522	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Spreader & Distributor; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Dredge (NOT Performing Work on the Great Lakes); Milling Machine; Skid Rig; Telehandler; Traveling Crane (Bridge Type). Premium Increase(s): Add $.25/hr for operating tower crane.	35.36	19.15	54.51
523	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Boring Machine (Horizontal or Vertical); Bulldozer or Endloader (Over 40 hp); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Manhoist; Material or Stack Hoist; Mechanic or Welder; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket). Premium Increase(s): Add $.25/hr for operating tower crane.	34.41	19.15	53.56

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
524	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Environmental Burner; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Hoist (Tugger, Automatic); Grout Pump; Jeep Digger; Lift Slab Machine; Mulcher; Power Subgrader; Pump (3 Inch or Over) or Well Points; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Tining or Curing Machine; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames.	31.89	18.11	50.00
525	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Loading Machine (Conveyor); Post Hole Digger or Driver; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack. Premium Increase(s): Add $.25/hr for operating tower crane.	31.96	19.15	51.11
526	Boiler (Temporary Heat); Forklift; Greaser; Oiler.	30.44	19.10	49.54
527	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	37.45	19.45	56.90
528	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	37.45	19.45	56.90
529	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	27.75	19.15	46.90
530	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; Off Road Trucks - Great Lakes ONLY.	27.75	19.15	46.90

AIRPORT PAVEMENT OR STATE HIGHWAY CONSTRUCTION

Includes all airport projects (excluding buildings) and all projects awarded by the Wisconsin Department of Transportation (excluding buildings).

SKILLED TRADES

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	35.58	19.20	54.78
105	Carpenter Future Increase(s): Add $.75/hr on 6/3/2013. Add $1.25/hr on 6/2/2014. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.93	19.81	52.74
107	Cement Finisher Future Increase(s): Add $1.87 on 6/1/13; Add $1.87 on 6/1/14; Add $1.87 on 6/1/15; Add $1.75 on 6/1/16. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	30.69	17.53	48.22
109	Electrician	31.54	21.14	52.68
111	Fence Erector	28.00	4.50	32.50
116	Ironworker	31.31	21.99	53.30
118	Line Constructor (Electrical)	31.29	15.34	46.63
124	Painter	29.22	16.69	45.91
125	Pavement Marking Operator	29.22	16.69	45.91
126	Piledriver	29.56	23.86	53.42
133	Roofer or Waterproofer	29.40	15.05	44.45
137	Teledata Technician or Installer	24.65	15.67	40.32
143	Tuckpointer, Caulker or Cleaner	34.35	11.13	45.48
144	Underwater Diver (Except on Great Lakes)	37.45	19.45	56.90
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.64	17.06	46.70

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	30.60	14.64	45.24
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	25.94	13.57	39.51
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.08	12.96	37.04
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	11.90	33.65

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	33.22	18.90	52.12
203	Three or More Axle Future Increase(s): Add $1.85/hr on 6/1/2013. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	23.31	17.13	40.44
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	27.77	19.90	47.67
205	Pavement Marking Vehicle	23.84	14.90	38.74
206	Shadow or Pilot Vehicle	33.22	18.90	52.12
207	Truck Mechanic	22.50	16.19	38.69

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Future Increase(s): Add $1.70/hr on 6/1/2013; Add $1.60/hr on 6/1/2014. Premium Increase(s): Add $.15/hr for air tool operator, joint sawer and filler (pavement), vibrator or tamper operator (mechanical hand operated), chain saw operator and demolition burning torch laborer; Add $.35/hr for bituminous worker (raker and luteman), formsetter (curb, sidewalk and pavement) and strike off man; Add $.50/hr for line and grade specialist; Add $.65/hr for blaster and powderman; Add $2.01/hr for topman; Add $2.46/hr for bottomman; Add $3.23/hr for pipelayer. / DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr for work on projects involving temporary traffic control setup, for lane and 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).	25.39	18.40	43.79
302	Asbestos Abatement Worker	18.00	0.00	18.00
303	Landscaper Future Increase(s): Add $1.70/hr on 6/1/13; Add $1.60/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr for work on projects involving temporary traffic control setup, for lane and 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).	25.39	18.40	43.79
304	Flagperson or Traffic Control Person Future Increase(s): Add $1.70/hr on 6/1/2013; Add $1.60/hr on 6/1/2014. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	21.88	18.40	40.28

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.24	15.03	32.27
314	Railroad Track Laborer	14.50	3.53	18.03

HEAVY EQUIPMENT OPERATORS
AIRPORT PAVEMENT OR STATE HIGHWAY CONSTRUCTION

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
531	Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Traveling Crane (Bridge Type). Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	35.22	19.90	55.12
532	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs., & Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	34.72	19.90	54.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
533	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boatmen (NOT Performing Work on the Great Lakes); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, VIbratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane WIth a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	34.22	19.90	54.12
534	Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or WIthout Attachments); Telehandler; Tining or Curing Machine. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s):	33.96	19.90	53.86

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
	DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.			
535	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	33.67	19.90	53.57
536	Fiber Optic Cable Equipment.	20.00	7.88	27.88
537	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	37.45	19.45	56.90
538	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	37.45	19.45	56.90
539	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	27.75	19.15	46.90
540	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; Off Road Trucks-Great Lakes ONLY.	27.75	19.15	46.90

LOCAL STREET OR MISCELLANEOUS PAVING CONSTRUCTION

Includes roads, streets, alleys, trails, bridges, paths, racetracks, parking lots and driveways (except residential or agricultural), public sidewalks or other similar projects (excluding projects awarded by the Wisconsin Department of Transportation).

SKILLED TRADES

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	33.00	15.00	48.00
105	Carpenter	30.16	15.31	45.47
107	Cement Finisher	28.73	17.03	45.76
109	Electrician Future Increase(s): Add $1.60/hr on 6/1/2013. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.20	21.71	53.91
111	Fence Erector	28.00	4.50	32.50
116	Ironworker	31.31	21.99	53.30
118	Line Constructor (Electrical)	37.05	16.94	53.99
124	Painter	29.27	18.18	47.45
125	Pavement Marking Operator	28.10	15.00	43.10
126	Piledriver	29.56	24.96	54.52
133	Roofer or Waterproofer	29.40	15.05	44.45
137	Teledata Technician or Installer	24.65	15.67	40.32
143	Tuckpointer, Caulker or Cleaner	34.35	11.13	45.48
144	Underwater Diver (Except on Great Lakes)	37.45	19.45	56.90
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.64	14.55	44.19
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	30.60	14.64	45.24
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	25.94	13.57	39.51
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.08	12.96	37.04
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	11.90	33.65

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	25.87	13.00	38.87
203	Three or More Axle	17.00	0.00	17.00
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add $1/hr on 6/2/2013.	32.39	18.46	50.85
205	Pavement Marking Vehicle	20.85	11.02	31.87
206	Shadow or Pilot Vehicle	25.87	13.00	38.87
207	Truck Mechanic	17.00	0.00	17.00

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer	22.31	18.64	40.95
303	Landscaper Future Increase(s): Add $1.70/hr on 6/1/13; Add $1.60/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr for work on projects involving temporary traffic control setup, for lane and 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).	28.07	13.90	41.97
304	Flagperson or Traffic Control Person Future Increase(s): Add $1.70/hr on 6/1/2013; Add $1.60/hr on 6/1/2014. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	24.70	13.90	38.60
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.24	15.03	32.27
314	Railroad Track Laborer	14.50	3.53	18.03

HEAVY EQUIPMENT OPERATORS
CONCRETE PAVEMENT OR BRIDGE WORK

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
541	Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	35.22	19.90	55.12
542	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Crane, Tower Crane Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	34.72	19.90	54.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
543	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	34.22	19.90	54.12
544	Backfiller; Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Jeep Digger; Joint Sawer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (WIth or Without Attachments); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	33.96	19.90	53.86

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
545	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack.	33.02	17.60	50.62
546	Fiber Optic Cable Equipment.	20.00	7.88	27.88
547	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	37.45	19.45	56.90
548	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	37.45	19.45	56.90
549	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or more); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	27.75	19.15	46.90
550	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; Off Road Trucks - Great Lakes ONLY.	27.75	19.15	46.90

HEAVY EQUIPMENT OPERATORS
ASPHALT PAVEMENT OR OTHER WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
551	Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads and/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic.	39.16	19.10	58.26
552	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add $1/hr on 6/2/2013.	32.92	18.46	51.38

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
553	Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boring Machine (Directional, Horizontal or Vertical); Bulldozer or Endloader; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Laser/Screed; Concrete Slipform Placer Curb & Gutter Machine; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames.	32.67	18.44	51.11
554	Backfiller; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self-Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14.	33.67	19.55	53.22
555	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14.	33.67	19.55	53.22
556	Fiber Optic Cable Equipment.	20.00	7.88	27.88

RESIDENTIAL OR AGRICULTURAL CONSTRUCTION

Includes single family houses or apartment buildings of no more than four (4) stories in height and all buildings, structures or facilities that are primarily used for agricultural or farming purposes, excluding commercial buildings. For classification purposes, the exterior height of a residential building, in terms of stories, is the primary consideration. All incidental items such as site work, driveways, parking lots, private sidewalks, private septic systems or sewer and water laterals connected to a public system and swimming pools are included within this definition. Residential buildings of five (5) stories and above are NOT included within this definition.

SKILLED TRADES

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer	19.50	10.98	30.48
102	Boilermaker	31.09	27.23	58.32
103	Bricklayer, Blocklayer or Stonemason	25.00	12.36	37.36
104	Cabinet Installer	26.00	2.61	28.61
105	Carpenter	33.43	7.16	40.59
106	Carpet Layer or Soft Floor Coverer	32.93	21.85	54.78
107	Cement Finisher	23.32	6.27	29.59
108	Drywall Taper or Finisher	29.87	18.79	48.66
109	Electrician	24.50	8.96	33.46
110	Elevator Constructor	41.71	23.88	65.59
111	Fence Erector	13.00	1.07	14.07
112	Fire Sprinkler Fitter	37.45	19.30	56.75
113	Glazier	22.00	2.09	24.09
114	Heat or Frost Insulator	35.00	0.00	35.00
115	Insulator (Batt or Blown)	12.82	0.00	12.82
116	Ironworker	30.90	19.11	50.01
117	Lather	33.43	7.16	40.59
119	Marble Finisher	16.50	2.38	18.88
120	Marble Mason	25.00	12.36	37.36
121	Metal Building Erector	17.00	2.62	19.62
123	Overhead Door Installer	25.00	19.00	44.00
124	Painter	23.50	3.73	27.23
125	Pavement Marking Operator	28.10	15.00	43.10

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
129	Plasterer	20.00	0.00	20.00
130	Plumber	36.97	18.42	55.39
132	Refrigeration Mechanic	24.75	10.42	35.17
133	Roofer or Waterproofer	29.40	15.55	44.95
134	Sheet Metal Worker	28.15	15.14	43.29
135	Steamfitter	38.26	19.49	57.75
137	Teledata Technician or Installer	18.85	5.00	23.85
138	Temperature Control Installer	22.00	1.10	23.10
139	Terrazzo Finisher	26.57	16.00	42.57
140	Terrazzo Mechanic	30.01	17.13	47.14
141	Tile Finisher	20.60	3.53	24.13
142	Tile Setter	20.43	8.03	28.46
143	Tuckpointer, Caulker or Cleaner	32.50	2.84	35.34
146	Well Driller or Pump Installer	27.60	0.00	27.60
147	Siding Installer	16.00	0.62	16.62

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	16.25	4.60	20.85
203	Three or More Axle	17.10	1.78	18.88
205	Pavement Marking Vehicle	20.85	11.02	31.87
207	Truck Mechanic	19.00	1.85	20.85

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer	18.00	6.16	24.16
302	Asbestos Abatement Worker	18.00	0.00	18.00
303	Landscaper	11.00	0.00	11.00

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.24	15.03	32.27
315	Final Construction Clean-Up Worker	15.00	0.00	15.00

HEAVY EQUIPMENT OPERATORS
RESIDENTIAL OR AGRICULTURAL CONSTRUCTION

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
557	Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Backhoe (Track Type); Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boring Machine (Directional, Horizontal or Vertical); Bulldozer or Endloader; Concrete Breaker (Large, Auto, VIbratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & DIstributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Crane, Shovel, Dragline, Clamshells; Forestry Equipment, TImbco, Tree Shear, Tub Grinder, Processor; Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type); WInches & A-Frames.	23.35	5.58	28.93
558	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Backfiller; Belting, Burlap, Texturing Machine; Boiler (Temporary Heat); Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & LIght Equipment); Concrete Finishing Machine (Road Type); Farm or Industrial Type Tractor; Forklift; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Jeep Digger; Lift Slab Machine; Mulcher; Oiler; Post Hole Digger or Driver; Power Subgrader; Pump (3 Inch or Over) or Well Points; Robotic Tool Carrier (With or Without Attachments); Rock, Stone Breaker; Roller (Rubber Tire, 5 Tons or Under); Screed (Milling Machine); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Stump Chipper; Telehandler; Vibratory Hammer or Extractor, Power Pack.	21.10	0.87	21.97

********** END OF RATES **********

SECTION 00 83 00 - PARTIAL PAYMENTS FOR STORED MATERIALS

PART 1 – GENERAL

1.1 As stated in the General Conditions, the Commissioner of Public Works may grant an estimate of the amount of properly stored fabricated or manufactured materials and components specified, previously paid for by the Contractor. Said payments will be made in accordance with "Procedure Rules of the Commissioner of Public Works for Progress Estimates".

1.2 For inspection of properly stored materials located outside Milwaukee County, the City shall be reimbursed by the Contractor for all transportation costs, travel time wages, meals and lodging, overtime and incidental expenses for City employees performing said inspection.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

PART 4 – MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 00 83 00

SECTION 01 11 00 – SUMMARY OF WORK

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. The Contractor for this work shall refer to the "General Specifications" of the Department of Public Works dated January 31, 1992 and all subsequent addenda, as he shall be held responsible for all requirements listed herein. The Contractor shall visit the site, consult the drawings and specifications, be familiar with the project, and determine for himself all conditions affecting the work.

B. Failure by a Contractor to be familiar with the project shall not release him from any obligation undertaken under the contract to complete the work in strict conformity with the plans and specifications and all City, State or Federal codes or regulations pertaining thereto.

C. The State of Wisconsin Department of Transportation, Division of Highways, Standard Specifications for Highway and Structure Construction – 2013 Edition Part 2 through Part 7, revised by these specifications and included in the special provisions.

D. The drawings accompanying these specifications illustrate the nature and intent of the work and with the specifications form a part of the contract documents. Wherever the clauses "as shown", "as directed" or similar expressions are used, it shall be understood that reference to drawings is made.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. It is understood that the submittal of a proposal shall include all labor, materials, 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.

B. The contractor shall locate and be responsible for all lines, elevations and measurements of the structure and other work executed by the Contactor under the contract. The Contractor must exercise proper precaution to verify areas to be worked on the drawing before laying out work and will be held responsible for any error resulting from failure to exercise such precaution.

C. Contractor shall verify grades, lines, levels, locations and dimensions as shown on drawings and report any errors or inconsistencies to the Engineer before commencing work or fabrication of materials. Starting of work by the Contractor shall imply acceptance of existing conditions.

1.3 DEFINITIONS

A. The word provide, when used in this specification shall mean that the provider shall furnish and install complete the referenced item or items.

1.4 DESCRIPTION OF PROJECT

A. This project involves furnishing and installing, complete in every detail, and every aspect whether specified or not, all structural steel, poured-in-place concrete, approach span repairs and deck replacement, electrical equipment, mechanical equipment, hydraulic equipment, painting, and additional work as detailed in the contract drawings and specifications required for the completion of the rehabilitation of the St. Paul Avenue Lift Bridge. This work involves, but is not limited to, the following:

1. A navigable waterway for the duration of the project
2. Temporary support system to maintain bridge in lifted position
3. Demolition of the specified bridge and related components
4. Structural steel
5. Poured-in-place concrete
6. Reinforcing steel
7. Mechanical equipment
8. Hydraulic equipment
9. Electrical equipment, traffic barrier, control desk, and related work
10. Incidental related work

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 HOURS OF WORK

A. The contractor shall coordinate hours of work with the City of Milwaukee.

B. The hours of work shall be between 7:00 AM and 7:00 PM.

3.2 EXAMINATION OF SITE

A. All existing conditions, elevations and dimensions shall be verified at the site by the Contractor. Prior to submitting his proposal, the Contractor shall visit the site, consult the drawings and specifications and determine for himself all conditions affecting the work.

B. Contractor shall become acquainted with the location of concealed services, utilities, structures, overhead conduits and piping, etc. 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.

C. 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 unforeseen developments may not occur. They are merely provided to assist the Contractor in the investigation of conditions.

D. Contractor shall obtain complete data at the site and inspect the area that is to receive the work before proceeding with fabricating, assembling, fitting, or erecting his work.

E. The Contractor shall notify the Engineer in case of discrepancies between existing work and drawings, and defects in such surfaces that are to receive the Contractors work. The Engineer will direct such work or surfaces to be remedied.

F. Damage to the structure not documented prior to the rehabilitation work will be the Contractor's responsibility to repair.

3.3 SUPERVISION OF WORK

A. The Contractor shall provide all necessary supervision, scheduling, planning and control to perform the work and coordinate the work of all trades on the project.

B. The contractor shall furnish the services of an experienced superintendant at all times when work is being performed.

C. The superintendant shall be constantly in charge of the installation of the work together with all subcontractors, skilled workman, helpers, and labor required to perform the work.

D. The Contractor 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.

E. Upon written notice to the 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 $75.00 per hour per person from the contract for the work.

3.4 STORAGE OF MATERIALS

A. The contractor shall assume full responsibility for the protection and safekeeping of products stored on the premises.

B. The contractor shall store materials within the confines of his work space or in other areas or locations negotiated by the Contractor.

C. Materials are to be so stored as to assure the preservation of their quality and fitness for the work. When considered necessary, materials 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.

D. Stored materials shall be located so as to facilitate prompt inspection.

3.5 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. The Contractor shall be responsible for any damages caused by his operations to vehicles, landscaping, persons or property. The contractor, during all operations shall take precautions necessary for the full protection of traffic, parked vehicles, property upon and in the vicinity of the structures and utilities.

C. 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.

D. 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 to the satisfaction of the City.

E. No damaged or imperfect materials, equipment accessories, etc., will be accepted. All materials, equipment, accessories, etc. 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.

F. The Contractor shall repair all damages that he, any of his employees or his subcontractors may do to any other work or any other parts of the bridge 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.

G. If any faults are found with the Contractor's work, he shall repair or replace any of the parts he has furnished or installed as directed without any additional costs to the City of Milwaukee.

H. The Contractor shall restore, repair, refinish or replace, as part of this contract any surfaces that are damaged or left incomplete or unsightly as a result of the removal of existing equipment.

PART 4 – MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 01 11 00

SECTION 01 22 00 – UNIT PRICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Cleaning and Project Closeout, and other Division 1 Specifications Sections apply to this section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

1.3 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services.

1.4 EXTRA WORK

A. Extra work shall be performed in accordance with the Department of Public Works General Specifications Section 2.6.0 “Extra Work and Credits”

1.5 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, labor, insurance, overhead, profit, and applicable taxes.

B. Measurement and Payment:

1. All work completed under the contract will be measured by the Engineer according to United States standard measure. The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

2. The completed work will be measured for final payment by the Engineer, as specified for the various items elsewhere in these specifications, to determine the quantities of such items of work performed, except when agreements have been made providing for compensation on the basis of plan quantities as hereinafter provided or when contract change orders have been executed providing for other methods of measurement. The Contractor will be paid for the actual amount of work performed in accordance with the contract, as shown by the final measurements or upon the basis of plan quantities.

3. If the Contractor and the Engineer agree in writing that the quantities of certain items or portions of items of work as set forth in the contract or on the plans, as originally drawn or

subsequently corrected or revised, are in substantial agreement with the actual quantities of work performed, compensation therefore will be made based on the quantities set forth in the contract or on the plans, as originally drawn or subsequently corrected or revised, without measurement thereof, and the contractor shall accept such compensation as full payment for such items or portions of items.

4. When standard manufactured items are specified such as fences, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gage, unit weight, section, dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.

C. The items listed in the bid documents shall be considered as sufficient to complete the work in accordance with the plans and specifications. Any portion of the work not listed in the bid form shall be deemed to be a part of the item which it is most closely associated with and shall be included in the cost of the unit shown on the bid form. Payment for the unit shown on the bid form shall be considered to cover the cost of all labor, material, equipment and performing all operations necessary to complete the work in place. The unit of measurement shall be the unit shown on the bid form. Payment shall be based upon the actual quantity multiplied by the unit prices. Where work is to be performed at a lump sum price, the lump sum shall include all operations and elements necessary to complete the work. No payment will be made for any material wasted, unused, rejected, or used for the convenience of the Contractor.

D. Quantities and measurement of work completed shall be agreed to by both the Contractor and Project Inspector prior to submission of progress payment(s).

E. The Owner reserves the right to add or remove quantities of work from the project after the project is awarded.

F. Final payment and release of retainage will be processed following final acceptance by the Engineer. Payment will only be released once all contract requirements are fulfilled and punch-list items are marked as acceptably completed. Punch-list work is incidental to the project quantities.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

PART 4 – MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 01 22 00

SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, special provisions, and general provisions of the contract, including General Conditions and other Division 1 specification sections, apply to this section.

1.2 SUMMARY

A. This section specifies administrative and procedural requirements for handling and processing contract modifications.

1.3 MINOR CHANGES IN THE WORK

A. The engineer will issue supplemental instructions authorizing minor changes in the work, not involving adjustment to the contract sum or contract time.

1.4 CHANGE ORDERS

A. Change orders shall be requested and processed in accordance with Department of Public Works General Specifications, Chapter 2.1.26 and as herein specified.

B. The Contractor shall submit all change order requests to the City in a timely manner. Each request should include a description of the proposed change, the reason for the change, and a complete breakdown of the proposed cost including supporting information to substantiate the claim.

C. The Contractor shall include with the change order request the impact, if any, the proposed change will have on the Contractor's schedule. If a time extension to the schedule is requested, then the Contractor shall include supporting information to substantiate the claim.

D. All change order requests shall be submitted as soon as possible after the above information can be compiled. Change order requests submitted after one month of occurrence may not be granted.

E. Change orders requested to be paid on a time and material basis shall have all work documented on a daily basis. Contractor's superintendent and the Project Inspector shall sign off on a daily basis all labor hours and materials used and charged to the change orders.

F. Approval of the change order work and method and/or amount of payment shall be approved prior to Contractor proceeding with change order as outlined in the Department of Public Works General Specification.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

PART 4 – MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 01 26 00

SECTION 01 31 13 – PROJECT COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, special provisions, and general provisions of the contract, including General Conditions and other Division 1 specification sections, apply to this section.

1.2 SUMMARY

A. The General Contractor shall assume and take responsible charge of the project and shall coordinate the work of each Subcontractor so as to complete the project in an orderly and timely manner.

B. Each Contractor shall:

1. Coordinate the work of his own employees

2. Expedite his work to assure compliance with schedules.

3. Coordinate the work with that of other Contractors and City of Milwaukee.

1.3 SPECIAL REQUIREMENTS

A. The required time of completion.

1. The Contractor shall complete all work for substantial completion by 12:01 A.M. on June 9, 2014.
2. The Contractor shall complete all work for the project by the Contract Completion Date by 12:01 A.M. on July 21, 2014.

B. This project has special requirements regarding the coordination of the work because of the specialized work involved and because of Milwaukee River must remain navigable at all times by marine traffic.

C. To meet these special requirements the General Contractor shall submit a plan for the lift span temporary structure shoring prior to the onset of rehabilitation. This plan will be reviewed and is subject to approval by the City.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 COORDINATION PROCEDURES

A. Cooperate with the City and other persons of all trades engaged in the work in such a manner and to such extent as will best facilitate the work of each and the prompt completion of the work.

B. Maintain progress of the work, order materials and let subcontracts promptly, and schedule and expedite work so as to avoid delay.

C. Notify other Contractors, trades and City of Milwaukee whose work is in any way connected to, combined with, or influenced by the Contractor's work and allow them reasonable time to complete their work.

D. Carefully examine the drawings and specifications to ascertain the extent of the work of all trades.

E. Coordinate access to and use of the site, and storage of materials on the site with the subcontractors.

F. Coordinate Contractor's work with adjacent work and cooperate with all other trades so as to facilitate the general progress of the project. Afford all other trades every reasonable opportunity for the installation of their work and for the storage of their material. In no case exclude from the premises or work, any other Contractor or Subcontractor or their employees; nor interfere with any Contractor or Subcontractor in the execution or installation of his work.

G. Perform work in proper sequence in relation to that of other trades. Pay all costs caused by defective or ill-timed work.

H. Arrange work and dispose of materials so as not to interfere with the work or storage of materials of other Contractors and join his work to that of others in accordance with the intent of the drawings, special provisions, and specifications.

I. Notify the City of unforeseen conditions found in the field.

3.2 EXAMINATION OF DRAWINGS

A. Examine all drawings together with the specifications, or special provisions applicable to the contract.

B. After examination of the contract documents, bring to the attention of the City any questions with regard to the intent of these documents, in a timely manner, prior to commencing with the work.

PART 4 - MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 01 31 13

SECTION 01 31 19 – PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General Conditions and other Division 1 specification sections, apply to this section.

1.2 SUMMARY

A. This section specifies administrative and procedural requirements for project conferences and meetings, including, but not limited to, the following:

1. Pre-Construction Conference

2. Progress Meetings

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 1 Section 01 31 13 “Project Coordination” for procedures for coordinating project meetings with other construction activities.

2. Division 1 Section 01 33 01 “Submittals And Permits” for submitting the contractor’s construction schedule.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION CONFERENCE

A. Soon after award of 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 conference responsible representatives from subcontractors who are to furnish the required materials and perform work on the project.

C. The purpose of the conference is to discuss in detail the plans and specifications. The discussion shall include but is not limited to:

1. Schedule
2. Equipment
3. Material storage
4. Inspection requirements
5. Inspection reports
6. Protection procedures for the structure adjacent facilities, environment, and personnel

D. The Contractor shall submit the construction schedule to the Engineer at this conference. It must include all of the Contractor's work and all the work of subcontractors. Copies of this schedule shall be submitted to the City for review. The schedule shall include the following:

    1. List of starting and completion dates for each major item

    2. Running schedule of a week-by-week charting and allowing for charting of:

        a. Expected progress on major items
        b. Actual progress on major items
        c. Critical path items

E. Contractor shall describe in detail when each portion of the work is to be accomplished and subcontractors shall participate in the discussion. The Engineer will serve to interpret the contract documents should such questions arise.

F. Any other questions that the Contractor/Subcontractors have about the work or its scheduling shall be raised at this conference.

G. Requirements for contract administration and construction operations will be defined for participants.

H. Time, date and place of the conference will be determined by the Engineer.

3.2 PROGRESS MEETINGS

A. Weekly progress meetings will be held at the project site by the City's representative for the purpose of coordinating and expediting the work progress.

B. Attendance at progress 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.

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

D. The Contractor shall submit an updated construction schedule at each progress meeting with the expected progress of major items, actual progress on major items and critical path items outlined. A short narrative should be written describing the cause of any delays and intended action to remedy delays. On a monthly basis, provide an overall project schedule tracking the actual progress of major and critical path items, expected progress of remaining major and critical path items, and anticipated completion date.

PART 4 – MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 01 31 19

SECTION 01 33 01 – SUBMITTALS AND PERMITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, special provisions, and general provisions of the contract, including General Conditions and other Division 1 specification sections, apply to this section.

1.2 SUMMARY

A. This section includes administrative and procedural requirements for submittals and permits required for performance of the work.

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

1. United States Department of Labor – Occupational Safety and Health Administration (OSHA)
2. Wisconsin Department of Workforce Development
3. City of Milwaukee Building Code
4. Wisconsin Administrative Code
5. Ordinances of the City of Milwaukee
6. National Electrical Code
7. American Association of State and Highway Transportation Officials (AASHTO)
8. Federal Navigation Regulations including U.S. Coast Guard Regulations

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SUBMITTALS AND SAMPLES

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

1. Forward submittals not more than 30 calendar days after the Award of Contract for all materials to be used on the project. No work, indicated on any one shop drawing, hardware list, etc., shall be started until such information has been approved.

2. Include with each submittal a transmittal letter signed by the Contractor containing the following:

a. Name of Contractor
b. Name of Project
c. List of Submittals with Specification Section references
d. Name of Manufacturer or Supplier
e. Additional information as required for the items being provided.

3. Coordinate transmittal of different types of submittals for related elements of the work so processing will not be delayed by the need to review submittals concurrently for coordination.

    a. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

4. Processing: No specific time periods are established herein for submittals or for the engineers review. To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.

    a. Allow up to 21 days for initial review. Allow additional time if the Engineer must delay processing to permit coordination with subsequent submittals.
    b. If an intermediate submittal is necessary, process the same as the initial submittal.
    c. Allow up to 21 days for reprocessing each submittal.
    d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the work to permit processing.

5. Questions on the plans and project specifications during the contract bidding phase should be directed no later than April 10, 2013 to:

    Mr. Craig Liberto
    Structural Design Manager
    Infrastructure Services Division
    Room 907, Frank P. Zeidler Municipal Building
    841 North Broadway
    Milwaukee, WI 53202
    (414) 286-3294
    craig.liberto@milwaukee.gov

    Questions that merit a formal response will be posted on the City's Official Notice Website on a periodic basis for all bidders to view.

    All correspondence including submittals, payment requests (5 copies), change order proposals, construction time letters (delays, suspensions), and any construction related matters shall be addressed as follows:

    Construction Supervisor
    Infrastructure Services Division
    Room 701, Frank P. Zeidler Municipal Building
    841 North Broadway
    Milwaukee, WI 53202

    Note: A specific Construction Supervisor will be assigned to the project prior to the start of construction and contact information will be shared at the preconstruction conference.

All correspondence concerning the following items; Minority, Woman, Small Business Enterprise program Reports, Residency Preference Program, Apprentice Program, Wage and Hour Reports, Insurance Certificates, Subcontractor Approval Forms, and all affidavits should be sent to:

Ms. Barbara A. Trible
Department of Public Works
Room 507, Frank P. Zeidler Municipal Building
841 North Broadway
Milwaukee, WI 53202
(414) 286-3309
barbara.trible@milwaukee.gov

B. Approvals: Wherever the words “or equal” or “approved equal” or similar terms are used, it shall mean as approved by the Commissioner of Public Works or agent. All shop drawings, bulletins, manufacturer’s cut sheets and data necessary for an approval shall be submitted with five (5) copies sent to the City Engineer. Three (3) copies are required for the City’s use, one (1) copy for the City’s Consultant, and one (1) copy will be returned to the Contractor. Electronic submittals are acceptable with the exception of color or material samples.

C. Approval shall apply to general conformance only, and shall in no way relieve this Contractor from his/her responsibility for the full performance of contract.

3.2 CODES AND PERMITS

A. The contractor shall obtain and pay for all permits, charges, fees and licenses, if any are necessary for the prosecution of the work.

B. The contractor shall comply with all laws, ordinances, rules and regulations bearing in the conduct of the work including the giving of notices.

C. The cost of special equipment, enclosures, protective coverings, etc., as may be required to comply with codes and ordinances shall be included in the appropriate price bid for the work.

D. If any material or work is specified contrary to such rules or omitted from the specifications or drawings but required by such rules, it shall be altered as required by the contractor to meet these rules and regulations.

E. Attention is directed to the Milwaukee County Air Pollution Control Ordinances and the Department of Natural Resources relative to the specific sections which are applicable to sandblasting and spray painting.

PART 4 – MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 01 33 01

SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, special provisions, and general provisions of the contract, including General Conditions and other Division 1 specification sections, apply to this section.

1.2 SUMMARY

A. This section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.

B. Temporary utilities may include, but are not limited to, the following:

1. Water service and distribution
2. Temporary electric power and light
3. Temporary heat
4. Ventilation
5. Telephone service

C. Support facilities may include, but are not limited to, the following:

1. Temporary enclosures
2. Hoists and scaffolding
3. Temporary project identification signs and bulletin boards
4. Waste disposal services
5. Construction aids and miscellaneous services and facilities

D. Security and protection facilities may include, but are not limited to, the following:

1. Barricades, warning signs, and lights
2. Enclosure fence for the site
3. Environmental protection

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TEMPORARY OR TRIAL USAGE

A. 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.

3.2 TEMPORARY POWER

A. The Contractor shall provide all power required, and be responsible for payment for all utility bills beginning at the start date for the duration of the project.

1. OSHA regulations require that employers use either ground fault circuit interrupters or an assured equipment grounding conductor program in addition to any other regulation or equipment ground connectors.

3.3 TEMPORARY LIGHTING

A. Temporary lighting shall be provided and maintained by the Contractor.

B. Furnish, install, and maintain temporary lighting during construction.

1. Lighting shall be sufficient to enable all trades to complete their work. Illumination in all areas shall meet or exceed State Code requirements. (See IND 35.38). Provide at least one 200 watt lamp for each 400 square feet of floor space.

2. Remove the temporary lighting when the job is completed.

3.4 BULLETIN BOARD

A. Furnish and maintain a 4-feet 0-inch by 4-feet 0-inch bulletin board for the posting of wage employment data, etc.

3.5 FIELD OFFICE

A. The location of a field office shall be coordinated with the City of Milwaukee for the Rehabilitation of the St. Paul Avenue Lift Bridge.

PART 4 –MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 01 50 00

SECTION 01 60 01 – MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 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 manufacturer's meeting the approval of the Engineer of equal specifications will be considered excepting as may be specifically stated otherwise. Evaluating of other manufacturer's products will be made at the time of shop drawing submission. Samples and/or demonstrations may be requested.

B. Materials and equipment 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. Packages shall have stamped on them the date of manufacture and shelf life, if applicable.

C. The Commissioner of Public Works or his representative shall have the right to reject material not in compliance with specifications as well as damaged material and the Contractor shall remove such material from the construction site when as directed.

1.2 MATERIAL STORAGE

A. Storage areas are available within the Contractor's occupancy limits.

B. Refer to Section 01 11 00 Summary of Work, Part 3.4 Storage of Materials.

1.3 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.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

PART 4 - MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 01 60 01

SECTION 01 70 01 – CLEANING AND PROJECT CLOSE-OUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, special provisions, and general provisions of the contract, including General Conditions and other Division 1 specification sections, apply to this section.

B. Article 2.5.4 of the General Specifications of the City of Milwaukee Department of Public Works shall be supplemented as specified hereafter.

1.2 SUMMARY

A. This section includes administrative and procedural requirements for cleaning and project closeout including, but not limited to, the following:

1. Project record document submittal
2. Submittal of warranties
3. Final cleaning

1.3 AS-BUILT DRAWINGS

A. At the completion of work and prior to final payment, the contractor shall provide the City with a marked up set of “as-built” drawings showing all changes or variations from contract drawings, including those specified on change order drawings heretofore issued. Contractors providing buried or concealed piping, conduit or similar items shall locate such items by dimensions and elevations.

B. Marked up sets of prints will be acceptable providing they are in first class condition for record purposes. Each contractor shall be responsible for accuracy of record drawings.

1.4 GUARANTEE

A. This 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, materials, or equipment in which defects may develop within a minimum one (1) year warranty period from the date of final acceptance of his work excepting as may be hereinafter specified. This guarantee includes all damage done by the City due to faulty equipment, poor installation or poor construction caused by the Contractor. The City shall also receive any extended guarantees or warranties normally supplied by any vendor or manufacturer for material or equipment incorporated in the work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SAFETY CLEANING

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

1. Work areas, passageways, stairs, must be kept free of debris and scrap.

2. Form and scrap lumber shall have nails withdrawn or bent over and lumber shall be stacked or removed.

3. Spills of paint, oil, grease, or other liquids shall be removed immediately.

3.2 PROGRESS CLEANING

A. Prime Contractor and subcontractor shall remove his rubbish and debris from the site promptly upon its accumulation.

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.

D. The Contractor is not allowed to wash debris or other harmful contaminants into the Milwaukee River or down drains that would be discharged into City Sewers. Filters shall be inserted in the drain where it is likely debris may accumulate.

3.3 DISPOSAL

A. All demolished materials required for this work shall be carefully collected and removed from site.

B. No burning of rubbish or debris will be allowed at the site. No rubbish shall be thrown from heights without proper protection. When dust will be generated or flying debris is likely to occur, provide dust tight chutes or other means to control dust.

C. 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.

3.4 FINAL CLEANING

A. Complete final cleaning immediately prior to substantial completion.

B. Contractors shall expedite or perform thorough cleaning, sweeping, and washing of work to remove from work area and equipment under his contract, all foreign matter, dust, debris, 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. Remove debris from drains and flush clean.

D. Employ trained experienced workmen for the final cleaning.

3.5 CHARGES

A. If Prime Contractors do not remove rubbish or clean the project site as specified above, the City reserves the right to have work done by others at Contractor's expense.

B. Employees of the City who are required to clean up any rubbish will record all hours involved to complete such work.

C. The cost incurred by the City for this special cleaning shall be charged against the contract price of the Contractor as determined by the City.

PART 4 - MEASUREMENT AND PAYMENT (Not Applicable)

END OF SECTION 01 70 01

Special Provisions

Table of Contents

SPECIAL PROVISIONS

1. General

Perform the work under this construction contract for the St. Paul Avenue Lift Bridge over the Milwaukee River, City of Milwaukee, Milwaukee County, Wisconsin as the plans show and execute the work as specified in the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, 2013 Edition, as published by the department, and these special provisions. The City considers only City and department standard specifications, supplemental specifications and interim supplemental specifications issued directly from the City as valid for this contract.

If all or a portion of the plans and special provisions are developed in the SI metric system and the schedule of prices is developed in the US standard measure system, the City will pay for the work as bid in the US standard system.

The City of Milwaukee is referred as the City and Wisconsin Department of Transportation is referred as the Department in this specification.

2. Scope of Work

The work under this contract shall consist of the rehabilitation of Structure P-40-523 including major rehabilitation of structural, mechanical, and hydraulic, electrical elements of the bridge, approach roadway work to match the bridge deck profile, sidewalk and all incidental items necessary to complete the work as shown on the plans and included in the proposal and contract.

3. Prosecution and Progress

Begin work within ten calendar day after the engineer issues a written notice to proceed.

Provide the start date to the engineer in writing within a month after executing the contract but at least 14 calendar days before the pre-construction conference. Upon approval, the engineer will issue the notice to proceed within 10 calendar days before the approved start date.

To revise the start date, submit a written requires to the engineer at least two weeks before the intended start date. The engineer will approve or deny that request based on the conditions cited in the request and its effect on the City' scheduled resources.

Closure of the St. Paul Ave. Bridge to vehicular and pedestrian traffic cannot occur until Tuesday, September 3, 2013. Activates such as mobilization, placement of barges, or construction activities under the bridge that do not affect vehicular/pedestrian traffic, navigation under the lift span, or bridge operations can begin prior to September 3,2013 with approval of the City Engineer or his representative.

The plans and specifications include accommodation and provisions for a proposed

streetcar dual track across the bridge. There may be revisions during the final design of the streetcar contract that may affect some of the details shown on the bridge plans and specifications. Every effort will be made to inform the bridge contractor in a timely manner of any changes and coordination.

Coordinate construction activities so that all work on this contract is completed by the project's completion date.

The City of Milwaukee will be responsible for raising, lowering, and opening the existing bridge to river traffic until the contractor is permitted to begin rehabilitating the bridge.

Provide the proposed sequence of operations, methods of handling traffic, method of operation in the Milwaukee River so as to minimize interference with river traffic, plans for cleanup of the Milwaukee River should spills of oil, soil or debris from abutment and pier rehabilitation construction or other types of pollutants be accidentally discharged into it, and a program of debris removal to prevent accumulation of unsightly debris in the water course in writing within fourteen days before the pre-construction conference. Submit revisions in traffic handling to the engineer for approval at least 48-hours in advance of making any changes in traffic operations.

The contractor will be responsible to find the staging area during construction by occupying the work area on the bridge, approaches, or by negotiating with the adjacent property owners for the construction staging.

Notify the following personnel within the specified time period prior to commencing any construction operations:

1. Obtain permission from the engineer a minimum of 48 hours prior to any construction schedule change.

2. The Coast Guard has determined that the project will not require a Coast Guard permit as there are no changes that alter the permitted navigational clearances or character of the bridge; however it does require a letter of authorization to proceed. Once the contract is awarded, the contractor is required to coordinate efforts with the U.S. Coast Guard – Commander, Ninth coast Guard District, 1240 East 9th Street, Room 2019, Cleveland, OH 44199-2060, telephone 216-904-6085, fax (216) 902-6088 at least 30 days in advance of any construction over the waterway. Allow an additional five days for mail processing once the package has been received by the U.S. Coast Guard facility. Primary contacts are:

Name:	Phone:	Email:
Lee Soule	216-902-6085	lee.d.soule@uscg.mil
Scot Striffler	(216) 902-6087	scot.m.strifflen@uscg.mil
Blair Stanifer	(216)902-6086	William.B.Stanifer@uscg.mil

Provide the Coast Guard with a schedule and timeframe for removal and replacement of the lift span and describe any temporary construction aids and work within the limits of the Milwaukee River to receive the U.S. Coast Guard authorization. The Coast Guard notification requirement is based on anticipated beginning of reconstruction of the lift span and any work that affects the operation of the bridge or navigation within the Milwaukee River throughout the duration of the project.

During the project (due to unforeseen project requirements) if the contractor needs to alter the original plan as it affects the navigation of the waterway the contractor will have to provide a minimum of two weeks advance notice to the Coast Guard prior to altering the original plan. Copy the engineer on all correspondence with the Coast Guard.

The contractor will have to maintain a clearance of at least 25'-6" above the City of Milwaukee Datum under the lift span at all times for the navigational traffic. The barges, if needed for construction, will have to be positioned outside the navigational waterway unless the minimum two weeks prior notice is given to the Coast Guard.

The scaffolding or containment should not be installed more than 2'-0" under the steel girders on the approach fixed spans. The contractor will have to provide temporary lighting to denote the low clearance of the scaffolding or containment on the approach fixed spans and the lift span.

Once work has started on the contract, work continually until the contract work is complete. The contract will not be considered complete until all items on the contract are completed. Obtain approval from the engineer at least 24-hours in advance if work on Saturday, Sunday or nationally recognized legal holidays is desired. Notify the engineers as soon as possible, but no later than 12:00 P.M. the day before of scheduling changes after approval has been obtained.

Maintain or provide where necessary, as directed by the engineer, pedestrian access to adjacent properties, businesses, river walks, and at bus stops. Provide adequate temporary sidewalk and bridging between the curb and right-of-way line over freshly paved concrete or other obstructions on the sidewalk area at entrances to building or as direct by the engineer.

Maintain vehicular access to all business and commercial properties at all times except as noted in traffic control plans and specifications.

Inform property owners at least 48-hours prior to removing a driveway approach, which serves that property. Schedule sidewalk and driveway approach removal and replacement so that the time lapse between the removal and replacement is minimal.

Use equipment having vacuum or water-spray mechanisms to eliminate the dispersion of dust when performing roadway-cleaning operations. Provide suitable, self-contained particulate collectors, if vacuum equipment is used, to prevent discharge from collection bin into the atmosphere.

Wisconsin DNR

The DNR recommends that all in-water construction activity be avoided from March 15 to June 15 to protect endemic fish population during spawning activities. It is also necessary to maintain an unobstructed passageway through to construction area at these locations at all times to allow for continuous fish movements.

There is potential for bird nesting under the St. Paul Avenue Bridge. The International Migratory Bird Act protects international migratory birds such as seagulls, swallows, and terns. The Department of Natural Resources recommends that the bridge roof and exterior be checked twice daily and empty nests be removed. It is a violation of federal law to disturb nests if eggs or fledgling young are present. Please contact Brian Nelson, United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services at (920) 324-4514 if eggs or fledgling young are present.

If swallow nests are present, do not remove or destroy them when the swallows are nesting or rearing their young. The nesting season for swallows has been established as May 1 through August 30. Apply for a depredation permit from the US Fish and Wildlife Service for work that may disturb or destroy occupied nests during the nesting period. The need for a permit may be avoided by removing the existing bridge superstructure prior to nest occupation by swallows, and clearing the nests from and installing a suitable netting device on the remaining existing superstructure prior to nesting activity to prevent the swallows from nesting. The cost for preventing nesting shall be included in the cost of Removing Old Structure Over Waterway with Minimal Debris.
State endangered species are present in the project area. They are:

Luxilus chrysocephalus	Striped Shiner	Fish

Please follow in-water work restrictive dates to avoid impacts to these species.

Boat and Gear Disinfection Protocol
Boat and trailer cleaning guidelines to prevent the spread of aquatic invasive species have been widely distributed to the public through a variety of publications, pamphlets, signs, etc. The guidelines consist of a nationally-accepted set of prevention steps. While disinfection is **not** a required prevention step for the general public, some boaters may be interested in the disinfection procedures followed by the WI DNR. Please note: the first three steps (Inspect and Remove, Drain, and Dispose) listed below are required.

The following steps shall be taken every time a boat, equipment or gear is moved between waters to avoid transporting invasive species and/or pathogens:

- **Inspect** and **remove** aquatic plants, animals, and mud from your boat, trailer, equipment and gear.

- **Drain** all water from your boat, motor, live well, bilge, transom wells, as well as from your equipment and gear, including but not limited to tracked vehicles, barges, silt or turbidity curtain, hoses, sheet pile and pumps.
- **Dispose** of unwanted aquatic plants and animals in an appropriate way.
- **Disinfect** your boat, equipment and gear by either:
- **Washing** with ~212º F water (steam clean), OR
- **Drying** thoroughly for 5 days after cleaning with soap and water and/or high pressure water, OR
- **Disinfecting** with either 200 ppm (0.5 oz per gallon or 1 Tablespoon per gallon) Chlorine for 10-minute contact time or 1:100 solution (38 grams per gallon) of Virkon Aquatic for 20- to 30-minute contact time. Note: Virkon is not registered to kill zebra mussel veligers nor invertebrates like spiny water flea. Therefore this disinfect should be used in conjunction with a hot water (>104º F) application.

Safety Precautions for Disinfectant Use:

Virkon-A:

1. Receive and be required to read a copy of the Virkon-A Materials Safety Data Sheet (MSDS) for the product.
2. Wear chemical splash goggles.
3. Wear a face shield where the possibility exists for face contact due to splashing or spraying of the material.
4. Wear impervious clothing to prevent contact with skin. (gloves, pants, jacket, hood, and boots) or a Tyvek style full body suit.

In addition, all employees who handle or mix Virkon-A in powder form and prefer to wear a dust mask respirator when handling powder, may do so in compliance with the DNR Respiratory Protection Program Handbook MC 9180.5 Voluntary Use requirements.

Bleach:

Follow precautions 2, 3, and 4 (above).

- Chlorine Wear eye protection, rain gear, gloves if spraying. Stay upwind of the spray. Will break down in sunlight and when in contact with organic material. Is corrosive to metal and rubber. Is toxic to fish at these concentrations so rinse well after disinfection or neutralize with sodium thiosulfate. For neutralizing chlorine, spray sodium thiosulfate in an 800 ppm solution (3 grams per gallon of water) on all surfaces after the disinfection period is over. Rinse with water from the next lake to remove any remaining sodium thiosulfate.
- Virkon Aquatic This is a disinfectant in the peroxygen (hydrogen peroxide) family. It is a powder. It is 99.9% biodegradable and breaks down to water and oxygen and is not corrosive at the working dilution. Wear dust mask if mixing powder and eye protection, rain gear and gloves if spraying. Stay upwind of spray.

Sources of disinfectants

Chlorine - Household bleach (5.25% chlorine) can be purchased from a grocery or convenience store. HTH is granular chlorine (70% calcium hypochlorite) and can be purchased from a pool supply company.

Sodium Thiosulfate - Commonly used to neutralize chlorine and iodine. It should be available at a pool supply company or from a chemical supply company.

Virkon Aquatic is available from Western Chemical. It is the same formulation, but without the perfume and dye, and the label addresses specific fish pathogens. Their phone is 1-800-283-5292.

Disinfection measures must be taken prior to moving boats, equipment and other gear from one waterbody to another. They are not needed daily when sampling the same waterbody or for law enforcement equipment in emergency situations. In cases where boats and gear return to state hatcheries, disinfection should be done in a location away from ponds and water supplies to prevent disinfectant or untreated water from entering those areas. Every effort should be made to keep the disinfection solution and rinse water out of surface waters.

To the extent practicable, equipment and gear used on waters known to be infested with invasive species and viruses should not be used on other non-infested waters. The following are some helpful hints to consider when planning your work in water.

- Organize your sampling so the work in infested waters is always done last.
- If a high percentage of your work is done in waters with invasive species, consider dedicating certain gear to be used only in those waters.
- Depending on the type of work you are doing, it may be possible to work with lake volunteers and use their boats to collect samples. That way only your gear needs to be disinfected.

The following methods are provided to assist staff when disinfecting equipment and gear commonly used by department staff.

Nets

Organic debris should be removed prior to disinfection. Power washing is not required, but nets could be sprayed with a garden hose to remove debris. Nets may be steam cleaned, washed and dried thoroughly for five days or treated with a disinfection solution. Nets should be placed in the disinfection solution for the appropriate contact time for the solution being used. After rinsing, the nets can be used immediately, or hung to dry.

Personal protective gear, including rain gear, gloves, boots/waders

Scrub personal protective gear with the disinfection solution. After scrubbing, the gear should be kept wet with the disinfection solution for the appropriate contact time. Rinse

with clean water or water from the next waterbody. Alternatively, personal gear may be steam cleaned or dried thoroughly for five days after cleaning with soap and water.

Dip nets, measuring boards and other sampling gear

Remove any organic material from sampling gear. There are several options for disinfecting smaller gear. *Dissolved oxygen probes and other sensitive electronic sampling gear may be damaged by disinfection solution and should only be rinsed with clean water*. For other gear used in water choose one of the following options:

- Option one: The gear can be sprayed with the disinfection solution and a wet surface maintained for the appropriate contact time. The gear should be rinsed with clean water or water from the next waterbody before it is used again.
- Option two: Fill a tub with disinfection solution and place all equipment in the tub for the appropriate contact time. The gear should be rinsed with clean water or water from the next waterbody before it is used again.
- Option three: Use a completely new set of gear for each waterbody during the work day and disinfect all gear at the end of the day using option one or two.

Boats, trailers, and live wells

Remove organic material from boats, trailers, and live wells. Drain water from live wells, bilges and pumps. The outside and inside of the boat, trailer, live wells, bilges, and pumps should be sprayed with the disinfection solution and left wet for the appropriate contact time. The inside of the live wells, bilges and pumps should be made to contact the solution for the appropriate contact time as well. Run pumps so they take in the disinfection solution and make sure that the solution comes in contact with all parts of the pump and hose. The boat, trailer, bilges, live well, and pumps should be rinsed with clean water or water from the next waterbody after the appropriate contact time. *Every effort should be make to keep the disinfection solution and rinse water out of surface waters.* Pull the boat and trailer off the ramp and onto a fairly level area and away from street drains to minimize potential runoff into surface waters.

Motors

After removing from the water, tip the motor to the down position and start the motor for several seconds or turn motor over several times to dispel water from the cooling system. Alternatively and especially for motors moored in water for several days or more, emerge the lower unit in a bucket of disinfectant and run the motor to ensure contact with all internal parts and allow for the appropriate contact time. Or, rig up a short (6-foot) piece of garden hose to lower unit muffs. A pail of the disinfectant can be set in the back of the boat and gravity fed to the lower unit to run the disinfectant through the motor. Allow solution to remain in motor for the appropriate contact time. The hose will need to be primed to start the gravity flow because the lower unit does not create enough suction to prime the hose. A non-corrosive (Virkon Aquatic) is recommended for use to protect the impeller. Rinse with clean water or water from the next waterbody.

Heavy Equipment

For heavy equipment steam-cleaning is an effective method of disinfection.

To minimize the environmental impacts during construction, the contractor should take the appropriate precautions. Some of them are listed below:

- Construction erosion and sedimentation must be controlled to the disturbed area. The project must conform to TRANS 207.09 and 207.10. An effective erosion control plan needs to be developed for this project to prevent downstream migration of sediment and other potential pollutants. Erosion control devices shall be specified on the final construction plans. All disturbed areas shall be adequately protected against erosion within seven days of work completion. Erosion control devices can be removed entirely after vegetation is established.

- Submit an Erosion Control Implementation Plan to our office at least two weeks prior to start of construction. A pre-construction conference with the Wisconsin DNR must be held at least 10 days prior to construction.

- Any demolition of the bridge deck and/or structures must not result in permanent or long-term deposition of debris in the waterway or wetlands. All material that enters the water is to be removed. Please also develop a plan to keep hazardous materials such as paint and epoxy out of the water, and have a hazardous material clean-up plan in place prior to the start of construction.

- If site dewatering is required, sediment-laden water shall be pumped into an adequate sediment basin located in an upland location prior to discharge to a waterway or storm sewer.

- Excess fill/borrow material or spoils should be stockpiled on upland areas an adequate distance away from wetlands, storm sewer inlets, floodplains, and the waterways. Piles of stockpiled soil shall be protected against erosion and shall not create nuisance dust emissions.

- Do not place any fills in waterways for work pads without permission from WDNR.

- Measures shall be taken to control fugitive dust emissions generated during construction.

- Fertilizer (liquid or granular) should not be used on re-vegetated areas that are adjacent to wetlands or waterways. This minimizes the risk of concentrated nutrients entering into waters of the state that can cause habitat impairments. Temporary cover crops can be used in lieu of fertilizers in these sensitive areas while the seed germinates during the growing season.

- All erosion control BMPs must be in place prior to ground disturbing activity.

The contractor should not place any fills in waterways for work pads. Also, grinding slurry should be contained and should not be allowed to drain to any wetlands, storm sewer inlets, or the river below.

All construction activities should occur in an environmentally sound manner. This includes the proper disposal of all demolition material that cannot be recycled.

4. Traffic

St. Paul Avenue over the Milwaukee River will be closed to vehicular traffic during construction operations under this contract. The Contractor will access to properties adjacent to the bridge and approaches, unless noted in the traffic control plan, except for minimum time necessary to undertake construction activities in the immediate vicinity of the property.

Maintain pedestrian access at all times to the entrances to the properties as shown on the plans and directed by the engineer. Maintain pedestrian access to the river walk in the northeast and southeast quadrants of the project at all times. These entrances and access to the river walk northeast and southeast quadrants may be restricted and closed only as necessary to accommodate construction operations as shown on the plans and with the approval of the engineer.

All posting of parking restrictions required to facilitate construction operations will be provided by the City of Milwaukee, Infrastructure Services Division, or as directed by the engineer. Contract James Brown at (414) 286-3276, at least three working days prior to the start of construction operations.

5. Work Restrictions

Comply with all local ordinances that apply to local street work operations, including those pertaining to working during Night Time hours. Furnish any ordinance variance issued by the municipality or required permits to the engineer, in writing, 3 days prior to performing such work. Do not operate motorized construction equipment from 7:00 PM until the following 7:00 AM, unless prior written approval is obtained from the Engineer.

Maintain or provide where necessary pedestrian access to adjacent properties, businesses, recreation areas, and bus stops as directed by the engineer.

Provide adequate temporary sidewalk and bridging between the curb and right-of-way line over freshly paved concrete or other obstructions in the sidewalk area at entrances to buildings, as directed by the engineer.

Do not remove any existing trees, street light poles, hydrants and other utility poles without the written approval of the engineer. Conduct an on-site visit prior to biding to determine any special measures required for proper clearance between the trees, hydrants, poles, and the construction equipment.

Inform property owners and tenants at least 48 hours prior to removing a driveway approach that serves a property. Schedule sidewalk and driveway approach removal and replacement so that the time lapse between removal and replacement is minimal.

Construct driveway approaches as shown on the plans. Do not close or remove any approaches without sufficient notice given to the occupants of the premises to remove their vehicles prior to driveway removal or closing of the driveway approach access. If the contractor can make other access arrangement, agreed to in writing and signed by the contractor and the property owner serviced by the driveway, other sequencing will be allowed when approved by the engineer.

6. Protection of Workers

Handle and manage all spent materials from paint removal operations as "hazardous." In this regard, direct attention to subsection 107.1 of the standard specifications on Safety, Health, and Sanitation.

Provide and require all employees to wear all personal protective equipment required for the environment to which the workers are subjected, and provide medical monitoring as required for those employees in the work area. The requirement includes, but is not limited to, air-supplied respirators, eye protection, ear protections, fall protection, protective clothing and other such items. Provide for the decontamination of workers and authorized persons in the work area so that no lead contamination leaves the work area on the bodies or clothing of those persons.

7. Labeling and Disposal of Waste Material

Properly label the hazardous waste materials generated from the construction site and dispose that material by following the guidelines of the Environmental Protection Agency. Unlike standard Wisconsin Department of Transportation let projects, the Contractor will be responsible to find suitable landfill and the cost of Labeling and Disposal of Waste Material will be paid as an incidental to the Negative Pressure Containment and Collection of Waste Materials P-40-523.

8. Public Convenience and Safety

Revise standard spec 107.8(6) as follows:
Check for and comply with local ordinances governing the hours of operation of construction equipment. Do not operate motorized construction equipment from 7:00 PM until the following 7:00 AM, unless prior written approval is obtained from the engineer.

9. Coordination with Businesses

The Contractor will arrange and conduct a meeting between the City, the contractor, local officials and business people to discuss the project schedule of operations including vehicular and pedestrian access during construction operations. Hold the first meeting

prior to the start of work under this contract and additional meetings held thereafter when there is an impact to an adjacent property owner or a change in traffic pattern.

10. Site Utilities

There are utility facilities within the construction limits of this project, though no conflicts have been identified between the proposed work and the existing utilities. The Contractor shall take care to protect any existing utilities that are encountered during construction operations.

The **City of Milwaukee** has **street lighting facilities** along St. Paul Avenue. There are no conflicts with the proposed work.

The **City of Milwaukee** has **sanitary sewer** along St. Paul Avenue. There are no conflicts with the proposed work.

The **City of Milwaukee** has a **water service** to the bridge house in the south side of St. Paul Avenue on the West side of the bridge abutment. There are no conflicts with the proposed work.

MMSD has several **structures and sewers** in the project area along St. Paul Avenue. There are no conflicts with the proposed work.

WE Energies has **gas and electrical** facilities in the project area at the southwest abutment. There are no conflicts with the proposed work.

11. Structure Utilities

The **City of Milwaukee** has **street lighting facilities** on the St. Paul Avenue Bridge. Existing light poles on the bridge will be removed by the City before the construction begins. After construction, City forces will reinstall existing poles and fixtures, install new cable, and reconnect the lights.

The **City of Milwaukee – Sewers** has a 4-inch diameter **sanitary lateral** that leads from the existing bridge house to the west approach and is hung from the bridge deck. Remove this sanitary lateral during the construction and reinstall after the construction.

The **City of Milwaukee - Water** has a 1 1/4-inch diameter water lateral that leads to the existing bridge house from the west approach and is hung from the bridge deck. Remove this water lateral during the construction and reinstall after the construction.

MMSD has Water Quality (WQ) and Water Level (WL) electronic sensing equipments and antenna on the east side of Pier 3. MMSD will remove the WQ, WL, and antenna before the bridge construction begins. Contractor to remove and dispose of the large green cabinet, large stainless steel box, cast iron piping, existing deck, and any related conduit or miscellaneous items located around above mentioned equipment. Contractor to

provide new conduits and conductors for installation of the electronic sensing equipments inside the pier by MMSD after the bridge construction.

Contact Debra Jensen (414-225-2143) of MMSD for any required coordination.

WE Energies has a 1-inch **gas service line** that leads to the existing bridge house from the west approach and is hung from the bridge deck. WE Energies will remove the gas service line before the bridge construction and reinstall the service line after the bridge construction.

Contact John Harvie (414-221-4045) 10 days in advance to coordinate removal and reinstallation of the gas service line.

Milwaukee Historic Third Ward has three light fixtures and associated conduits attached to the bottom of the bridge deck above the existing river walk on the east side. Remove these light fixtures during the construction and reinstall after the construction. Provide new conduits and conductors for these light fixtures.

Contact Nancy O'Keefe (414-273-1173) for any required coordination.

AT&T has a **telephone service** line that leads to the bridge house from the west approach and is attached to the bottom of the bridge structural steel framing. Remove the conduit and service cable during the bridge construction and provide new conduits for the cable. The contractor shall request a service disconnect from the existing pedestal adjacent to the bridge. AT&T will suspend service for the reconstruction efforts. When service is needed, the contractor shall contact AT&T to replace the wire from the pedestal to the bridge house and restore service.

Contact Jay Bulanek (414-535-7407) to coordinate this work.

12. Work Done by Others

City crews will remove existing light poles before start of the construction and reinstall after the deck is poured. Provide a minimum of one week's notice to the City Street Lighting Department for removal of the light poles. Provide conduits, junction boxes, and anchor bolts for the light poles as part of this contract.

Contact Robert Bryson (414-286-3244) 10 days in advance to coordinate the removal and reinstallation of the light poles.

The existing underdeck gas service line to the bridge house from the west approach will be removed by the utility company before the beginning of the construction and reinstalled after the deck is poured. Provide a minimum of two week's notice to the utility company for removal and reinstallation of the gas service line. Coordinate the removal and reinstallation of the gas service line with the utility company. Protect the gas meter on the bridge house from damage during the construction period.

Contact John Harvie (414-221-4045) to coordinate this work.

13. Field Facilities

Replace standard spec 642.2.2.1 (1) with the following:

Provide the field office with up to three communication services, designated as follows: 1-voice, 1-fax, and 1-high speed Internet connection for computer(s) at setting no less than 384 K and up to 1 MB. The high speed Internet connection must utilize either DHCP or PPPoE as the connection method and may be combined with the fax service.

Provide two programmable touch-tone telephones of which one will be a cordless type operating at no less than 2.4 GHz and one will have an answering machine unless voice mail service is available. The telephones and the communication services are for the sole purpose of the City staff.

14. Shop Drawings and Submittals.

A Description
This special provision describes specific requirements for shop drawings and other submittals.

B Materials
B.1 General
Submit construction drawings, erection diagrams, shop details, catalog data, test data, and other pertinent information for review as specified herein, in City specifications, and as specified in other special provisions.

Review by the engineer of shop drawings, methods of installation or contractor's construction details does not relieve the contractor of the responsibility of compliance with the contract specifications; and does not relieve the contractor of the responsibility for providing adequate quality control measures; and does not relieve the contractor of the responsibility for providing proper and sufficient materials, equipment and labor to complete the approved work in accordance with the contract documents.

Unless otherwise stated in the contract documents, do not commence any portion of the work requiring shop drawings or a sample of the work until the submission has been approved by the engineer.

Unless otherwise stated in the contract documents, review of shop drawings, erection plans, and demolition plans will begin only after the submission of a complete set of information required to complete a discrete item of work.

Each individual piece of equipment furnished for a particular item must be compatible with all the other equipment associated with the item. It is the responsibility of the contractor to make certain that all items furnished for the project are compatible and will perform the function indicated on the plans and within the specifications. Some of the

mechanical and hydraulic equipment is specified by catalog number in order to establish the minimum requirements and special features needed for the project. Compatibility with other specified equipment is not guaranteed. It is the contractor's responsibility to verify the compatibility of all equipment before submitting it for review. The engineer will review the submissions for compliance with the requirements of the special provisions, but not for compatibility.

B.2 Submittal Materials

Submit all data on paper measuring either 8-1/2-inch x 11-inch, 11-inch x 17-inch, or 24-inch x 36-inch as is appropriate. Where appropriate, bind individual sheets measuring 8-1/2-inch x 11-inch into sets with a cover, title sheet, and table of contents.

Submit to the engineer samples of materials for selection of colors, patterns, finishes, etc. for all items which affect the appearance of the bridge and the inside and outside of the bridge houses and other product samples when required by the various articles of the special provisions or the standard specifications. Product samples become the property of the City of Milwaukee unless determined otherwise by the engineer.

B.3 Submitting and Review Process

The review process will consist of two or more steps. The first step is to submit four (4) copies of sets of materials to the engineer, or his designated agent, for preliminary review. The engineer, or his designated agent, will return one copy or set of submitted materials with instruction for correction and re-submittal. When instructed by the engineer, resubmit four (4) copies or sets of materials for further review. When instructed by the engineer, the final step is to submit materials to the engineer, or his designated agent for distribution. The engineer will return one to three (1-3) copies or sets of materials to the contractor with a stamp denoting general conformance to the plans and specifications. The exact review process, number of copies or sets of submittal materials, delivery requirements, and other procedural matters for the complex project will be determined at the pre-construction conference.

Drawings that are not initialed as having been checked or obviously have not been completed or are not clear and legible will not be accepted for review. The contractor will be notified that the subject drawings must be properly completed and resubmitted for review.

The title box of each shop drawing must carry the job number and structure and control section numbers, and the name and address of the fabricator, foundry, or manufacturer. The title sheet of each bound set of product information sheets must carry the job, control, and structure identification numbers, and the name and address of the supplier. Each sheet in a bound set must clearly identify the product or products being used and carry the name of the manufacturer.

A unique drawing and/or sheet number must be placed on each sheet so that similar items with subtle differences will not be confused with one another. When data is returned by the engineer to the contractor for correction and re-submission, each revised sheet needs

to be marked with a revision number, indicating the number of times the sheet has been revised since the first submission and with the date of each revision. Each change on the sheet must also be marked with the appropriate revision number, shown on a small triangle, placed next to the change.

Drawings on data sheets that contain information for items or options other than those intended for use on this project must be clearly marked so as to indicate which items or options are intended for use on this project. Line or cross out those items or options that do not apply, or by circling or highlighting those items or options that do apply. Whatever method is used it must be done in a manner that clearly indicated which items apply to the project.

The contractor is responsible to make sure that everyone, including suppliers, furnishes complete product and shop detail data for review by the engineer. The data must include, but is not limited to, the following:

1. Drawings including information on the exact number of units, exact unit to be furnished, and all of the equipment options to be furnished with the unit. Dimensions, material grades fits, finishes applicable standards (ASTM, AASHTO, ANSI, and other applicable standards) and all other data sufficient to meet the requirements of the contract documents.

2. Complete catalog data and specifications including the name of the manufacturer.

3. Complete installation and maintenance instructions.

4. Drawings and catalog data must indicate the pertinent bid item.

If a submission is incomplete, it may be returned without review or comment. If so, it must be completed before re-submittal. The contractor is advised to keep an accurate record of all shop drawing transmittals and to maintain constant contact with all suppliers to obtain prompt re-submittal of drawings and data returned for correction and completion. Significant time lapses between the return and re-submittals of data could delay the project and shall be avoided.

B.4 Submittal and Review Time

It is the contractor's responsibility to ensure that all shop details and data are submitted for approval in a timely manner. The preparation of construction drawings, shop details compilation of the technical data, transmittals, review, revision, and re-submittals constitutes a time consuming process.

Span balance calculations, balance testing, acceptance testing of in situ equipment or portions of the structure, and other submittals required during construction or operation of the bridge shall be submitted in a timely manner and in accordance with the various articles of the special provisions.

Although no specific time periods are established herein for submittals or for the engineers review, the contractor should anticipate that each review may take up to approximately 21 days. The engineer, or his designated agent, will endeavor to complete each review in the shortest practical time. However the contractor must realize that this is a complex project with many inter-related parts and that instant reviews are generally not practical. Delays in submitting, reviewing, or approving submittals will not be cause for additional compensation.

B.5 Operating and Maintenance Manuals
Submit operation and maintenance manuals required by the contract documents for preliminary review and approval in accordance with Bridge Machinery – General, Bridge Hydraulic System, and Bridge Electrical Work of these special provisions. The number of distribution copies is five (5) hard copies and two (2) electronic copies, unless otherwise required on the plans or in other special provisions.

B.6 As-Built Drawings
Furnish final shop drawings in electronic format and hard copy. Also furnish a copy of all catalogue cuts, parts lists, operating procedures, operating and maintenance manuals, and other data required by the articles of the special provisions clearly marked that these items of work are included in the final work. The words "As-Built" and the date are acceptable for this identification.

C (Vacant)

D (Vacant)

E Payment
The City will not pay for any costs associated with shop drawings or other submittals. Include all costs for preparation, handling, shipping, storage, or other expenses associated with shop drawings, erection drawings, catalog data, test data, calculations, operating manuals, parts lists, maintenance manuals, and "As-Built Drawings" in the costs of the bid items with which the submittals are associated.

The City reserves the right to charge reasonable expenses for the review of submittals where the contractor substitutes items, at his option, for items previously submitted and approved for use in the project. Re-submittals requested by the City will not be back chargeable, except in the cases where the contractor obviously has not addressed previous review comments.

15. Construction Over or Adjacent to Navigable Waters.

Supplement standard spec 107.19 with the following:

The Milwaukee River is classified as a navigable waterway.

16. Nighttime Work Lighting-Stationary.

A Description

Provide portable lighting as necessary to complete nighttime work. Nighttime operations consist of work specifically scheduled to occur after sunset and before sunrise.

B (Vacant)

C Construction

C.1 General

This provision shall apply when providing, maintaining, moving, and removing portable light towers and equipment-mounted lighting fixtures for nighttime stationary work operations, for the duration of nighttime work on the contract.

At least 14 days prior to the nighttime work, furnish a lighting plan to the engineer for review and acceptance. Address the following in the plan:

1. Layout, including location of portable lighting – lateral placement, height, and spacing. Clearly show on the layout the location of all lights necessary for every aspect of work to be done at night.

2. Specifications, brochures, and technical data of all lighting equipment to be used.

3. The details on how the luminaires will be attached.

4. Electrical power source information.

5. Details on the louvers, shields, or methods to be employed to reduce glare.

6. Lighting calculations. Provide illumination with average to minimum uniformity ratio of 5:1 or less throughout the work area.

7. Detail information on any other auxiliary equipment.

C.2 Portable Lighting

Provide portable lighting that is sturdy and free standing and does not require any guy wires, braces, or any other attachments. Furnish portable lighting capable of being moved as necessary to keep up with the construction project. Position the portable lighting and trailers to minimize the risk of being impacted by traffic on the roadway or by construction traffic or equipment. Provide lightning protection for the portable lighting. Portable lighting shall withstand up to 60 mph wind velocity.

If portable generators are used as a power source, furnish adequate power to operate all required lighting equipment without any interruption during the nighttime work. Provide wiring that is weatherproof and installed according to local, state, federal (NECA and OSHA) requirements. Equip all power sources with a ground-fault circuit interrupter to prevent electrical shock.

C.3 Light Level and Uniformity
Position (spacing and mounting height) the luminaires to provide illumination with an average to minimum uniformity ratio of 5:1 or less throughout the work area.

Illuminate the area as necessary to incorporate construction vehicles, equipment, and personnel activities.

C.4 Glare Control
Design, install, and operate all lighting supplied under these specifications to minimize or avoid glare that interferes with all traffic on the roadway or that causes annoyance or discomfort for properties adjoining the roadway. Locate, aim, and adjust the luminaires to provide the adequate level of illumination and the specified uniformity in the work area without the creation of objectionable glare.

Provide louvers, shields, or visors, as needed, to reduce any objectionable levels of glare. As a minimum, ensure the following requirements are met to avoid objectionable glare on the roadways open to traffic in either direction or for adjoining properties:

1. Aim tower-mounted luminaires, either parallel or perpendicular to the roadway, so as to minimize light aimed toward approaching traffic.

2. Aim all luminaires such that the center of beam axis is no greater than 60 degrees above vertical (straight down).

If lighting does not meet above-mentioned criteria, adjust the lighting within 24 hours.

C.5 Continuous Operation
Provide and have available sufficient fuel, spare lamps, generators, and qualified personnel to ensure that the lights will operate continuously during nighttime operation. In the event of any failure of the lighting system, discontinue the operation until the adequate level of illumination is restored. Move and remove lighting as necessary.

D (Vacant)

E Payment
Costs for furnishing a lighting plan, and for providing, maintaining, moving, and removing portable lighting, tower mounted lighting, and equipment-mounted lighting required under this special provision are incidental to the contract.

17. Structure Repainting General.

A General
A.1 Inspection
On all structures in this contract, notify the engineer of any missing or broken bolts or nuts, any missing or broken rivets, or of any cracks or flaws in the steel members while cleaning or painting.

A.2 Date Painted

At the completion of all painting work, stencil in black paint or contrasting color paint the date of painting the bridge. The numbers shall be three inches (75 mm) in height and shall show the month and year in which the painting was completed: e.g., 11-95 (November 1995). On each bridge painted, stencil the date at two locations. On truss bridges, stencil the date on the cover plates of end posts near and above the top of the railings at the oncoming traffic end. On steel girder bridges, stencil the date on the **inside** of the outside stringers at the abutments. The date on grade separation bridges shall be readable when going under the structure or at some equally visible surface near the ends of the bridge, as designated by the engineer.

A.3 Graffiti Removal

Remove any graffiti on concrete abutments, piers, pier caps, parapet railings, slope paving or any other location at the direction of the engineer. Use a brush sandblast to remove graffiti.

The above work will not be measured and paid for separately, but will be considered incidental to other items in the contract.

B (Vacant)

C Construction

C.1 Repainting Methods

Do not perform blasting, cleaning and painting on days of high winds. Prevailing winds in excess of 15 mph (25 km/hr) shall be considered high winds.

Prior to final acceptance, completely clean and free from spent abrasive and other waste materials resulting from the contractor's operation the bridge deck surfaces, gutter lines, drains, curbs, bridge seats, pier caps, slope paving, roadway below, and all structural members and assemblies.

Place the final field coat of paint on the exterior of the exterior beams as a continuous painting operation. Stop at splices, vertical stiffeners or other appropriate locations so that lap marks are not evident or noticeable.

C.2 Inspection

Supplement standard spec 105.9 as follows:

Furnish, erect and move scaffolding and other appropriate equipment to permit the inspector the opportunity to closely observe all affected surfaces. The scaffolding, with appropriate safety devices, shall meet the approval of the engineer.

18. Bridge Machinery- General

A Description

A.1 General

This section describes the general requirements for the detailed work to be completed for bridge machinery components and systems. Provide bridge machinery that meets the requirements of AASHTO LRFD Movable Highway Bridge Design Specifications, 2007 2nd Edition with Interim Revisions through 2012, hereafter referred to as AASHTO Movable, and these contract documents. The lift span shall be powered by four hydraulic cylinders and hydraulic power unit.

The Bridge Machinery consists of the following machinery:

Hydraulic System
Counterweight Machinery
Span Guide Machinery
Bumper Beam Machinery
Centering Device

The cost of work in Bridge Machinery- General is included in the Bridge Machinery bid items.

A.2 Manufacturer's Product Data

Submit manufacturer's data and/or shop drawings for all manufactured and purchased products.

Include in the submittal, as applicable: the manufacturer's name and trade name; descriptive literature, catalog cuts, drawings, diagrams and certified prints and lay out dimensions; catalog model number, nameplate data, size and capacity, plus commercial, federal and military specification references; and any other relevant data required to establish contract compliance.

A.3 Shop Drawings

Detail and accurately dimension all parts on the shop drawings. Show limits of accuracy and tolerance required for machining, surface finishes and allowances for fits. Provide fits and finishes as specified in accordance with ANSI B46.1 and ANSI B4.1.

Show proprietary parts in outline on the drawings. Furnish complete dimensions and data to enable a determination of the adequacy of the unit. Furnish certified dimensional prints stating the name, part and job number. Give pertinent load and speed ratings; provisions for lubricating, the method of lubrication, location and type of all lubrication, and vent fittings. If a product is modified in any way from the description submitted by its original manufacturer, provide a drawing that details the modifications and assigns a special part number to that part to avoid supply of replacement parts not similarly modified.

Provide a diagram or assembly drawing sufficient to enable disassembly and reassembly of the component. Identify and describe on the assembly drawing, or diagram, each internal part and show dimensions of principal parts; certified external dimensions; gross weight and normal operating ratings.

Provide shop bills of material, listing all parts by number and quantity. Provide the materials and specifications for each part. Where standard specifications are used, give the designating numbers.

The following abbreviations may be used:

AASHTO	American Association of State Highway Transportation Officials
ABMA	American Bearing Manufacturers Association
AGMA	American Gear Manufacturers Association
AISI	American Iron and Steel Institute
ANSI	American National Standard Institute
ASME	American Society of Mechanical Engineers
ASTM	ASTM International
AWS	American Welding Society
NEMA	National Electrical Manufacturers Association
NLGI	National Lubricating Grease Institute
OSHA	Occupational Safety and Health Act
SAE	Society of Automotive Engineers
Standard Specifications	State of Wisconsin Standard Specifications for Highway and Structure Construction, 2013 edition
SSPC	Steel Structures Painting Council

Furnish assembly and erection drawings with identifying marks and essential dimensions for locating parts and assemblies. The use of opposite hand or mirror image assembly drawings is not acceptable. It is the contractor's responsibility to achieve satisfactory construction and operation of the machinery; approval of shop drawings by the engineer does not constitute relief from this provision.

Show subtitles describing the parts and the inspection agency on each shop drawing.

Submit shop drawings to the engineer for review and approval in accordance with article "Shop drawings and submittals". Resubmit drawings rejected or requiring correction until they are approved. Any damages or costs that result from ordering materials or performance of any work before receiving shop drawing approval shall be the responsibility of the contractor.

A.4 Operation and Maintenance Manuals

A.4.1 General Requirements

Furnish manuals containing complete descriptive literature, catalog cuts, reduced size shop drawings and other information required for successful operation and maintenance

for the machinery systems of the bridge. Provide revisions, if required, after the start-up period by means of addenda to the manuals.

Clearly print all materials so that the submittals, drawings, catalog cuts and all other information is legible, accurate and distinct. Reduced size drawings and illustrations must be legible so that dimensions and lettering are readable. Fold all large format pages to the page size necessary for inclusion in the manuals.

Print the material on durable mediums. Use water resistant inks. Use printing methods that offer permanence and durability.

A.4.2 Contents

Neatly inscribe the following information on the manual's cover: Title: "Operating and Maintenance Manual"; the name and location of the bridge; the contract number, date, and the names of the consulting engineer and the contractor.

Include the following in the manual:

1. Index of contents and tabbed dividers for each section.
2. A system layout showing all machinery components, including all existing components reused.
3. A detailed description of the control system and procedure for operating the bridge using the main drive motors, auxiliary drive motors and any manual means.
4. Reduced size copies (11" x 17") of shop drawings and lubrication charts.
5. Certified parts drawings and descriptions of proprietary units.
6. A detailed description of the function of each principal component.
7. Manufacturer's standard literature and instructions for installation, operation, lubrication, adjustment, and maintenance for each component and assembly.
8. A list of the names, addresses and telephone numbers of all subcontractors and manufacturers furnishing and installing the equipment and systems together with a record of the local representatives for the equipment and systems installed.
9. Recommended procedures and frequency for cursory and detailed inspections of the equipment.
10. Information on trouble-shooting problems that may be encountered during operation for each of the major pieces of equipment. Include things to look for, signs of irregular operation and suggested solutions.

A.4.3 Materials for Manuals

Bind the maintenance and operating materials in heavy duty, three hole binders, of either ring or post type, as directed by the engineer. Use binders that have nickel-plated, metal hinges and a locking mechanism that permits the sheets to lie flat, such as a channel lock. Use heavy duty, stiff covers that are moisture, oil and grease resistant such as plastic or other suitable materials.

Bind all the printed material between the rigid covers of the book. Provide a book measuring approximately 9 x 12 inches. Provide included drawings in black outline on white background. Use archival quality, acid free, punched, 60 pound, loose leaf paper. Use paper pages, foldout drawings, diagrams and illustrations having three standard spaced holes, 5/16 inch minimum diameter, with plastic or cloth reinforcement.

A.4.4 Manual Submittals

Submit to the engineer for approval the arrangement of the books, proposed methods of binding, printing and reproduction and materials to be included. Two copies of sample formats and outlines of the contents in draft form are required ninety (90) days before the earliest of: final inspection, acceptance tests or return of the span operation to the City of Milwaukee, Department of Public Works.

Submit two (2) copies of the complete manual in final form thirty (30) days prior to final inspection, acceptance tests or return of the span operation to the City of Milwaukee, Department of Public Works.

Submit five (5) copies and two (2) CDs or electronic copies of the approved manual ten (10) days after final inspection and acceptance tests. One of the five copies shall become the property of the engineer of record; the remaining copies shall become the property of the City of Milwaukee, Department of Public Works. Submit two (2) copies of the manual in Adobe Acrobat format.

A.5 Operating Instructions

Provide operating instructions, approved by the engineer, for each system and principal piece of equipment for the use of operation and maintenance personnel. Post on or adjacent to the piece of equipment the printed operating instruction, including proper adjustment, operation, lubrication, safety precautions, procedures to be followed in event of equipment failure and other items of instruction recommended by the manufacturer. Use either weather-resistant materials or protect the instructions with suitable enclosures. Prepare diagrams showing the complete layout of the operating machinery. Frame the diagrams, under glass or in an approved laminated plastic, and post where directed by the engineer. Securely fasten all posted instructions and diagrams to prevent easy removal. Do not locate in the direct sunlight.

A.6 Quality Assurance

A.6.1 Standard Products

In so far as practical, use materials and equipment that are the standard, catalogued products of manufacturers regularly engaged in the production of such products; and that are the latest standard design; and that comply with the requirements of the contract documents. Provide materials and equipment that essentially duplicate units which have served satisfactorily for at least two years prior to bid opening. Where two units of the same category equipment are required in the system use products of the same manufacturer; although, components of the system need not be the products of one manufacturer.

Provide each major component with a name plate, securely affixed in a conspicuous place, with the manufacturer's name and address, the model and serial number. The nameplate of the distributing agent is not acceptable.

A.6.2 Manufacturer's Recommendations
Install and align all units and components as recommended by the manufacturer of that product. Furnish printed copies of those instructions and procedures to the engineer before beginning installation. Failure to furnish these instructions may be cause for rejection. Preparation of the mounting surfaces and associated components required for the installation is included in the work.

A.6.3 Codes and Standards
Furnish all machinery bid items in compliance with the applicable requirements of the latest standards and codes of, but not limited to, those organizations designated above. Where other codes and standards are designated in these special provisions they shall also apply to the work requirements of the parts and equipment with which they are associated.

A.6.4 Qualification, Personnel and Facilities
Complete all fabrication, cleaning, lubrication, testing and all other work required for bridge machinery pay items using an adequate number of experienced mechanics and service personnel who are thoroughly trained and familiar with the required methods specified for correct completion of the work.

For the installation, alignment and fastening of the bridge machinery, use an adequate number of trained and skilled millwrights having past experience in the installation of machinery on at least two (2) previous movable bridges.

Equip the mechanics, millwrights and service personnel with the necessary instruments, tools and other equipment necessary to assure the related components have been furnished within acceptable tolerances; and to make any adjustments required to attain correct installation and satisfactory operation.

A.6.5 Rules, Regulations and Ordinances
Assure that all work complies with all applicable federal, state and local rules, regulations and ordinances.

In the event of a conflict between these special provisions and the federal, state and local codes, standards, rules, regulations and ordinances the most stringent requirement applies.

A.6.6 Measurements and Verification
Dimensions given on the plans are nominal and intended for guidance only. Note any variations from nominal dimensions on the shop drawings.

A.6.7 Substitutions

The specification of a manufacturer's name and part number is for the purpose of defining quality, configuration, rating and arrangement of parts. Equivalent products of another manufacturer may be substituted for the specified item upon the written approval of the engineer. Make any changes necessary, as a result of the substitution, in related machinery, structural, and electrical parts at no additional cost to the City.

Obtain the engineer's written approval for a substitute product prior to ordering it. Acceptance of the substitute product is at the sole discretion of the engineer. The basis for acceptability of a substitute product will be a review of the descriptive material and detail submitted and evaluation of its ability to fulfill the contract requirements.

The engineer will stamp submittals for substituted materials. Resubmit rejected shop drawings showing the specified product. Rejection shall in no way result in extra cost to the City. Approval of a substitute product by the engineer does not relieve the contractor of the responsibility for proper operation, performance or functioning of that product.

Inform the engineer if departures from the contract documents are deemed necessary. Submit full details of the departures and reasons for the need, as soon as possible, to the engineer for approval. Do not proceed with any departure without written approval.

B Materials

B.1 Steel Castings

Provide steel castings that are true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes, and other defects. Sandblast or otherwise effectively clean castings of scale and sand, to present a smooth, clean, and uniform surface. Finish all edges of castings with rounded corners, and provide ample fillets on all inside angles. Provide adequate material allowance for all surfaces requiring finish for machining to finish dimensions. Finish all surfaces of castings in contact with other metal to 125 micro-inches as measured under ANSI B46.1, unless a finer finish is specified by the plans. Where castings are machined, the thickness of the metal after finishing shall not be less than the thickness shown on the plans. Provide machined bosses to give proper seats for bolt heads and nuts.

Blow holes appearing upon finished castings shall not have a depth injuriously affecting the strength of the casting. Weld minor defects, which do not impair the strength, by an approved process, with the approval of the engineer, and inspect by magnetic particle examination.

Perform visual surface examinations per ASTM A802 criteria for Level II and requirements of MSS SP-55 for every steel casting. Perform liquid-penetrant exams in accordance with ASTM E165, or magnetic particle examination in accordance with ASTM E709 on every casting to detect surface and near-surface flaws. Perform ultrasonic inspection on every casting in accordance with ASTM A609 that meets the requirements of Level 2 (Procedure A) or Level 3 (Procedure B) for castings with cross

sections in both directions thicker than 4 1/2 inches. Meet the requirements of Level 1 (Procedure A) or Level 1 (Procedure B) for thinner castings.

Reject steel castings that do not meet all of the above examination criteria. Reject castings that have been welded without the engineer's approval. Reject steel castings that do not have adequate thickness to “clean up” during machining.

Retain and deliver all patterns, not including wire rope sheaves and wire rope fittings, to the engineer. Make all patterns for castings neat, strong and durable of thoroughly seasoned, first-class pattern lumber. Proportion the pattern to suit the shrinkage of the particular metal to be cast from them and allow adequate thickness for tool finish mating with other components. Round the outstanding unfinished edges of all ribs, bases, etc., to a radius of one-fourth the thickness of the ribs, bases, etc., and fit inside corners with wood or leather fillets with a radius of at least one-half the thickness of the thinnest member forming the corner.

Provide all patterns with lifting and rapping plates, set flush with their surfaces. Provide a metal plate bearing the letters “ST. PAUL AVENUE BRIDGE" in sharp gothic style, at least three-fourths inch high in each pattern outside of the casting region.

Stain patterns black on surfaces unfinished on castings, red on surfaces tool finished, and yellow or clear shellac on core points. Varnish the patterns before use with first-class pattern shellac, and repair after final use. Clean and varnish again before delivery to the engineer.

All patterns shall be subject to inspection and approval by the engineer before castings are made from them and again on final delivery to the engineer.

B.2 Steel Forgings

Use annealed forgings where possible. Reduce to size all forged shafts from a single bloom or ingot until perfect homogeneity is secured. For all forged shafts provide a bloom or ingot cross-sectional area of at least three times that required after finishing. Forge material only at temperature greater than or equal to a red-heat. Provide forged rounds for shafts that are true, straight, and free from all injurious flaws, seams, or cracks. Prior to heat treatment, bore a hole lengthwise through the forging for shafts with a finish diameter greater than eight inches. Provide forgings with adequate material allowance for machining to finish dimensions. Reject all shafts with areas that do not clean up after machining. Inspect forgings with ultrasonic evaluation per the conditions of ASTM A668 supplement requirement S7 and Practice A388. Submit all test results to the engineer. For forgings that are to be welded to plate steel, ensure that the forgings meet the requirements of ASTM A668 supplement requirement S4 for low carbon content.

B.3 Shafting and Pins

Furnish shafts that are accurately finished, round, smooth, and straight; and when turned to different diameters, provide rounded fillets at shoulders and chamfers at shaft ends. At the journal-bearing areas on shafts and pins provide surfaces that are accurately turned,

ground, and polished with no trace of tool marks or scratches on the journal surface or adjoining shoulder fillets. Finish journal surfaces to the limits specified in AASHTO Movable.

Provide shafts of forged steel meeting the requirements of ASTM A668. Hot rolled steel of equivalent strength and ductility may be substituted for shafting with a finished diameter of 4 inches or less. Cold finished shafts and pins will not be permitted. Provide ANSI Standard B4.1 FN2 fit at hub locations. Machine finish each shaft over its entire length to obtain a smooth finish concentric with the bearing centerline. For shafts with holes, install plugs prior to final assembly at each end of shaft.

B.4 Wire ropes and Sockets

Provide wire rope and sockets in accordance with the requirements of 6.8.3.3 of AASHTO Movable.

Provide only zinc coated wire ropes and sockets.

Test three samples of each rope size to destruction to verify the minimum breaking force as specified in 6.8.3.3.6 of AASHTO Movable for fiber core rope or ASTM A1023 for independent wire rope core. Perform the test in accordance with 3.2.8 of 1988 AASHTO Movable.

Provide detailed rope length calculations prepared and signed by a Professional Engineer licensed in Wisconsin. Submit the calculations with the shop drawings for review. Prestretch all ropes in accordance with 3.2.10. Measure the length of all ropes in accordance with 3.2.13 of 1988 AASHTO Movable.

Paint a stripe with a width of 25% of the rope diameter along the entire length of each counterweight rope to facilitate rope installation.

Provide wire rope sockets that meet the requirements of 6.8.3.3.7 of AASHTO Movable. Provide specialty sockets of the spelter type for threaded adjustable sockets. Swaged sockets are not approved. During the destructive testing of the rope, verify that the slip is no greater than the specified amount in AASHTO Movable. If a greater slip occurs, change the attachment method until the amount of slip is below the threshold specified. Sockets used for the tests are not to be reused for the permanent rope assemblies.

B.5 Fasteners

B.5.1 General

Subdrill all holes for connecting machinery parts to the supporting steel at least 1/32 inch smaller in diameter than the finish diameter, unless otherwise specified. Line ream at assembly with the mating part for proper fit after the parts are correctly aligned.

Furnish positive locks for all nuts. Provide double nuts for all connections requiring occasional opening or adjustment. For connections with single nuts, provide lock washers

made of tempered steel and conforming to the SAE regular dimensions. Provide lock washers of material that meets the SAE tests for temper and toughness.
Use beveled washers where bearing faces have a slope of more than 1:20 with respect to a plane normal to the bolt axis.

Provide fasteners manufactured in the United States correctly marked on top of the head with identification of the property, class and source.

Clean all contacting surfaces of machinery elements and structural steel to be bolted together in accordance with the standard specifications before bolting.

Provide bolts, nuts, and cap screws that conform to the coarse thread series and have a Class 2 tolerance for bolts and nuts or Class 2A tolerance for bolts and Class 2B tolerance for nuts in accordance with the ANSI B1.1, "Unified Screw Threads."

All bolt heads and nuts shall bear on seats square with the axis of the bolt. On castings, except where recessed, furnish finished bosses or spot-faced seats. Provide square bolt heads for recesses in castings. Spot face all bolt holes through unfinished surfaces for the head and nut, square with the axis of the bolts.

B.5.2 Turned Bolts (Machinery to Machinery Supports)
Use turned bolts for all connections of machinery to supports. Provide turned bolts that conform to the requirements of ASTM Specifications A449. Provide nuts, and hardened washers that conform to the requirements of ASTM Specifications A563, and F436, respectively. Turn the diameter of the shank such that it is 1/16-inch larger than the diameter of the threads. Supply a surface finish of 63 micro-inches as measured under ANSI B46.1. Use hexagonal heads and nuts in accordance with the heavy series specified in ANSI B18.2.1. Use two nuts or one nut and a lock-washer on turned bolts. Lock washers will only be permitted if approved by the Engineer. Carefully ream holes for turned bolts in mating structure to provide for an ANSI B4.1 LC6 fit with the body of the bolt.

B.5.3 High Strength Bolts (Machinery Supports to Steel Structure)
Use high strength bolts for connections of supports to steel bridge structure. Provide bolts, nuts, and hardened washers that conform to the requirements of ASTM Specifications A449, A563, and F436, respectively. Drill holes for bolts 1/32 inch larger than the diameter of the bolt. All high strength bolts, nuts, and washers shall be zinccoated with a Class 50 mechanically deposited zinc coating in accordance with the requirements of ASTM B695.

B.5.4 Anchor Bolts (Machinery Supports to Concrete Structure)
Use embedded stainless steel bolts that conform to ASTM F593 for connecting machinery supports to concrete structures. Use stainless steel nuts that conform to the requirements of ASTM F594, and stainless steel washers. Use double nuts on all anchor bolt connections.

B.5.5 Socket Head Screws
Where socket-head cap screws are used, provide screws that conform to ANSI B18.3, made of cadmium-plated heat-treated alloy steel, and furnished with a self-locking nylon pellet embedded in the threaded section. Provide set screws of the headless, safety type; threads of the coarse thread series; and cut points. Do not use set screws to transmit torque nor as the fastening or stop for any equipment that contributes to the stability or operation of the bridge.

B.6 Keys and Keyways
Provide square and rectangular keys and keyways that meet ANSI B.17.1, except where specified herein. Provide closed-end, milled keyways in the shaft to hold all keys in place. Provide clearance between keyways and bearings. Where one key is used, provide a key with an ANSI B4.1 LC4 fit with the keyway. Where two keys are used locate them 120 degrees apart and provide an ANSI B17.1 Class 2 fit between keys and keyways. Finish keys and keyways to a roughness value of 63 micro-inches as measured under ANSI B46.1.

Furnish keys that are machined from carbon steel forgings, ASTM A668, Class D, unless otherwise specified in the contract documents.

B.7 Bearings and Bushings
Select anti-friction bearings to provide for an ABMA rated L-10 life of 40,000 hours. Use pillow block bearings, adapter mounted, self-aligning, fixed or expansion versions as required. Use cast steel housings capable of withstanding the design loads in any direction, including radial up-lift. Cast the mounting bases without bolt holes. Mounting holes may be sub-drilled in the shop and then final drilled and reamed with the supporting structures, after alignment in the field. Provide units that are grease lubricated and have provision for re-lubrication through fittings in the housings. Provide triple lip shaft seals, mounted in the housings, capable of retaining the lubricant and preventing the entry of water and foreign materials.

For sleeve bearings, provide cast bronze that meet the requirements of castings above. Finish machine the outside diameters of the bushings to provide an ANSI Class LC-1 fit with their associated housing bores, unless specified otherwise in the Plans or herein. Provide sufficient stock in the bushing inside diameter to permit final machining of the bore after assembly in their housings with the full liners in place. Polish bushing bores to a surface texture of 16 microinches in accordance with ANSI B46.1 and provide an ANSI B4.1 RC6 fit between bushing and shaft. Provide grease grooves that have smooth edges that blend smoothly in the bearing surface. Provide entry holes for the grease fittings that intersect and lie completely within the grooves. Provide machine cut grease grooves.

B.8 Shims
Provide stainless steel shims required for leveling and alignment conforming to ASTM A240, Type 304, sub-drilled for all bolts that pass through and trimmed to the dimensions of the assembled unit. Final drill and ream the shims at assembly with the components and structures. Provide shim packs capable for adjustment from 0 inches to twice the

nominal shim pack dimension. Provide sufficient thicknesses to permit 1/64 inch variations of the shim allowance plus one full allowance shim. Corrosion resistant precision thickness shims will be permitted if desired by the contractor. Shims with slots or slotted holes will not be permitted.

B.9 Welding

Perform all welding required or designated in the plans in conformance with the appropriate American Welding Society Specification D1.5. Ultrasonically inspect all welds used to fabricate machinery per AWS D1.5 for compression welds. Stress relieve all weldments. Keep distortion of the pieces to a minimum by use of welding fixtures or other approved devices, fixtures and procedures. Perform required machining after welding and stress relieving. Field welding of completed structures and machinery assemblies or components will not be permitted without the approval of the engineer.

Show complete details of welding joint sizes on the shop drawings. Submit welding procedures with the working drawings to the engineer for approval.

B.10 Machinery Base Supports and Brackets

Provide machinery base supports that are constructed of welded steel plate. Select plates of proper thickness to allow for final machining. Indicate initial and final machined thicknesses on shop drawings.

Mill top and bottom surfaces of all machinery base supports after fabrication to provide a uniform surface. All surfaces requiring milling shall have adequate material allowance for milling to the minimum finish dimensions as required by AASHTO Movable or as shown on the Plans.

Hot-dip galvanize and paint with the approved two-coat paint system all machinery supports and brackets after fabrication.

Weldments for machinery base supports including all brackets shall be neat. Remove all exposed sharp corners and edges. Mounting surfaces of the machinery base supports shall be straight and flat such that full contact with the equipment being supported or retained is obtained.

Examine all fillet welds and partial penetration groove welds by the magnetic-particle method in accordance with the requirements of Section 6 of AASHTO/AWS D1.5. Examine all complete joint penetration groove welds in butt joints by radiographic testing. Examine all complete penetration groove welds in T-joints and corner joints by ultrasonic testing.

All complete joint penetration welds shall be tested in accordance with the requirements of Section 6 of AASHTO/AWS D1.5 for each size and type weld. Inspection and testing of welds and basis of acceptance shall be in accordance with the requirements of Section 6 of AASHTO/AWS D1.5.

B.11 Epoxy Grout and Sealant for Supports on Concrete Surface.
Apply a pre-approved epoxy grout for level contact under all brackets and supports mounted to concrete surfaces. Seal joint with pre-approved sealant.

B.12 Lubrication
B.12.1 General
Standardization of the lubrication for the mechanical and electrical systems is required. Coordinate with all the system suppliers to ensure that the type of lubricant supplied shall be kept to as few as possible.

B.12.2 Lubrication Fittings
Provide all bearings and other grease lubricated machinery components except the span guide rollers with ¼ PTF lubrication fittings with ball check.

Locate the fittings to conveniently facilitate lubrication. Connect the lubrication ports to central stations using ¼ inch stainless steel, seamless pipe with stainless steel fittings. Use pipe extensions that are as short as possible and securely supported.

Upon completion of fabrication plug all grease fitting locations until the components are installed and regular lubrication is started. Immediately after erection and prior to operation lubricate all rotating and sliding parts.

Provide removable hinged or bolted covers in order to access lubrication fittings and other routine maintenance devices that might be covered by machinery guards.

B.12.3 Lubrication Charts
Furnish three (3) copies on laminated sheet or mylar full size (22 inches by 34 inches) as well as reduced 1/2 sized for inclusion in the operating and maintenance manuals. The lubrication chart shall show the location of all lubrication fittings and other points of lubrication for the new and existing mechanical and electrical equipment, which will require lubrication of any kind. The chart shall show the kind of lubricant to be used at each point and the frequency of lubrication. A full size print of the chart shall be framed under Lexan in a neat wooden frame with backing and shall be placed as directed by the engineer within the control house.

Submit the lubrication chart to the engineer for review and approval as a working drawing in accordance with this Special Provision. Final lubrication chart shall not be made until the chart has been approved by the engineer.

B.12.4 Lubrication of Wire Rope
Field wire rope lubricant shall be of light-bodied consistency which will penetrate the interstices between wires and strands to the core of the rope, resist oxidation, and form a self healing film. Contractor shall certify that the lubricant is compatible with the factory-applied lubricant on the wire ropes and submit his proposed lubricant to the engineer for approval.

After the lift span is in operating condition, the contractor shall properly clean all ropes of foreign material and shall furnish and apply, in an approved manner, and when weather conditions are suitably dry and warm, one coat of approved Wire Rope Dressing.

B.13 Spare Parts
Provide the following spare parts:
2 Complete sets of seals for each type of antifriction bearing

See additional requirements for spare parts in specific sections.

B.14. Tools
Provide one set of wrenches suitable for machinery maintenance and to fit all nuts and bolt heads in the machinery installation. In addition, furnish a full set of flat head and Phillips head screwdrivers that will fit all machinery and furnish an assortment of punches, files, chisels, and a ball peen hammer.

Provide a cabinet made of galvanized steel of sufficient size to store the tools, lubricants, and grease guns. Provide a cabinet that is lockable with a padlock. Place the cabinet in a location designated by the engineer.

C Construction
C.1 Shop Fabrication
Give the City or its representative no less than ten (10) working days notice before beginning work at foundries, forge and machine shops so that inspections and tests may be arranged. Provide the City with the names and locations of casting, forging and machining suppliers; and other suppliers; and furnish copies of orders that have been placed, prior to the start of any work.

Allow the inspector, designated by the engineer, free access and facilities for inspection of materials and workmanship in foundries, forge and machine shops. Such inspections are to facilitate work and avoid errors, but it is understood the contractor is not relieved of the obligation of assuring compliance with the plans and specifications or the necessity of replacing defective materials and workmanship. Any work performed while free access has been refused will be automatically rejected.

The inspector shall have full authority to reject materials or workmanship which does not fulfill the requirements of these special provisions.

Perform all testing and furnish test specimens, certified copies of chemical and physical tests and certificates of compliance to the engineer without additional charge. Initial acceptance of material and finished parts and assemblies will not preclude subsequent rejection if found deficient. Correction of the deficiencies and/or replacement of materials shall be the responsibility of the contractor. Any materials, components or assemblies rejected after receipt at the bridge site shall be removed and replaced without additional cost to the City.

C.2 Shop Inspection and Testing
Completely assemble all machinery components to assure they fit as required. Perform critical measurements to confirm conformance with the shop detail and assembly drawings.

C.3 Defective Materials and Workmanship
Remove and replace, without additional cost to the City, components determined defective and not made acceptable during inspection and testing. No claims for additional compensation due to delays resulting from defective materials and/or components will be recognized.

Correct, without additional cost to the City, defects resulting from faulty materials, workmanship, components or installation errors that are revealed during the warranty period. If corrections are not made in a timely manner the City will make the necessary corrections and charge the costs to the contractor.

C.4 Guarantees and Warranties
The contractor will assign to the City all manufacturer's warranties and guarantees covering products, components and assemblies purchased by the contractor and used in fulfillment of this contract. The terms of those warranties and guarantees are to be consistent with the customary practices of the manufacturer in commercial trade upon acceptance of the contract.

The contractor shall warrant satisfactory service operation of the mechanical systems, components and associated equipment for a period of sixty (60) months following the date of final acceptance of the project. Manufacturer's standard warranties shall be extended to cover this period at no additional cost to the City.

C.5 Shipment and Storage
C.5.1 Protection for Shipment
Clean all machinery components and assemblies of dirt, grit, chips, corrosion and other injurious substances before shipment. Coat unpainted surfaces with an approved corrosion-inhibiting preservative.

Grease exposed shaft journals, wrap in oil-resistant paper, cover with oil-soaked burlap and securely timber lag for shipment. Take all precautions to assure the bearing surfaces are not damaged during shipping and handling.

Completely protect machinery parts from weather, dirt and foreign materials during shipment. Store machinery parts indoors while awaiting installation and erection at the site. Mount assembled units on skids or otherwise crate or protect during handling and shipping.

Bag and/or crate for shipment all mounting hardware and other small parts. Do not co-mingle the parts. Identify each part with its number and keep separate from other parts.

Provide tags recording the part number wired to the containers for each part prior to shipment. Coat bolts, nuts and other steel parts with approved rust-inhibitor.

C.5.2 Package and Deliver Spare Parts
Prepare spare parts for long term storage as recommended by the manufacturer. Wrap and box in a durable wooden container. Tag all individual spares with clear identification using the part number and description as shown on the approved shop drawings. Clearly and permanently mark the outside of the spare parts boxes, identifying the contents of the box.

C.6 Erection
C.6.1 General
Erection and adjustment of machinery shall be by millwrights or experienced machinists with demonstrated skill in this type of work. Hydraulic work shall be installed under the direct supervision of a Certified Fluid Power Specialist.

C.6.2 Alignment and Bolting
Erect and assemble the machinery in accordance with part number and match marks, and in accordance with manufacturer's recommendations. Adjust all parts for precise alignment and orientation by means of shims. Pull tightly against supporting members by use of clamps, temporary bolts, or other approved means before drilling and reaming holes for connecting fasteners. Tapered shims may be used, if required, and shall be furnished at no additional cost to the City.

Turned bolt holes into structural steel for attaching machinery components shall, generally, be drilled from the solid after final alignment of the machinery. During erection a sufficient number of ¼ inch undersized, subdrilled holes are permissible for the use of undersize, temporary bolts. When final alignment is achieved, drill and ream the remaining bolt holes and install full size bolts. Remove the temporary bolts, ream the undersize holes and install full size bolts.

In locations where existing bolt holes in the bearings and structures are to be reamed to accept a larger diameter turned bolt, use some of those holes for temporary bolting to achieve alignment. When properly aligned, ream the unused holes to full size, install the full size bolts; remove the temporary bolts, ream the holes and install full size bolts.

Accuracy of the reamed holes through the machinery component, shims and structural steel is required to maintain correct alignment of the machinery. Use a structural steel reaming jig, affixed to the drill and secured to the work piece to prevent the reamer from deviating and assure a cylindrical hole throughout its length. Check holes with a bolt hole micrometer.

Torque all high strength bolts, and turned bolts as recommended by the equipment manufacturer.

C.6.3 Wire Ropes

Prior to installing the ropes, the entire grooved surface of each counterweight sheave shall be coated with the wire rope dressing provided for the ropes.

Ship all ropes on reels of diameter not less than 25 times the nominal diameter of the wire rope. Fasten and protect the windings such that they are protected from damage during shipment, storage, and handling. Ropes with bends, kinks, or other significant damage to the rope will be rejected. Install counterweight ropes such that the alignment stripe is straight without revolving around the axis of the rope.

C.6.4 Coatings

Coat threads for all turned bolts with anti-seize compound before assembly to avoid corrosion or galling and ease future removal.

C.7 Painting

C.7.1 General

Clean and paint all unfinished surfaces of machinery and equipment as required by the City using a system listed on Wisconsin Department of Transportation master list of pre-approved zinc rich three coat paint systems. Submit an outline of painting materials and methods with the shop drawings. Coat in accordance with section 517 of the standard specifications and the requirements herein.

Structural steel components shall be hot-dip galvanized and painted with the two coat system specified in article “Painting Epoxy System P-40-523”.

C.7.2 Shop Painting

Before painting unfinished surfaces in the shop, remove all burrs, chips, rust, scale, sand, grease and other foreign material by blasting, wire brushing or other approved means. Prepare surface for painting by blasting to achieve a SSPC-SP-10 “Near White Metal Blast Cleaning”.

Use masking to avoid painting machinery surfaces which are in normal rubbing contact, such as shaft journals and bushings, and sliding guides.

After properly cleaning the surfaces apply one prime coat of shop paint to all unfinished machinery surfaces. Use a primer compatible with the paints selected for subsequent coats.

C.7.3 Faying Surfaces

All finished contact surfaces which are not finally assembled in the shop shall be coated with waterproof National Lubricating Grease Institute No. 3 Multipurpose grease as soon as possible after being accepted and before removal from the shop, and shall be adequately protected during shipment by wrapping with burlap or canvas held by wooden bats securely wired together. During erection these surfaces shall be thoroughly cleaned and a field coat of grease applied prior to assembly.

C.7.4 Field Painting
After erection and installation is completed, clean and paint all remaining non-rubbing, exposed machinery surfaces with an intermediate, weather resistant free coat.

Upon completion of all operation and acceptance tests and after removing all accumulated grease, oil, dirt and other material, apply a final finish coat.

C.8 Contractor' Inspection
Upon completion of the machinery installation, make a thorough inspection to confirm that all machinery components are free of obstructions and properly aligned; all bolts tightened in accord with section 506 of the standard specifications; all field painting is complete; bearings and other rotating and sliding parts are supplied with lubricants; and the lift span is balanced as required.

The City's representative shall accompany the contractor during his final inspection to determine if the bridge is ready for field testing.

C.9 Field Testing
When the bridge is ready for field testing, notify the engineer no less than fifteen (15) days before scheduling the tests. Inform all City personnel designated by the engineer about the tests. Provide a complete crew of machinists to be available during conduct of the tests to operate the lift span and make all adjustments and corrections required to complete the tests.

Submit a testing procedure to the engineer for approval prior to the tests. Coordinate all mechanical equipment testing with tests required for electrical equipment.

The testing procedure shall include, but not be limited to, the verification of proper installation, alignment, fastening, adjustment and operation of the following:

1. Hydraulic Machinery
2. Counterweight Machinery
3. Span Guides
4. Bumper Beam
5. Centering Device

The tests shall include operation of the span under normal and auxiliary drive conditions. Open and close the bridge ten times consecutively, both on the main drive and auxiliary drive systems, without problems prior to final acceptance. Lowering of the lift span without electrical power is also required to be demonstrated.

During the test runs, observe and inspect all machinery assemblies to determine if everything is in proper running order and fully meets the requirements of the contract documents, special provisions and the manufacturer's performance standards. The engineer and representatives of the machinery and electrical control manufacturers shall

be present and witness all field testing. Temperature rises in mechanical and electrical equipment shall not exceed design and/or manufacturer's limits.

If testing shows that components are defective, inadequate, functioning improperly or incorrectly adjusted, make all corrections, adjustments, repairs or replacements necessary before final acceptance at no additional cost to the City.

C.10 Training
Provide instruction for the City's Operation and Maintenance personnel. The instruction shall include classroom presentations and discussions, utilizing materials in the Operation and Maintenance Manuals, as well as observations of the equipment in place on the lift span, while stationary as well as in operation. Facilities for training will be provided by the City.

The topics covered during the training shall include, but not be limited to:

1. Function and purpose of the major components and systems
2. Normal, auxiliary, and manual operation
3. Routine maintenance, adjustments, and lubrication
4. Trouble shooting

D Measurement (Vacant)

E Payment
No payment is associated with the work specified in this article Bridge Machinery-General. The cost of work required by Bridge Machinery- General is included in the bridge machinery bid items.

19. Expansion Device, P-40-523.

A Description
This special provision describes furnishing and installing an expansion device in accordance to standard spec 502, as shown on the plans, and as hereinafter provided.

B Materials
The minimum thickness of the polychloroprene strip seal shall be ¼-inch for non-reinforced elastomeric glands and 1/8-inch for reinforced glands. Furnish the strip seal gland in lengths suitable for a continuous one-piece installation at each individual expansion joint location. Provide preformed polychloroprene strip seals that conform to the requirements ASTM D3542, and have the following physical properties:

Property Requirements	**Value**	**Test Method**
Tensile Strength, min.	2000 psi	ASTM D412
Elongation @ Break, min	250%	ASTM D412
Hardness, Type A, Durometer	60 ± 5 pts.	ASTM D2240
Compression Set, 70 hours @212˚F, max.	35%	D395 Method B Modified
Ozone Resistance, after 70 hrs. at 100˚F	No Cracks	ASTM D1149 Method A

under 20% Strain with 100 pphm ozone		
Mass Change in Oil 3 after 70 hr. 212˚F Mass Change, max.	45%	ASTM D471

Install the elastomeric strip seal gland with tools recommended by the manufacturer, and with a lubricant adhesive conforming to the requirements of ASTM D4070.

The manufacturer and model number shall be one of the following approved strip seal expansion device products:

	Model Number Strip Seal Gland Size*		
Manufacturer	**4-Inch**	**5-Inch**	**6-Inch**
D.S. Brown	SSA2-A2R-400	SSA2-A2R-XTRA	SSA2-A2R-XTRA
R.J. Watson	RJA-RJ400	RJA-RJ500	RJA-RJ600
Watson Bowman Acme	A-SE400	A-SE500	A-SE800
Commercial Fabricators	A-AS400	-----	-----

*Expansion device strip seal gland size requirement of 4" shall be as shown on the plans.

Furnish manufacturer's certification for production of polychloroprene represented showing test results for the cured material supplied, and certifying that it meets all specified requirements.

The steel extrusion or retainer shall conform to ASTM designation A 709 grade 36 steel. After fabrication, steel shall be galvanized conforming to the requirements ASTM A123.

Manufacturer's certifications for adhesive and steel shall attest that the materials meet the specification requirements.

20. Painting Epoxy System P-40-523.

A Description

This special provision describes steel preparation, shop and field application of the galvanized steel two-coat epoxy system, and repairs to all damaged areas in accordance to standard spec 517 and as hereinafter provided:

This work is applicable to new galvanized steel girders, floor beams, stringers, steel bracing members, connection plates, stiffeners, and all new galvanized structural steel in either the lift span or the fixed approach spans. The work is also applicable to "Bearing Assemblies Fixed P-40-523" and "Bearing Assemblies Expansion P-40-523".

B Materials

B.1 Coating System

Furnish a complete coating system from the department's approved list. The color of epoxy shall be white and the urethane coating material will be chosen by the City of Milwaukee from manufacturer's full color charts. The epoxy shall be a wash primer that chemically etches the galvanized surface and shall be subject to the engineer's approval.

Samples for initial selection: Submit manufacturer's full color charts. The City will select a minimum of five colors.

Samples for Verification: For each color and gloss of selected:

Submit samples on rigid backing, 8 inches square.
Step coats on samples to show each coat required for system.
Label each coat of each sample.
Label each sample for location and application area.

Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

The City will designate items or areas required.

Final approval of color selections will be based on mockups.

If preliminary color selections are not approved, apply additional mockups of additional colors selected by the City at no added cost to the City.

Approval of mockups does not constitute approval of deviations from the contract documents contained in mockups unless the City specifically approves such deviations in writing.

Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

Supply the engineer with the product data sheets before any coating is applied. The product data sheets shall indicate the mixing and thinning directions, the recommended spray nozzles and pressures, the minimum drying time for shop applied coats, and the recommended procedures for coating galvanized bolts, nuts, and washers.

Supply the engineer with the product data sheets in accordance with 517.2.4.2 before any coating is applied.

B.2 Steel

Furnish materials conforming to the following:

Structure Steel	Section 506

Traffic Railing	Section 513
Pedestrian Railing	Section 513
Other Steel	per the special provisions

Prior to fabrication, blast clean structural steel, traffic railing, and pedestrian railings, and bearings per SSPC-SP 6 and hot dip galvanize according to ASTM A123. Bolts, nuts and washers shall be supplied as factory galvanized according to section 506.2.5 and in accordance with ASTM A153. Clean and zinc coat other steel in accordance with the applicable special provisions.

Steel preparation includes the chamfering of sharp edges. All sharp edges shall be flattened by a single pass of a grinder or suitable device along the sharp edge. Condition any thermal cut edges before blast cleaning by shallow grinding or other cleaning to remove any hardened surface layer. Remove evident steel defects exposed in accordance to AASHTO M 160 prior to blast cleaning.

Grind the welded joints to a smooth finish where shown in the plans. Repair galvanized coating damaged during fabrication as specified in 635.3.5.

C Construction

C.1 Cleaning

Galvanized surfaces shall be cleaned per SSPC-SP1 to remove chlorides, sulfates, zinc salts, oil, dirt, organic matter, and other contaminants. The cleaned surface should then be brush blast cleaned per SSPC-SP7 to create a slight angular surface profile (1.0-1.5 mils suggested) for adhesion. Blasting should not fracture the galvanized finish or remove any dry film thickness.

C.2 Painting

After cleaning provide a tie coat from an approved coating system that is specifically intended to be used on a galvanized surface. The tie coat shall etch the galvanized steel and prepare the surface for the top coat. Apply a top coat matching the specified color. The tie and topcoats should be of contrasting colors. Use a pre-approved top coat that is resistant to the effects of the sun, and is suitable for use in a marine environment.

This work shall be in accordance with ASTM D6386.

C.3 Epoxy System

Replace subsection 517.3.1.5.2(4) of the standard specifications with the following:

The maximum time between coats shall be in accordance with the manufacturer's recommendations except that no more than 60 days may elapse between coats of Epoxy System with the exception of additional time allowed for field application of the urethane top coating.

Modify the fourth paragraph of standard spec 517.3.1.7.2 to read:

On all other areas including the outside surfaces of splice plates, the minimum dry film thickness above the surface profile for the primer coat shall be 3.0 mils (0.076 mm).

C.4 Field Painting
Supplement subsection 517.3.1.8.1 of the standard specifications with the following:

After adjoining concrete work, including formwork removal, has been completed repair all field-damaged areas of newly painted steel. Field apply the top coat in conjunction with the field application of the top coat to the steel.

All edge of flanges, splice plates connections and bolts shall require a stripe coat and back rolled to ensure full paint coverage on sharp edges.

Prior to applying the field top coating, clean all paint surface that are to be repaired or top coated using a light water blast, and allow the paint surface to dry. Clean painted areas that are damaged in accordance with 517.3.1.3. Prior to any painting, all cleaning shall be approved by the engineer. Field repair and paint all damaged areas in accordance with 517.3.1.8.2. Coating repairs and application of top coating shall be in accordance with weather conditions as specified in 517.3.1.2.

D (Vacant)

E Payment
Supplement 517.5 as follows: Payment for the field-applied urethane shall be included in the contract lump sum price for Painting Epoxy System (P-40-523)

21. Removing Old Structure Over Waterway with Minimal Debris Station 28+53, Item 203.0600.S.

Conform to standard spec 203 as modified in this special provision.

Add the following to standard spec 203:

203.3.6 Removals Over Waterways and Wetlands
203.3.6.2 Removing Old Structure Over Waterway with Minimal Debris

(1) Remove the existing structure P-40-523 over the Milwaukee River in large sections and conforming to the contractor's approved structure removal and clean-up plan. During superstructure removal, prevent all large pieces and minimize the number of small pieces from entering the waterway or wetland. Remove all reinforcing steel, all concrete, and all other debris that falls into the waterway or wetland. The contractor may leave limited amounts of small concrete pieces scattered over the waterway floor or wetland only if the engineer allows.

(2) Barges shall be used under bridge to capture falling debris. If needed, sand should be placed on barge to prevent debris from rebounding in to the waterway.

(3) Submit a structure removal and clean-up plan as part of the erosion control implementation plan required under standard spec 107.20. Do not start work under the structure removal and clean-up plan without the City's written approval of the plan. Include the following information in the structure removal and clean-up plan:

- Methods and schedule to remove the structure.
- Methods to control potentially harmful environmental impacts.
- Methods for superstructure removal that prevent all large pieces and minimize the number of small pieces from entering the waterway or wetlands.
- Methods to control dust and contain slurry.
- Methods for removing deteriorated concrete on piers and abutments.
- Methods for cleaning the waterway or wetlands.

(4) If stockpiling spoil material, place it on an upland site an adequate distance from the waterway, wetland, or any open water created by excavation. Install silt fence between the spoil pile and the waterway, wetland, or excavation site.

(5) The following shall be salvaged by the Contractor and returned to the City:

- Brake Control Cabinet
- Remote PLC Cabinet
- Operator Desk Top
- Wall and Ceiling Heaters
- Hot Water Heater
- Bridge Position Limit Switches
- Navigation and Pier Lights
- Sump Pump Motor Starters
- Black Box containing Telecenter and Video Card Rack
- Gates and Gate Houses
- Cameras
- Signal Horn
- Copper Signal Ball (kept in the equipment room)
- Signs attached to walls, railings, and doors.

(6) Remove portions of existing bridge as shown on the plans. Items to be removed include, but not limited to, the following:

- Entire Lift Span Superstructure
- Lift span jacking girders and lifting legs
- Bumper beam assembly including counterweight
- Entire Lift Span Machinery except items indicated to be salvaged.
- Entire counterweight except counterweight steel slabs to be salvaged and reused.
- Entire concrete deck and asphaltic overlay on fixed approach spans.
- Portions of fixed span structural steel
- Entire railing on bridge and wing walls.
- Entire railing on pier walks

- Portions of concrete substructure units
- Entire dock fenders

(7) Remove existing underdeck sanitary and water service lines to the bridge house from the west approach and salvage for reinstallation.

Add the following Removing Old Structure bid item to standard spec 203.5.1:

ITEM NUMBER	DESCRIPTION	UNIT
203.0600.S	Removing Old Structure Over Waterway With Minimal Debris Station 28+53	LS

22. Bearing Replacement P-40-523, Item 506.7000.S.

A Description
This special provision describes raising the girders, removing the existing bearings, and furnishing and placing new laminated elastomeric bearings with new top and bottom plates, and anchor bolts at the west and east abutments as shown on the plans and as hereinafter provided.

B Materials
Conform to laminated elastomeric bearing pads requirements of Section 506.2.6 and 506.2.6.5 of the standard specifications. Furnish tapered top plate and bottom anchor plate with the elastomer vulcanized to both the plates.

C Construction
Raise the structure's girders, remove the existing bearings, cut existing anchor bolts as shown on the plans, clean the remaining length of existing anchor bolts, and furnish and place the bearings as shown in the plans.

Obtain prior approval from the engineer for the method of jacking the girders and of supporting them during replacement operations.

D Measurement
The City will measure Bearing Replacement P-40-523 by the unit for each bearing removed and replaced.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
506.7000.S	Bearing Replacement P-40-523	Each

Payment is full compensation for raising the bridge; removing the old bearings; furnishing and placing new bearings and anchor bolts; and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the work.

23. Preparation and Coating of Top Flanges, Item 517.0900.S.

A Description

This special provision describes thoroughly cleaning and coating the top surface and edges of the top flanges of the existing girders of the fixed spans, removing loose paint, rust, mill scale, dirt, oil, grease, or other foreign substances until the specified finish is obtained.

B (Vacant)

C Construction

In accordance with SSPC SP-10, blast clean to a near white finish the top surface and edges of the top flanges that have no paint on them, and paint them with one coat of an approved zinc rich primer. No collection of blast waste material is required.

In accordance to SSPC SP-2 or SP-3, clean all areas of rust and loose paint on the top surface and edges of the top flanges, which have paint on them, by wire brushing, grinding or other mechanical means. Wash the top surface and edges of the top flanges and give them one coat of an approved zinc-rich primer.

Where plans call for the cleaning of other painted structural steel including hanger assemblies, bearings, field splices, and connections, clean areas of loose paint and rust by wire brushing, grinding, or other mechanical means as necessary and in accordance to SSPC SP-2, SP-3, or SP-11. Sound paint need not be removed with the exception of an area 12-inches on either side of hanger assembly centerlines. Clean this area to base metal in accordance to SSPC SP-10, or SP-11.

In accordance to SSPC SP-2, or SP-3, thoroughly clean by wire brushing, grinding or other mechanical means as necessary the surface area of exposed steel members that are to be imbedded in the new concrete, and wash and give one coat of an approved zinc rich primer to these areas.

Furnish and erect tarpaulins or other materials to collect all of the spent paint containing material resulting from blasting or hand and power tool cleaning and coating. Minimize dust during all clean-up activities. Collect and store waste material at the end of each work day or more often if needed. Store waste materials in the hazardous waste containers. Lock and secure all waste containers at the end of each work day. Cover the container(s) at all times except when adding or removing waste material. Store the containers in an accessible and secured area, not located in a storm water runoff course, flood plain or exposed to standing water. Transportation and disposal of such waste material will be the responsibility of the contractor.

Damage to existing painted surfaces as a result of construction operations, shall be restored to the approval of the engineer at the contractor's expense.

D Measurement
The City will measure Preparation and Coating of Top Flanges, completed in accordance to the contract and accepted, as a single complete unit of work for the structure.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
517.0900.S	Preparation and Coating of Top Flanges	LS

Payment is full compensation for preparing and cleaning the designated surfaces; and for furnishing and applying the coating. Transportation and disposal of waste materials will be paid for under item" Negative Pressure Containment and Collection of Waste Materials P-40-523".

24. Concrete Staining P-40-523, Item 517.1010.S.

A Description
Furnish and apply a two coat concrete stain to the exposed concrete surfaces of the structure, as detailed in the plans and as hereinafter provided.

B Materials
B.1 Mortar
Use mortar for sack rubbing the concrete surfaces as given in standard spec 502.3.7.5 or use one of the following products:

Preblended, Packaged Type II Cement:	Tri-Mix by TK Products
	Thoroseal Pearl Gray by Thoro Products

The mortar shall contain one of the following acrylic bonding admixtures mixed and applied in accordance to manufacturer's recommendations:

Acrylic Bonding Admixture:	TK-225 by TK Products
	Achro 60 by Thoro Products
	Achro Set by Master Builders

B.2 Concrete Stain
Use concrete stain manufactured for use on exterior concrete surfaces, consisting of a base coat and a pigmented sealer finish coat. Use the following products, or equal as approved by the department, as part of the two coat finish system:

Tri-Sheen Concrete Surfacer, Smooth by TK Products
Tri-Sheen Acrylic by TK Products
TK-1450 Natural Look Urethane Anti-Graffiti Primers by TK Products

Safe-Cure & Seal EPX by Chem Masters
H + C Shield Plus by Sherwin-Williams

C Construction

C.1 General

Furnish, prepare, apply, cure, and store all materials in accordance to the product manufacturer's specifications for the type and condition of application required.

Match or exceed the stain manufacturer's minimum recommended curing time of the concrete or 28 days, whichever is greater, prior to staining.

C.2 Preparation of Concrete Surfaces

Provide a sack rubbed finish in accordance to standard spec 502.3.7.5, using mortar as indicated above on concrete surfaces with open voids or honeycombing.

Following the sack rubbing, clean all concrete surfaces that are to be coated to ensure that the surface is free of all laitance, dirt, dust, grease, efflorescence, and any foreign material and that the surface will accept the coating material according to product requirements. As a minimum, clean the surface using a 3000-psi water blast. Hold the nozzle of the water blaster approximately 6 inches from the concrete surface and move it continuously in a sweeping motion. Give special attention to smooth concrete surfaces to produce an acceptable surface texture. Correct any surface problems resulting from the surface preparation methods. Grit blasting of the concrete surface is not allowed.

C.3 Staining Concrete Surfaces

Apply the concrete stain in accordance to the manufacturer's recommendations.

Apply the concrete stain when the temperature of the concrete surface is 45º F or higher, or as given by the manufacturer.

Submit manufacturer's full color charts for initial selection. The City will select a minimum of five colors.

Samples for Verification: For each color and gloss of selected:

Submit samples on rigid backing, 8 inches square.
Step coats on samples to show each coat required for system.
Label each coat of each sample.
Label each sample for location and application area.

Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

The City will designate items or areas required.

Final approval of color selections will be based on mockups.

If preliminary color selections are not approved, apply additional mockups of additional colors selected by the City at no added cost to the City.

Approval of mockups does not constitute approval of deviations from the contract documents contained in mockups unless the City specifically approves such deviations in writing.

Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

Tint the base coat to match the finish coat; the two coats shall be compatible with each other.

Do not begin staining the structure until earthwork operations are completed to a point where this work can begin without receiving damage. Where this work is adjacent to exposed soil or pavement areas, provide temporary covering protection from overspray or splatter.

C.4 Test Areas
Prior to applying stain to the structure, apply the stain to sample panels measuring a minimum of 48-inches x 48-inches and constructed to demonstrate workmanship in the use of the form liner specified on the structure if applicable. Match or exceed the stain manufacturer's minimum recommended curing time of the concrete or 28 days, whichever is greater, prior to staining. Prepare the concrete surfaces of the sample panels and apply stain using the same materials and in the same manner as proposed for the structure, including staining of the joints between the stones produced by the form liner if applicable. Do not apply stain to the structure until the City approves the test panels.

C.5 Surfaces to be Coated.
Apply concrete stain to the surfaces in accordance to the plan.

D Measurement
The City will measure Concrete Staining P-40-523 in area by the square foot of surface, acceptably prepared and stained.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
517.1010.S	Concrete Staining P-40-523	SF

Payment is full compensation for furnishing and applying the two coat system; for preparing the concrete surface; and for preparing the sample panels.

25. Structure Repainting Recycled Abrasive P-40-523, Item 517.1800.S.

A Description

This special provision describes surface preparation and painting of the metal surfaces in accordance to the manufacturer's recommendations and as hereinafter provided.

A.1 Areas to be Cleaned and Painted

All structural metal surfaces of:

1. Structure P-40-523 14,000 SF.

Areas are approximate and given for informational purposes only.

B Materials

B.1 Coating System

Furnish a complete coating system from the department's approved list. The color for the finish coating material shall match the color number shown below in accordance with Federal Standard Number 595C, as printed in 2008. Supply the engineer with the product data sheets before any coating is applied. The product data sheets shall indicate the mixing and thinning directions, the recommended spray nozzles and pressures, and the minimum drying time between coats.

Finish Color:

> The color for the finish coating material for all existing structural steel shall be the same color and semi gloss finish as provided under the bid item Painting Epoxy System Structure P-40-523.

The color of the primer must be such that a definite contrast between it and the color of the blasted steel is readily apparent. There shall be a color contrast between all subsequent coats for the paint system selected. Submit color samples of the primer to the engineer for approval.

C Construction

C.1 Surface Preparation

Prior to blast cleaning, solvent clean all surfaces to be coated in accordance to SSPC-SP1. A No. 10 Near White Blast Cleaning according to Steel Structures Painting Council Specification Ten will be required on all metal surfaces to be painted. Prime the same day all metal surfaces receiving a No. 10 blast or re-blast before application.

The steel grit and any associated equipment brought to the site and used for blast cleaning shall be clean. Remove immediately dirty grit or equipment brought to the site at no expense to the City. Furnish an abrasive that has a gradation such that it will produce a uniform surface profile between 1 to 3 mils on the steel surface, as measured with extra profile course Testex Replica Tape. Use a minimum air pressure for abrasive blasting, measured at the nozzle, of 90 psi.

The abrasive blasting and recovery system shall be a completely integrated self-contained system for abrasive blasting and recovery. It shall be an open blast and recovery system that will allow no emissions from the recovery operation. The recovery equipment shall be such that the amount of contaminants in the clean recycled steel grit shall be less than 1 percent by weight.

Remove by grinding all fins, tears, slivers, and burred or sharp edges that are present on any steel member, or that appear during the blasting operation, and re-blast the area to give a 1 to 3 mils surface profile.

Remove all spent material and paint residue from steel surfaces with a good commercial grade vacuum cleaner equipped with a brush-type cleaning tool, and hand wipe the steel surfaces with a clean soft cloth. The airline used for surface preparation shall have an in-line water trap and the air shall be free of oil and water as it leaves the airline.

Take care to protect freshly coated surfaces from subsequent blast cleaning operations. Thoroughly wire brush damaged primed surfaces with a non-rusting tool, or if visible rust occurs, re-blast to a near white condition. Clean and re-prime the brushed or blast cleaned surfaces within the time recommended by the manufacturer.

C.2 Coating Application

Apply paint in accordance to the manufacturer's recommendations in a neat workmanlike manner. Paint application shall normally be by airless spray.

The engineer may allow the use of conventional spray equipment after satisfactory demonstration by the contractor of the proper technique and handling of that equipment.

Mix the paint or coatings in accordance to the manufacturer's directions to a smooth lump-free consistency. After mixing and during application, continuously stir the paint or coating under constant slow speed agitation by use of a jiffy mixer.

Remove all dry spray by vacuuming, wiping, or sanding if necessary.

If the application of the coating at the required thickness in one coat produces runs, bubbles, or sags; apply a "mist-coating" in multiple passes of the spray gun; separate the passes by several minutes. Where excessive coating thickness produces "mud-cracking", remove such coating back to soundly bonded coating and re-coat the area to the required thickness.

The resultant paint film shall be smooth and uniform, without skips or areas of excessive paint.

The coating is supplied for normal use without thinning. If in cool weather it is necessary to thin the coating for proper application, thin in accordance to the manufacturer's recommendations.

During surface preparation and coating application the ambient and steel temperature shall be between 39 degrees F and 100 degrees F. The steel temperature shall be at least 5 degrees F above the dew point temperature. (This requires the steel to be dry and free of any condensation or ice regardless of the actual temperature of the steel.) The relative humidity shall not exceed 85%.

Paint thickness shall be as follows:

	Dry Film Thickness
Prime Coat	3 mils min.
Intermediate Coat	3 mils
Top Coat	3 mils

Prior to applying the prime coat, stripe with primer all edges, rivet and bolt heads, nuts and washers by either brush or spray application.

Time to recoat shall be according to the manufacturer's recommendations.

The dry film thickness will be determined by use of a magnetic film thickness gage. The gage shall be calibrated for dry film thickness measurement in accordance to SSPC-PA 2. Dry film thickness in each area measured will be based on an average of three gage readings, after calibration of the gage to account for surface profile of the bare steel as a result of surface preparation.

D Measurement

The City will measure Structure Repainting Recycled Abrasive (Structure), completed in accordance to the contract and accepted, as a single complete unit of work.

E Payment

The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
517.1800.S	Structure Repainting Recycled Abrasive P-40-523	LS

Payment is full compensation for preparing and cleaning the designated surfaces; furnishing and applying the paint; and for providing the listed equipment.

26. Negative Pressure Containment and Collection of Waste Materials, P-40-523, Item 517.4500.S.

A Description

This special provision describes providing a dust collector to maintain a negative air pressure in the enclosure; furnishing and erecting enclosures as required to contain, collect and store waste material resulting from the preparation of steel surfaces for

painting, and repainting, including collection of such waste material, and the labeling and storage of waste material in approved hazardous waste containers, all as hereinafter provided.

B (Vacant)

C Construction

Erect an enclosure to completely enclose (surround) the blasting operations. The ground, slope paving, or roadway cannot be used as the bottom of the enclosure. So that there are no visible emissions to the air or ground or water, design, erect, operate, maintain and disassemble the enclosures in such a manner to effectively contain and collect dust and waste materials resulting from surface preparation and paint over spray. Where bulkheads are required, construct them of plywood and properly seal them. Suspend all enclosures over water from the structure or as approved by the engineer.

Construct the enclosure of flexible materials such as tarpaulins or of rigid materials such as covered plywood, or of a combination of flexible and rigid materials. Systems manufactured and provided by Eagle Industries, Detroit Tarps, or equal, are preferred. The tarpaulins shall be lined, either as part of the tarp system or have a separate plastic lining. Maintain all materials free of tears, cuts or holes. The vertical sides of the enclosure shall extend from the bottom of the deck down to the level of the work platform or barge where used for structures over water, and shall be fastened securely to those levels to prevent the wind from lifting them. Bulkheads are required between beams to enclose the blasting area as approved by the engineer. Where bulkheads are required, construct them of plywood and properly seal them. To prevent spent materials and paint over spray from escaping the enclosed area, overlap and fasten together all seams. Place groundcovers under all equipment prior to operations or as approved by the engineer.

To allow proper cleaning, inspection of structures or equipment, and painting, provide safe adequate artificial lighting in areas where natural light is inadequate.

Provide a dust collector so that there are no visible emissions outside of the enclosure and so that a negative air pressure inside the enclosure is maintained. The dust collector shall be sized to maintain the minimum air flow based on the cross-sectional area of the enclosure.

A combination of positive air input and negative air pressure may be needed to maintain the minimum airflow within the enclosure.

Filter all air exhausted from the enclosure to create a negative pressure within the enclosure so as to remove all hazardous and other particulate matter.

As a safety factor for structures over water, provide for scum control. Effectively contain the scum that forms on the water and does not sink in place from moving upstream or downstream by the use of floating boom devices.

If in the use of floating boom devices the scum tends to collect at the devices, contain, collect, store the scum, and do not allow it to travel upstream or downstream beyond the devices. Remove the scum at least once a day or more often if needed.

Collect and store at the bridge site for disposal all waste material or scum collected by this operation, or any that may have fallen onto the ground tarps. Collect and store all waste material and scum at the end of each workday or more often if needed. Storage shall be in provided hazardous waste containers. Label each container as it is filled, using the labels provided by the Hazardous Waste Disposal contractor. Check the label and ensure that the project ID, bridge number and EPA ID match the structure. Fill in the generation date when the first material is placed in the container. Secure all containers at the end of each workday. Keep the containers covered at all times except to add or remove waste material. Store the containers in an accessible and secured area, not located in a storm water runoff course, flood plain, or exposed to standing water. The disposal of waste materials shall be the contractor's responsibility.

In a separate operation, recover the recyclable abrasive for future application, and collect the paint and/or corrosion particles for disposal. Sand is not an acceptable abrasive.

D Measurement

The City will measure Negative Pressure Containment and Collection of Waste Materials P-40-523, completed in accordance with the contract and accepted, as a single complete unit of work for each structure designated in the contract.

E Payment

The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
517.4500.S	Negative Pressure Containment and Collection of Waste Materials P-40-523	LS

Payment is full compensation for designing, erecting, operating, maintaining, and disassembling the containment devices; providing negative pressure exhaust ventilation; collecting, labeling, and for storing spent materials in hazardous waste containers, and for disposing of the waste containers.

27. Portable Decontamination Facility, Item 517.6001.S.

A Description

This special provision describes furnishing and maintaining weekly, or more often if needed, a single unit portable decontamination facility as hereinafter provided.

B Materials
Supply adequate heating equipment with the necessary fuel to maintain a minimum temperature of 68° F in the facility.

The portable decontamination facility shall consist of a separate "Dirty Room", "Shower Room" and "Clean Room". The facility shall be constructed so as to permit use by either sex. The facility shall have adequate ventilation.

The "Dirty Room" shall have appropriately marked containers for disposable garments, clothing that requires laundering, worker shoes, and any other related equipment. Each container shall be lined with poly bags for transporting clothing, or for disposal. Benches shall be provided for personnel.

The "Shower Room" shall include self-contained individual showering stalls that are stable and well secured to the facility. Provide showers with a continuous supply of potable hot and cold water. The wastewater must be retained for filtration, treatment, and/or for proper disposal.

The "Clean Room" shall be equipped with secure storage facilities for street clothes and separate storage facilities for protective clothing. The lockers shall be sized to store clothing, valuables and other personal belongings for each worker. Benches shall be provided for personnel.

Supply a separate hand wash facility, either attached to the decontamination facility or outside the containment.

C Construction
Properly contain, store, and dispose of the wastewater.

D Measurement
The City will measure Portable Decontamination Facility by the unit acceptably completed.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
517.6001.S	Portable Decontamination Facility	Each

Payment is full compensation for furnishing and maintaining a portable decontamination facility.

28. Anchor Assemblies Light Poles on Structures, Item 657.6005.S.

A Description
This special provision describes furnishing and installing anchor bolt assemblies for light poles, traffic signal poles, and future OCS poles as shown on the plans, and as hereinafter provided.

B Materials
Furnish anchors of the size and spacing as given on the plans, and that conform to ASTM A449 or AASHTO M314 GR 55. The bolts, nuts and washers are to be electrogalvanized per ASTM A164 (Type GS). Provide NC threads for the bolts and nuts and provide enlarged threads on nuts for proper fit after galvanizing.

C Construction
Provide two nuts and two washers per anchor bolt, and install per light standard manufacturer's recommendations.

D Measurement
The City will measure Anchor Assemblies Light Poles on Structures as a unit for each individual anchor bolt assembly acceptably completed.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
657.6005.S	Anchor Assemblies Light Poles on Structures	Each

Payment is full compensation for furnishing and installing the anchorages.

29. Lightweight Concrete Masonry, Item SPV.0035.174.

A Description
This special provision describes furnishing and installing lightweight concrete on portions of the lift span within the block outs provided for installation of future streetcar rails in accordance with Section 502 of the standard specification, as shown on the plans, and as herein provided.

B Materials
The lightweight concrete masonry should weigh between 105-115 lbs and the compressive strength of the lightweight concrete at 28 days should be a minimum of 4,000 psi. Submit the concrete mix design for the engineer's approval prior to using the material for the project. Assure the strength and weight of the concrete by performing a minimum of three batch mixes and submit along with the concrete mix design for approval to assure the requirements as given above.

C Construction
Before placing the lightweight concrete, clean the block out thoroughly and apply an approved bond breaker to the sides of the block out. Finish the concrete to match the elevation of existing concrete on either side of the block out.

D Measurement
The City will measure Lightweight Concrete Masonry, completed in accordance with the contract and accepted by the quantity per cubic yard of lightweight concrete properly formed, poured leveled, and cured for the areas shown on the plans.

E Payment
The City will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0035.174	Lightweight Concrete Masonry	CY

Payment for Lightweight Concrete Masonry is full compensation for providing concrete, forms and falseworks; for providing and applying bond breaker; for placing, finishing, curing, and protecting the concrete; and for all other labor, material, equipment, and incidentals necessary to complete the work.

30. Weep Drain Cleaning, Item SPV.0060.159.

A Description
This special provision describes the removal of any debris in the weep drains located in both abutments and the cleaning of the screens located at the backface of the abutment and covering the weep drain. Work shall include cleaning of the entire weep drain from front face to back face of the abutment and cleaning of the screen; and for all labor, tools, equipment and incidentals necessary to complete the work in accordance with the contract.

B (Vacant)

C Construction
The weep drain screens are to be cleaned in situ. Screens are to be cleaned with pressurized water applied in short bursts with the nozzle as close to the screen as possible. Care should be taken to not dislodge the screen or create a void in the soil behind the screen.

Weep drain cleaning shall be done prior to the approach work and concrete staining.

D Measurement
The City will measure Weep Drain Cleaning by each unit, acceptably completed.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.159	Weep Drain Cleaning	Each

Payment is full compensation for cleaning the weep drain; and for furnishing all labor, material, tools, equipment, and incidentals necessary to complete the work.

31. Bearing Maintenance P-40-523, Item SPV.0060.162.

A Description
This special provision describes raising the girders, removing the existing bearings at the piers, furnishing and installing new bearing base plate shims, blast cleaning and painting the bearing components in the shop, replacing the anchor bolts as required, reassembling the bearings to provide full contact bearing for the existing fixed span girders, and for installing caulk around the perimeter of the bearings in accordance with the plans and as hereafter provided.

B Materials
Furnish a complete epoxy coating system from the department's approved product list. The color of epoxy shall be white and the urethane coating material shall match the color for the finish coating material for all existing steel bearings shall be the same color and semi-gloss finish as provided under bid item Painting Epoxy System (P-40-523). Supply the engineer with the product data sheets before any coating is applied. The product data sheets shall indicate the mixing and thinning directions, the recommended spray nozzles and pressures, the minimum drying time for shop applied coats, and the recommended procedures for coating galvanized bolts, nuts, and washers.

Bearing base plate shims shall be stainless steel.

C Construction
C.1 General
Raise and support the existing steel girder and remove the bearing plate and existing shim pack. Leave the top plate as is, attached to the girder bottom flange. Keep and sandblast existing anchor bolts at the beam seat. Replace the bottom shim pack with new stainless steel full width shims. Blast-clean in the shop all bearing components while disassembled to a near white finish and paint all bearing components with one of the coating systems specified above. Install existing rehabilitated bottom bearing plate using existing anchor bolts and new nuts and washers, and reassemble the bearing assembly. As required, use adequate containment methods to contain material resulting from preparation of painted steel surfaces for painting. Remove existing nuts and washers by scoring the nuts and breaking them apart versus torquing off the nuts. Replace anchor bolts as required with new galvanized anchor bolts. Perform any concrete repairs required under the beam seats while the girder is temporarily supported for bearing maintenance.

C.2 Coating Application
Apply paint in the shop in a neat workmanlike manner, and in accordance to the manufacturer's instructions and recommendations.

D Measurement
The City will measure Bearing Maintenance P-40-523 as each individual fixed span bearing assembly acceptably completed.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.162	Bearing Maintenance P-40-523	Each

Payment is full compensation for jacking up the girders; removing, cleaning, painting, installing new stainless steel shims; reinstalling bearings and replacing the anchor bolts as required; and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

32. Junction Boxes 12x12x6-inch, Item SPV.0060.170.

A Description
This work shall be in accordance to the requirements of section 653 of the standard specifications, the plans, standard detail drawings, and as hereinafter provided.

B Materials

B.1 General
Furnish materials in accordance to the plans and subsection 653.2.2 of the standard specifications.

B.2 Junction Boxes
Furnish 12x12X6-Inch hot dipped zinc coated cast iron junction boxes with a checkered cover rated for vehicular loading. Provide Junction Box manufactured by OZ/Gedney, model #YT121206-CSV or equivalent.

C Construction
Perform construction in accordance to the plans and subsection 653.3 of the standard specifications.

D Measurement
The City will measure Junction Boxes 12x12x6-Inch as each individual junction box, acceptably completed.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0060.170	Junction Boxes 12X12X6-Inch	Each

Payment shall be full compensation in accordance to subsection 653.5 of the standard specifications.

33. Bridge Structural Steel, Item SPV.0085.151.

A Description
A.1 General
This work shall consist of furnishing, fabricating, and erecting all structural steel, for fixed spans, lift span, anchor rods, and other miscellaneous steel called on the plans and/or not included under other bid items. All work shall be performed in accordance with the applicable requirements of the standard specifications in general and Section 506 in particular, except as modified herein or shown on the plans.

A.2 Scope
This work consists of but is not limited to, the following items:
All steel on the lift span including lifting legs, girders, floorbeams, stringers, plates on top of stringers, exodermic deck support beams, bracing, brackets, and sidewalk framing.
All steel on the piers (fixed portion).
Angles with anchors embedded in concrete edges of roadway slab and anchor studs welded to the angles.
All shear connectors and anchor studs welded to the fabricated structural steel.
All shop and field fasteners for the structural steel.
Shop and field fasteners for connection of other items to the above structural steel except for the items furnished as a part of the bridge machinery special provisions.
Any other fabricated steel attached to the movable span, shown on the plans but not specifically listed above, unless an item is specifically included in another special provision.
All structural steel work associated with placing the lift span in proper operating condition.

A.3 Submittals
Submit shop drawings and erection drawings for review in accordance with the standard specifications and other provisions of the contract.

B Materials
B.1 Structural Steel
All structural steel shapes and plates covered by this work shall be new and shall be ASTM A709 grade 36 or grade 50 unless otherwise noted in the plans. All of the requirements in the Article, FRACTURE CONTROL PLAN, shall apply.

Any plate that is to be bent during fabrication shall be ordered from the mill such that the bend line will be oriented across the width of the plate, ie. Perpendicular to the direction of rolling.

B.2 Bolts and fasteners
All high strength bolts shall meet FHWA requirements for rotational tests.

All threaded fasteners shall be ASTM A325, Type 1 zinc-coated, unless otherwise noted on the plans or special provisions.

B.3 Masonry Anchors
Concrete masonry anchors type S shall be as specified in Subsection 502.2.12 of the standard specifications. The anchors shall be stainless steel, or if specifically called for on the plans or special provisions, hot dip zinc-coated in accordance with AASHTO M232.

B.4 Zinc-coating
The following items, including all appurtenant parts, but not limited to, shall be hot-dip zinc-coated in accordance with ASTM A123 or A153 as applicable.

Roadway girders, stringers, plates on top of stringers, floorbeams, and beams supporting the exodermic deck.
Lifting legs and lifting girders
Curb stringers
Sidewalk brackets and stringers
Roadway and sidewalk breaks.
Angles embedded in the roadway slab and anchor studs welded to them.
All bolts, unless noted otherwise on the plans
All anchor bolts from the exposed end to a point 3" below the surface of the concrete, unless noted otherwise.
Position dowels and anchor bolts, including nuts and washers, shall be hot-dip zinc coated in accordance with ASTM A153. Zinc-coated nuts shall be tapped oversize in accordance with the requirements of ASTM A563 and shall meet the requirements of Supplementary Requirements S1 of ASTM A 563, Lubricant and Test for Coated Nuts. Excess hot-dip zinc coating on threaded portions shall be removed by centrifuging or air blasting immediately upon withdrawal; flame chasing is prohibited.

All portions of bearings not welded to the beam or girder and other structural members and parts required to be zinc coated shall be zinc-coated in accordance with ASTM A123. Fabricated bearing components shall be blast cleaned to remove all mill scale prior to zinc-coating.

Any and all zinc-coated areas that are damaged by welding, abrasion, or other causes shall be repaired in accordance with ASTM A780, using either the Zinc-Based Solders or the Zinc-Rich Paints type of materials. The requirements of Annexes A1, REPAIR USING ZINC-BASED ALLOYS, and/or A2, REPAIR USING ZINC-RICH PAINTS,

shall be followed. Alternatively, damaged areas may be repaired as specified in Subsection 635.3.5 of the standard specifications.

B.5 Painting

All structural steel, including steel that is galvanized, shall be cleaned and coated as specified in Section 517 of the Standard Specifications except as noted herein.

Any galvanized surfaces that are also to be painted shall be cleaned and given a tie coat in accordance with the recommendations of the manufacturer of the paint system, unless otherwise noted. The tie coat shall be a wash primer that chemically etches the galvanized surface and shall be subject to the engineer's approval.

C Construction

C.1 Construction Requirements

The requirements of Subsection 506.3 of the Standard Specifications shall be supplemented by the following:

C.1.1 Inspection and Testing

All welding and non-destructive testing for redundant main members and secondary members shall conform to the current edition of the AWS/AASHTO Bridge Welding Specifications, D1.3-95, modified in accordance with the latest AASHTO Standard Specifications for Welding of Structural Steel Highway Bridges and to the details shown on the plans. All welding and non-destructive testing for non-redundant fracture critical members shall conform to the AASHTO/AWS Fracture Control Plan per the current edition of the AWS/AASHTO Bridge Welding Specifications, D1.3-95 and to the details shown on the plans. All welding shall be done by the electric arc process. All butt and groove welds are to be full penetration welds. The symbols used on the Plans indicate only the general type of weld required. The fabricator shall submit, to the engineer for approval, the proposed weld geometry to be used in fabrication. The weld geometry shall include machining or grinding required to maintain 3 to 1 slope limitation. If a fillet weld size is not shown on the Plans, it shall be sized in accordance with WISDOT requirements for minimum weld size based on material thickness.

Notify the engineer at least 30 calendar days in advance of the beginning of work at the steel fabrication shop. The engineer shall be under no obligation to accept any work performed before the thirtieth (30th) day after such notice.

All quantitative and qualitative testing and performance and other incidentals to perform the work under this section shall be in accordance with the standard specifications and other applicable special provisions.

Nondestructive testing will include radiographic, magnetic particle, and ultrasonic methods as well as any other type of inspection the contractor proposes to use with the engineer's approval.

Ultrasonic testing may be used in lieu of radiographic testing subject to the approval of the engineer, except as noted in the fracture control plan.

Fillet welds shall be tested by the magnetic particle method.

All inspection shall be performed by a firm or agent employing qualified welding inspection personnel and using up-to-date equipment. The contractor shall inform the engineer the name of this firm and the identity of the equipment to be used. No fabricated steel shall be inspected or accepted until the firm and its equipment have been approved.

All radiographic, magnetic particle and ultrasonic inspection shall be performed in the presence of the City's designated representative. Any radiographic, magnetic particle or ultrasonic inspection performed without the presence of the City's representative will be considered void, and shall be repeated with the presence of the City's representative. The contractor's inspector and the City's representative shall jointly ascertain that each radiograph is photographically marked with a suitable identification exactly when the picture was taken on the beam or girder.

The contractor shall be responsible for the arranging and performing the radiographic, magnetic particle, and ultrasonic inspection of the welds, all at his own cost and expense.

C.1.2 Qualifications

The following shall apply except as noted in the fracture control plan. If a fabricating shop prequalified its metal-arc welding operators according to the standard qualification procedures of the American Welding Society and certifies to the City's representative that an operator working on the structure has been prequalified within twelve (12) months previous to the beginning of the work on the subject structure, the City's representative may consider such operator qualified. The certificate shall state that such operator has been doing satisfactory welding of the required type within the three (3) month period previous to the subject work. A certificate shall be submitted for each operator and for each project, stating the name of the operator, the name and title of the person who conducted the examination, the kind of specimens, the positions of welds, the results of the tests and the date of the examination. Such a certificate of prequalification may also be accepted as proof that an operator of field welding is qualified, if the contractor who submits it is properly staffed and equipped to conduct such an examination or if the examining and testing is done by a recognized agency which is staffed and equipped for such purposes.

C.1.3 Aligning

The steel framing carrying the exodermic deck grid shall be accurately located so as to provide even surface and proper vertical grade alignments.

Special attention is called to the necessity for the correct alignment of the curb and the end break details. The contractor shall take particular care to fabricate these members to accurate dimensions, straight and without weave, to insure the proper elevation and clearance providing adjustments for alignments during erection whenever necessary. The

deck stringers shall be cambered for dead load and vertical curvature. In cases where the dead load camber can be neglected the rolled natural beam camber of stringers will be placed upward.

The setting of all members and other parts that serve as supports or connect the movable parts or machinery shall be set with the utmost accuracy. In no case shall concrete be placed around such parts before they are firmly held in place by proper temporary bracing and before the accuracy of the setting has been checked by the engineer.

To facilitate proper alignment of machinery bearings or other castings requiring field adjustments, the holes in the castings should be at least a ½" diameter pilot hole or be at least 1/16" undersized. Corresponding holes in the steelwork shall be left blank

Unless otherwise specified, holes for field-connecting parts shall be drilled or reamed in the shop with the connecting parts assembled or else drilled or reamed to a metal template.

C.1.4 Counterweight

The contractor shall prepare the shop counterweight calculations, counterweight balancing calculations, and the shop counterweight drawings as part of this work.

C.1.5 Machinery Supports

Supports for the machinery components shall be furnished and installed as shown on the plans and as described herein. Scribe lines shall be made on the supports in the shop to assure accurate location in the field. The cost of making modifications to the supports to make them compatible with the machinery selected by the contractor shall be incidental to the machinery bid items. To facilitate the proper erection and alignment of the operating machinery, the bearing surfaces of the machinery supports shall be square and true. The bearing surfaces shall be finished after all welding is completed. It is the contractor's responsibility to ensure that the bearing surfaces are square and true after finishing. Therefore, the contractor may elect to stress relieve the weldments prior to finishing. If the contractor elects to stress relieve the weldments, no additional payments will be made. Cost of machinery supports is included in the respective machinery bid item.

C.1.6 Stainless Steel Shims

Wherever shims are required, the nominal, or theoretical, thickness "t" shall be indicated. The actual shim pack furnished shall have a thickness equal to 2 times the nominal thickness indicated and shall be composed of the following material thicknesses: t, t/2, t/4, t/8, t/16, etc. The thicknesses of the material furnished shall be such that the total shim pack thickness can be adjusted in increments of 1/32nd inch for machinery bases and structural parts that have machined surfaces, or 1/16th inch for structural steel connections for parts not having machined surfaces.

C.1.7 Tolerances
Dimensional tolerances for welded members shall be in accordance with the AWS Specifications with revisions and as modified by the AASHTO Standard Specifications for welding of Structural Steel Highway Bridges. The deviations shall be determined in accordance with Section 11.4.B.2 of the AASHTO Standard Specifications for Welding of Structural Steel Highway Bridges.

C.1.8 Finishing
Any welded assembly that is to be finished shall be finished after all welding is complete. Anywhere the terms "Fin", "Finish", "Finished", or "Machined" appear on the plans or specifications, it shall mean that the surface and faying surface must be machine finished; hand grinding will not be permitted.

C.2 Erection
C.2.1 General

The entire lift span shall be assembled in the fabrication shop, prior to delivery to job site, to verify proper fit, length of members, and squareness.

The lift span shall be erected in the open position to the maximum practical extent, so as not to interfere with navigation on the waterway. The contractor shall coordinate with and secure permission from the U.S. Coast Guard to close the river to navigation for periods of time sufficient to accomplish work that must be performed with the lift span in the closed position.

C.2.2 Field Adjustments
After erection of the lift span and placement of the exodermic deck the lifting legs shall be checked for plumbness. In the event the lower ends of the lifting legs have deflected horizontally from its theoretical position record the amount of deflection. Record the deflection again after transferring the counterweight load to the lifting legs. If the total deflection is more than 1/8 inch release the counterweight load and bridge load to temporary supports and replace the shim plate between the lifting leg and the girders with tapered stainless steel shims so as to make the lifting leg plumb when the counterweight load is applied. Support the lifting leg temporarily during this operation. Fabricate the tapered shim plate based on the field measurements. Allow sufficient time to fabricate the shims in the project schedule. The connection plates for attaching the lifting girder web to the lifting leg web may have to be replaced as well. Furnish additional connection plates and field drill bolt holes on the connection plate to match the holes in the lifting leg and lifting girder after the tapered shim is installed. The tapered shim plates and connection plates shall be hot dip galvanized and painted as specified in article B.4 of this special provision. Pretensioned bolts removed or loosened to insert the shims shall be replaced with new bolts. The field adjustment work shall be performed at no additional cost to the City.

C.2.3 Clearances
The first time the lift span is slowly moved, a check shall be made of all points of minimal clearance or possible interference between the fixed and movable parts of the structure or as otherwise specified on the plans.

Particular care must be taken to insure that the breaks in floor are adjusted for smooth joints, and proper alignment. Work at the floor breaks shall be coordinated in such a manner that proper alignment and clearance will be maintained during pouring and curing of the concrete floor slabs at this joint.

All metal work set in concrete shall be placed and maintained with the greatest care in exact alignment at the proper elevation. Where a grout bed is required, the metal parts shall be adjusted and supported by means of leveling bolts. The grout bed shall be made with an approved self-leveling, high strength non-shrink and non-staining grout. All metal work shall be adjusted to the satisfaction of the engineer before being set in concrete or mortar.

C.2.4 Placing Span in Operating Condition
The span shall be placed in an operating condition, to the satisfaction of the engineer, upon its final completion. The span shall be operated sufficiently to enable the engineer to inspect its operation to his own satisfaction. Faulty and defective work shall be repaired or replaced at no additional cost to the City, subject to approval of the engineer.

C.2.5 Operating Machinery Work
The furnishing, fabricating, installing and/or erecting, painting, adjusting, and the placing in operation of all related items shall be as specified in the bridge machinery special Provisions.

C.3 Fracture Control Plan
The current AWS/AASHTO Guide Specifications for Fracture Critical, Non-Redundant Steel Bridge Members, including subsequent interim specifications shall constitute the Fracture Control Plan, except as modified herein.

All non-redundant fracture critical material shall adhere to all requirements of the Fracture Control Plan.

Section 12.6.4 of the AWS/AASHTO Specifications is amended as follows:

The charpy test requirements for weld metal connecting AASHTO M270 (ASTM A709) Grades 36, 50, and 50W steels shall be 35 ft-lb (47.5 Nm) at -30° F (-34.4°C).

Table 51.3 of the ASTM 709 and AASHTO M270 Specifications is replaced by the following table:

MATERIAL: AASHTO M270 (ASTM A709)

GRADES	THICKNESS, INCHES	REQUIREMENTS
36F	Up to 4”	25 ft-lb @ -30°F
50*F & 50W*F	Up to 4” Mechanically Fastened	25 ft-lb @ -30°F
50*F & 50W*F	Up to 2” Welded	25 ft-lb @ -30°F
50*F & 50W*F	Over 2” to 4” incl. Welded	30 ft-lb @ -30°F
70W*F	Up to 4” Mechanically Fastened	30 ft-lb @ -30°F
70W*F	Up to 2 ½” Welded	30 ft-lb @ -30°F
70W*F	Up to 2 ½” to 4” incl. Welded	35 ft-lb @ -30°F

(F) Designates “Fracture Critical” (Zone No. is omitted because this specification exceeds Zone 3).

1. The CVN-impact testing shall be “P” plate frequency testing in accordance with AASHTO T-243 (ASTM A673). Charpy impact tests are required on each plate at each end. The Charpy test pieces shall be coded with respect to heat/plate number and that code shall be recorded on the mill-test report of the steel supplier with the test result. If requested by the engineer, the broken pieces from each test (three specimens, six halves) shall be packaged and forwarded to the Quality Assurance organization of the City. Use the average of the three (#) tests. If the energy value for more than two thirds (2/3) of the specified minimum average requirements, a retest shall be made and the energy value obtained from each of the three specimens shall equal or exceed the specified minimum average requirements.

2. If the yield strength of the material exceeds 65 ksi, the temperature for the CVN value for acceptability shall be reduced by 15°F for each increment of 10 ksi above 65 ksi. The yield strength is the value given in the certified “Mill Test Report.”

** If the yield strength of the material exceeds 85 ksi, the temperature for the CVN value for acceptability shall be reduced by 15°F for each increment of 10 ksi above 85 ksi. The yield strength is the value given in the certified “Mill Test Report.”

D Measurement

The City will measure Bridge Structural Steel by the pound acceptably completed. Only new structural steel will be measured for payment.

E Payment

The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0085.151	Bridge Structural Steel	LB

Payment is full compensation for furnishing, fabricating, testing, shop assembling, and erecting all new structural steel in conformance to the plans and this special provision; for hot-dip galvanizing structural steel where specified; for performing counterweight balance calculations; and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work. Structural steel for machinery supports, machinery enclosures, counterweight, railings, and bridge house will be paid for under separate bid items. Cost of removing and reinstalling existing steel is incidental to this bid item.

34. Bridge House Structural Steel, Item SPV.0085.171.

A Description
This section describes furnishing and erecting structural steel for the Bridge House columns and beams. Perform this work in accordance with Section B.2 of the special provision "Bridge Operator's House" except as described herein.

B Materials
Materials shall conform to Section B.2.5 of special provision "Bridge Operator's House".

C Construction
Apply an approved primer to the steel after fabrication. Assemble the entire bridge house structural steel framing in the shop to verify proper fit and squareness.

D Measurement
The City will measure Bridge House Structural Steel by the pound acceptably completed.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0085.171	Bridge House Structural Steel	LB

Payment is full compensation for furnishing, fabricating, painting, shop assembling, and erecting all new structural steel in conformance to the plans and this special provision; and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.

35. Marine Dock Fender, Item SPV.0090.150

A Description
This section describes labor, material and equipment required for furnishing and placing the marine dock fender, including bolts and mounting hardware.

B Materials
Fenders shall be extruded and continuous in the length indicated. The fenders shall be black in color. The connecting hardware shall be fully exposed.

The elastomer shall be the ethylene propylene dimonomer (EPDM), as specified in ASTM D2000, with the following line callout:

3BA 720 A_{14} B_{13} C_{12} F_{19} Z_1, Z_2 and Z_3.

Furnish zinc-coated steel nuts, bolts, and washers conforming to ASTM A307 and hotdip coated according to AASHTO M 232 Class C or mechanically coated according to AASHTO M 298 Class 50. Bolts shall be of the size and spacing required by the manufacturer's design and testing.

C (Vacant)

D Measurement

The City will measure Marine Dock Fender, completed in accordance to the contract and accepted, by the lineal foot.

E Payment

The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.150	Marine Dock Fender	LF

Payment is full compensation for removing the existing wood fender, furnishing and installing the rubber fender, furnishing and installing treated timber whalers, and for furnishing all equipment, tools, labor and incidentals necessary to complete the work in accordance with the contract.

36. Epoxy Crack Sealing, Item SPV.0090.163.

A Description

This special provision describes repairing structural cracks in the piers and abutments by the epoxy injection method, in accordance with the requirements of section 509 of the standard specifications, as shown on the plans, directed by the engineer, and as hereinafter provided.

B Materials

Furnish epoxy injection material that is insensitive to the presence of water and is composed of a two-component epoxy resin designed specifically for structurally rebonding cracks in Portland cement concrete. The epoxy injection material shall conform to the following physical properties at 77 degrees F:

	Unmixed		Mixed
	Component A (Resin)	Component B (Catalyst)	
Weight per gallon, lbs.	9.15 ±0.1	8.2 ±0.1	9.15 ±0.1
Viscosity, cps	500-700	120 - 160	275 - 350
Specific Gravity, g/cc	1.128 ±0.012	0.984 ±0.012	1.099 ±0.012
Color	Straw	Straw	Straw
Shelf Life (closed containers)	2 years	2 years	---
Solids by Weight	---	--	100%
Pot Life (200 gram mass)	---	---	12 - 15 mins.
Mixing Ratio (by weight)	80%	20%	---
Mixing Ratio (by volume)	78%	22%	---
Bond Strength	---	---	2000 psi min
Shrinkage Resistance	---	---	ASTM C883
Thermal Compatibility	---	---	ASTM C884

Furnish surface seal material for confining the injected epoxy resin in the cracks that meets the following requirements:

- Adequate strength to hold the injection fittings firmly in place to resist injection pressures and prevent leakage during injection
- Non-sag consistency
- Insensitive to the presence of water
- Controlled cure time
- Two-component epoxy resin
- 100% solids by weight
- Applicable to wet surfaces
- Viscosity should be paste

C Construction

C.1 Injection Equipment

Use equipment to meter and mix the two-epoxy resin components and to inject the mixture into the cracks that is portable and has positive displacement type pumps equipped with an interlock to provide positive ration control of exact proportions of the two components at the nozzle. Use electric or air powered pumps that provide in-line metering and mixing.

Use injection equipment that has automatic pressure control capable of discharging the mixture at any present pressure up to 160 psi (±5 psi), and is equipped with a manual pressure control override.

The equipment shall have the capability of maintaining the volume ration for the mixture prescribed by the manufacturer of the epoxy resin material within a tolerance of ±5% by volume at any discharge pressure up to 160 psi.

The injection equipment shall be equipped with sensors on both the Component A and B reservoirs that will automatically stop the machine when only one component is being pumped to the mixing head.

C.2 Surface Area Preparation
Clean the surface areas adjacent to cracks of all dirt, dust, grease, oil, efflorescence, or other foreign matter, permitted for cleaning.

Install injection ports along the cracks at intervals of four to ten inches, or as appropriate to accomplish full penetration of the injection resin. Center the injection ports over the cracks and secure in place using surface seal material. Where possible, install the injection ports over the widest areas of the cracks.

Apply the surface seal material to the face of the crack between the entry ports. For known through cracks, apply the surface seal material to both faces of the member. Before proceeding with the injection operation, allow sufficient time to elapse for the surface seal material to gain adequate strength.

C.3 Epoxy Injection
Install the epoxy injection resin in accordance with the manufacturer's instructions.

During installation, limit pressures, in general, to 35 psi at the point of entry into the crack.

On vertical cracks, start the injection at the lowest point and continue upward along the crack. While injecting, resin should flow to and out of the next higher port. When this flow is established, cap the lower port and continue the injection until all ports have been injected and flow has been established between them.

Following the same procedures used for vertical cracks, start the injection on horizontal cracks at one end and continue the injection in succession along the crack.

C.4 Finishing and Clean-Up
When cracks are completely filled, cure the epoxy resin for a sufficient length of time so that when the surface seal is removed, there is no draining or runback of the epoxy material from the cracks. Grind, or use other appropriate method, to remove surface seal material, excess epoxy material, and injection ports. No epoxy material shall extend beyond the plane of the surfaces of the in-situ concrete.

D Measurement
The City will measure Epoxy Crack Sealing by the linear foot acceptably completed.

E Payment
The City will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0090.163	Epoxy Crack Sealing	LF

Payment is full compensation for furnishing and placing the epoxy sealant, including any cleaning before and after injection, and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

37. Counterweight Ballast, Item SPV.0105.152.

A Description
This section describes furnishing, placing, adjusting and readjusting placing of the concrete counterweight ballast until counterweight is satisfactorily balanced. The counterweights shall be constructed of concrete and existing counterweight steel slabs placed inside a galvanized and painted steel box. The amount of required counterweight shall be determined by the contractor from computations based on the approved shop details and as hereinafter specified.

B Materials
The structural steel for the galvanized and painted counterweight box shall be as described in "Bridge Structural Steel".

C Construction
Workmanship, sequence of construction and the balancing of the lift span shall conform to the AASHTO LRFD Specifications for Movable Highway Bridges.

Before construction of the counterweight begins, the contractor shall have calculations showing weight and location of the center of gravity of the lift span from the structural steel fabricator.

Clean the existing counterweight steel slabs that are to be reused by sandblasting according to SSPC-SP10 and apply the department approved 3-coat paint system. Determine the center of gravity of each slab in the field to incorporate into the balancing calculations.

Place concrete inside the galvanized box uniformly and support the box adequately balanced during concrete placement.

Sample concrete mixes are to be cast and weighed and the exact weight incorporated in the counterweight design. Provide concrete balancing blocks as shown on the plans.

Place the counterweight ballast corresponding to stages of erection of the lift span. Balancing calculations for these stages are to be given to the engineer for his approval. At

all times the lift span is to be kept at a stage of balancing that enables the lift span to be lifted.

Final balancing will require the movable lift span to be approximately 60,000 lbs span heavy.

D Measurement
The City will measure Counterweight Ballast, completed in accordance to the contract and accepted, as a single complete unit of work.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.152	Counterweight Ballast	LS

Payment is full compensation for furnishing and installing the galvanized and painted steel counterweight box, concrete, reinforcement, and concrete balancing blocks; removing, cleaning, painting, and installing existing counterweight steel slabs; temporarily supporting the counterweight until it is attached to the lifting leg; and for furnishing all labor, material, equipment, tools, and incidentals necessary to perform the work as described herein and as shown on the plans.

38. Pedestrian Railing, Item SPV.0105.153.

Conform to section 513 of the standard specifications as modified in this special provision.

A Description
This section describes designing furnishing and installing pedestrian railing in accordance with the general details shown on the plans, the standard specifications and these special provisions. Work includes detailing, fabricating, zinc coating, painting, and installing the railing; and for all labor, tools, equipment and incidentals necessary to complete the work in accordance with the contract.

B Materials
B.1 Pedestrian Railing
Pedestrian railing shall project above the surface of the sidewalk 42 inches and be attached to the top of the cantilever brackets along the outside edge of the lift span, top of concrete sidewalk on fixed spans, and other appropriate wing wall structures as shown on the plans. The railing shall be continuous along the entire length of the structure with appropriate expansion joints at the posts, as shown on the plans. Provide gates in the railing at the stairs leading to the bridge piers. Submit shop drawings to the engineer for review.

B.2 Galvanizing and Painting
Use structural steel conforming to section 513 of the standard specifications. Hot-dip galvanize all new structural steel in accordance with the plans.

Paint traffic railing in accordance with "Painting Epoxy System P-40-523" in the special provisions. Provide the same paint system provided under that special provision.

B.3 Fasteners
Use high strength, hot-dip galvanized bolts and studs conforming to ASTM A325. Use hot dip galvanized anchor assembly per section 513 of the standard specifications, except that the whole anchor assembly shall be galvanized.

C (Vacant)

D Measurement
The City will measure Pedestrian Railing, completed in accordance to the contract and accepted, as a single complete unit of work.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.153	Pedestrian Railing	LS

Payment is full compensation for fabrication, galvanizing, painting, and installing the pedestrian railing as shown on the plans and as described herein; for furnishing and installing galvanized anchor assembly, for providing gates at the stairs; and for furnishing all labor, material, equipment, tools, and incidentals necessary to complete the work.

39. Tubular Steel Railing Type F Modified, Item SPV.0105.154.

A Description
This special provision describes the fabrication, painting and erection of the steel traffic railing along the curb line, in accordance with the plans, standard specifications, and these special provisions. Included in the work are the posts, railing, base plates, closure details, span breaks, and joint material as shown on the plans; hot-dip galvanizing and painting the traffic railing in accordance with the plans and special provisions.

Perform the work in accordance with the pertinent requirements of section 513 of the standard specifications.

B Materials
Use structural steel conforming to section 513 of the standard specifications. Hot-dip galvanize all new structural steel in accordance with the plans.

Paint traffic railing in accordance with "Painting Epoxy System P-40-523" in the special provisions. Provide the same paint system provided under that special provision.

Use high strength, hot-dip galvanized bolts and studs conforming to ASTM A325. Submit the bolt specification and test report to the engineer in accordance with the standard specification.

Use the electric arc process for all welding. Field welding is not permitted, unless specifically shown on the plans.

The symbols on the plans indicate only the general type of weld required. Submit the proposed weld geometry to be used in fabrication to the engineer for approval. If a fillet weld size is not shown on the plans, size in accordance with department requirements for minimum weld size based on material thickness.

C Construction
Section 513.3 of the standard specification applies to this bid item.

D Measurement
The City will measure Tubular Steel Railing Type F Modified, completed in accordance with the plans, as a single complete unit of work

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.154	Tubular Steel Railing Type F Modified	LS

Payment is full compensation for fabricating, galvanizing, painting, and erecting the traffic railing as shown on the plans and as described herein; and for furnishing all labor, material, tools, equipments, and incidentals necessary to complete the work.

40. Pier Railing, Item SPV.0105.155

A Description
This special provision describes providing new steel pipe railing on the bridge piers at locations shown on the plans in accordance with section 513 of the standard specifications and as hereinafter provided.

B Materials
Provide galvanized steel pipe railing of the dimensions shown on the plans.

C Construction
Remove existing pipe railing, where indicated on the plans, without damaging the existing concrete or structural steel. Remove existing anchor bolts flush with the surface of concrete and grind smooth. Apply epoxy repair paint to the exposed ends after grinding. Field verify

the location of existing anchor bolts and locate the new anchor bolts to miss the existing anchor bolts. Install new railing as shown on the plans.

D Measurement
The City will measure Pier Railing, completed in accordance with the contract, as a single complete unit of work.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.155	Pier Railing	LS

Payment is full compensation for providing, fabricating, galvanizing, transporting, and erecting the railing; for providing and installing fasteners and anchor bolts; and for furnishing all labor, tools, equipment and incidentals necessary to complete the work. Removing the existing railing is paid for under bid item "Removing Old Structure Over Waterway with Minimal Debris Station 28+53".

41. Rehabilitating Pier Circular Stair and ladders, Item SPV.0105.158.

A Description
This special provision describes rehabilitation of the existing metal stair, railing, checkered plates, and support members on the south end of Pier 3; and existing steel ladders and safety cages from the pier walk level to the pier pit level for Pier 2 and Pier 3, in accordance to the applicable provisions of section 513 of the standard specifications and as hereinafter provided.

Work shall include blast cleaning all surfaces to bare metal, per SSPC-SP10, near white blast, surface preparation, painting with the department approved 3- coat paint system, any necessary removal and reinstallation, providing new checkered plate where indicated in the plans; and all labor, tools, equipment and incidentals necessary to complete the work in accordance with the contract.

Remove part of the sidewalk level platform of the circular stair on south end of Pier 3, and the platform's attachment to the fixed span sidewalk, as shown on the plans. Modify the platform as shown on the plans. Clean and paint the circular stair extending from the sidewalk to the maintenance walk including stringers, treads, support brackets, and railing.

B (Vacant)

C Construction
Surface preparation and painting shall be completed in-place, without member removal.

D Measurement
The City will measure Rehabilitating Pier Circular Stair and ladders, completed in accordance with the contract, as a single complete unit of work.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.158	Rehabilitating Pier Circular Stair and ladders	LS

Payment is full compensation for fabricating and erecting the stair platform and supports; cleaning and painting of existing stair; and for furnishing all labor, material, equipment, tools, and incidentals necessary to complete the work. Stair from sidewalk to the bridge house on Pier 2 will be paid for separately under the item" Bridge Operator's House".

42. Field Verification Survey, Item SPV.0105.161.

A Description
This special provision describes performing a field survey of the existing St. Paul Avenue Bridge and approach roadways for the purpose of establishing current dimensions and elevations to be used in the fabrication and construction of new bridge elements.

All dimensions and elevations shown on the contract plans are based on values found on the plans from the original bridge construction and subsequent bridge rehabilitations. These values should not be construed to be completely true or accurate. They are accurate enough for the design of the rehabilitation and for the establishment of bid quantities. However, the nature of the work involved in this rehabilitation is such that new elements must be constructed and fabricated to much closer tolerances than are needed for design.

A Registered Land Surveyor with a minimum of five years of surveying experience, licensed to practice in the State of Wisconsin, shall conduct the field survey under this special provision. Prior to beginning the work, furnish the engineer the name of the surveyor and a copy of his registration certificate.

All survey field notes and sketches shall be kept in a neat and orderly fashion so the fabricators and constructors of the new bridge elements can readily interpret them. If, following completion of the survey and submittal of all survey notes and sketches, questions arise regarding the meaning or interpretation of the notes and sketches, provide the necessary clarification and interpretation at no additional cost to the City.

B (Vacant)

C Construction
Conduct the survey in a timely and efficient manner prior to beginning any fabrication or construction of new bridge elements.

The survey shall include the determination of all dimensions and elevations necessary to fabricate and construct the new bridge elements.

It is expected that the results of the survey will correlate very closely with the dimensions and elevations given on the plans. If there are any obvious discrepancies of a magnitude that will severely and detrimentally impact the work, discuss with the engineer prior to proceeding.

Submit results of the survey, in the form of field notes, sketches and any other forms of survey documentation to the engineer for review before proceeding with fabrication.

Following the engineer's review, use the survey results to fabricate and construct new bridge elements as shown on the plans.

The survey shall include but not be limited to the following:

1. Location of existing girders with respect to the proposed streetcar track alignment.
2. Overall length and width of the bridge
3. Spacing of girders, diaphragms, and connection plates on the fixed approach spans
4. Location of existing bolt holes on the approach span structural steel that are to be reused
5. All existing beam seat elevations
6. All relevant dimensions, clearances, and elevations for the fabrication of new machinery elements, supporting steel, and under deck gutter system.
7. Location of existing anchor bolts where new anchor bolts are to be installed in close proximity.

The above list is not to be taken as complete or all inclusive. It is presented as an example of the items to be surveyed. It is the contractor's responsibility to determine the full extent of survey necessary.

If it is determined that during the course of the work, additional survey is required, if shall be furnished at no additional cost to the City.

The results of the survey are the contractor's responsibility. These results are to be used in the fabrication and erection of new bridge elements. As such, in the event that elements are incorrectly fabricated and do not fit existing spaces or conditions, the contractor is responsible for correcting any such errors and repairing or replacing the parts and elements to the satisfaction of the engineer at no additional cost to the City.

D Measurement

The City will measure Field Verification Survey, completed in accordance with the contract, as a single complete unit of work.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.161	Field Verification Survey	LS

Payment is full compensation for conducting the field survey of existing conditions as described herein; for providing clear and concise survey results; for performing any required resurvey or additional survey; and for furnishing all labor, tools, equipment and incidentals necessary to complete the work.

43. Lift Span Roadway Joints, Item SPV.0105.164.

A Description
This work shall consist of furnishing and installing the roadway section of the lift span joints in accordance with the plans, standard specification, and these special provisions. This work shall include furnishing and installing joint plates, angles, channel sections, compression seals, and joint supports, including welded studs, as shown on the drawing for both the fixed and movable portion of the joints.

Removal of existing joint will be paid for under the bid item "Removing Old Structure Over Waterway with Minimal Debris. Station 28+53"

B Materials
Structural steel shall be hot-dipped galvanized and painted as specified in article "Bridge Structural Steel".

Galvanizing shall be in accordance with ASTM A123 and A153. Apply the approved two coat paint system after galvanizing.

Performed elastomeric compression joint sealer shall be in accordance with Section 502.2.8 of the standard specification. The installation of the compression joint sealer shall be in accordance with Section 502.3.6.3.2 of the standard specification.

C (Vacant)

D Measurement
The City shall measure the Lift Span Roadway Joints, completed in accordance to the contract and accepted, as a single complete unit of work.

E Payment
The City will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.164	Lift Span Roadway Joints	LS

Payment is full compensation for furnishing, fabricating, galvanizing, painting, and installing lift span roadway joints in conformance with the plans, standard specifications, and special provisions; and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.

44. Lift Span Sidewalk Joints, Item SPV.0105.165.

A Description
This work shall consist of furnishing and installing the sidewalk section of the lift span joints in accordance with the plans, standard specifications, and special provisions. This work shall include furnishing and installing joint plates, angles, and channel sections including welded studs, compression seals, and joint supports as shown on the drawing for both the fixed and movable portion of the joints.

Removal of the existing joint will be paid for under the bid item "Removing Old Structure Over Waterway with Minimal Debris."

B Materials
Structural steel shall be hot-dipped galvanized and painted as specified in article "Bridge Structural Steel".

Galvanizing shall be in accordance with ASTM A123 and A153. Apply the approved two coat paint system after galvanizing.

Preformed elastomeric compression joint sealer shall be in accordance with Section 502.2.8 of the standard specifications. The installation of the compression joint sealer shall be in accordance with Section 502.3.6.3.2 of the standard specifications.

C (Vacant)

D Measurement
The City shall measure the Lift Span Sidewalk Joints, completed in accordance to the contract and accepted, as a single complete unit of work.

E Payment
The City will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.165	Lift Span Sidewalk Joints	LS

Payment is full compensation for furnishing, fabricating, galvanizing, and installing lift span sidewalk joints in conformance with the plans and this special provision; and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.

45. Refurbishing Existing Name Plates, Item SPV.0105.166.

A Description
The work under this item includes removing, cleaning, refurbishing, and reinstalling the existing nameplates of the bridge house.

B Materials
Provide anchoring devices of similar material to reinstall the existing name plates. New anchors shall be of a material that will not cause electrolysis between the two materials

C Construction
Remove the existing nameplates prior to beginning any repair work on the bridge house. Do not reinstall until after all repair work has been completed and accepted by the engineer. Thoroughly clean the removed nameplates of all paint, concrete, and other debris. Polish to an acceptable finish without damaging the name plates or removing or otherwise damaging the inscriptions on the nameplates and as shown in the plan. Cleaning shall be done to the satisfaction of the engineer.

Coat back of existing nameplates to prevent electrolysis from the attachment holes and staining of the concrete substrate. Reinstall at the original location on the bridge house. Use existing anchor bolts to reattach name plates.

D Measurement
The City will measure Refurbishing Existing Name Plates, completed in accordance to the contract and accepted, as a single complete unit of work.

E Payment
The City will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.166	Refurbishing Existing Name Plates	LS

Payment is full compensation for removing, cleaning, and reinstalling existing name plates; and for furnishing all labor, tools, materials, and incidentals necessary to complete the work.

46. Temporary Lift Span Shoring, Item SPV.0105.167.

A Description
This special provision describes furnishing, installing or constructing, maintaining, and removing, temporary shoring for the lift span.

B Materials
Provide a shoring design for required temporary shoring. The shoring design shall include, but is not limited to; shoring location, shoring size, shoring spacing, anchorages required, and removal procedure. The design shall include all necessary schematics to

show sufficient detail of the shoring, which shall include but not be limited to; jacking equipment specifications, temporary structural elements, whalers, and temporary foundation attachments necessary. During periods when the lift span is unbalanced, provide positive, sturdy supports, shoring, and/or false work to support the unbalanced loads. The design shall have the capacity to support the entire unbalanced load plus all additional loads resulting from wind forces, temporary erection forces, accumulations of snow, ice or dirt, or other loads or forces. The adequacy of each shoring design shall be verified by a professional engineer registered in the State of Wisconsin and knowledgeable of the specific site conditions and requirements. Submit to the City for documentation three (3) copies of each shoring design that is signed and sealed by the same professional engineer verifying the design. It remains the contractor's responsibility to ensure that the lift span is adequately shored in a safe manner during all phases of erection and construction. The deflection of the temporary shoring shall be accounted for while setting the elevations of the new lift span superstructure.

C Construction

Obtain permission from the U.S. Coast Guard at least one month in advance to accomplish work that must be performed in the navigable channel. If any change is needed during construction, inform the U.S. Coast Guard a minimum of two weeks in advance before making the change. Construct or install the temporary shoring at the required location in accordance with the design developed.

Maintain a clearance of at least 25'-6" above the City of Milwaukee Datum under the temporary shoring at all times for navigational traffic.

Upon completion of the need for the temporary shoring the shoring must be removed as provided in the design. Any anchorages for the temporary shoring shall be removed. Any anchorages into concrete members shall be removed after use and patched in accordance with subsection 502.3.7.1 of the standard specifications.

D Measurement

The City will measure Temporary Lift Span Shoring, completed in accordance to the contract and accepted, as a single complete unit of work.

E Payment

The City will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.167	Temporary Lift Span Shoring	LS

Payment is full compensation for preparing Temporary Lift Span Shoring design and plans; for furnishing, installing or constructing, maintaining, and removing all temporary shoring; for removing anchorages; for repairing any damage caused by the shoring or anchorages; and for furnishing all equipment, tools, labor and incidentals necessary to complete the work in accordance to the contract.

47. Underdeck Gutter System P-40-523, Item SPV.0105.168.

A Description

This special provision describes furnishing, coating, and installing galvanized and painted underdeck gutters, in accordance with the plans, the pertinent requirements of sections 514 of the standard specifications, and as hereinafter provided. Included in this work are the gutter downspouts at the abutments and the lift span breaks.

B Materials

Furnish materials for the deck drains and downspouts that are in accordance with the plans, subsection 514.2 of the standard specifications, and as hereinafter provided.

Fabricate gutters from steel plates conforming to ASTM A36. Hot-dip galvanize and paint with the approved two-coat paint system gutters, steel pipes, drainage pans, end closure plates, pipe clamps, fasteners, saddles, and downspouts of the sizes and gauges shown in the plans. All components in contact with concrete shall be asphaltic coated.

Asphaltic coating shall meet the requirements of ASHTO M190.

C Construction

Install the under deck gutters in accordance with the details shown on the plans, subsection 514.3 of the standard specifications.

Prepare shop drawings and submit them to the engineer in accordance with "Shop Drawings and Submittals" article.

D Measurement

The City will measure Under Deck Gutter System P-40-523 as a single complete unit of work acceptably completed.

E Payment

The City will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.168	Under Deck Drainage System P-40-523	LS

Payment is full compensation for furnishing, galvanizing, painting, and installing under deck drains, drainage pans, closure plates, outlet stubs, downspouts, pipe clamps, flashing, and all other components of the drainage system; and for furnishing all labor, tools, equipment, materials, and incidentals necessary to complete the contract work.

48. Stainless Steel Platform for Electrical Cabinets, Item SPV.0105.169

This special provision describes furnishing and installing a stainless steel extension platform on Pier 2 for mounting the electrical cabinets.

B Materials

B1. Stainless Steel Structural members and shim

Provide stainless steel structural members and shim of Grade 316, mill finish, for the platform.

B2. Masonry Anchors

Provide Stainless Steel threaded adhesive anchors, type S, in accordance with section 502.3.14 of the standard specification.

C Construction

Fabricate the brackets for the platform as shown on the plans. Coordinate the layout of the platform with the electrical cabinet manufacturer.

Install masonry anchors per manufacturer's instructions.

D Measurement

The City will measure Stainless Steel Platform for Electrical Cabinets as a single lump sum unit for work acceptably completed.

E Payment

The City will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.169	Stainless Steel Platform for Electrical Cabinets	LS

Payment is full compensation for furnishing all labor, material, tools, and equipment necessary to fabricate, assemble, erect, and perform all incidental work to achieve a complete and acceptable installation.

49. Nameplate, Item SPV.0105.172

A Description

The work under this item consists of furnishing and installing a new special nameplate on the bridge house as shown on the plan and specified herein. Refer to plans for new nameplate size. Provide shop drawings, including rubbing, showing all names prior to casting/fabricating new nameplate, as well as anchoring, rosette and fastening details. Verify all names on new nameplate with engineer and city prior to casting/fabricating name plate.

B Materials

Provide the new nameplate and rosettes of bronze, having the composition of aluminum/copper, with aluminum not more than 9%. Provide anchoring devices of similar material.

C Construction
Locate new nameplate as shown on plan, or as directed by the engineer. Use anchoring details as shown in the plans for the nameplate. Drill holes in substrate. Set anchoring for nameplates per plan.

D Measurement
The City will measure Nameplate as a single lump sum unit for work acceptably completed.

E Payment

The City will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.172	Nameplate	LS

Payment is full compensation for furnishing, fabricating and installing a new nameplate as specified; and for furnishing all labor, tools, materials, equipment, and incidentals necessary to complete the work.

50. Refurbish and Reinstall Bridge House Bell, Item SPV.0105.173

A Description

The work under this item consists of cleaning, refurbishing, and reinstalling the bridge house bell mounted on top of the bridge house roof.

B Materials
Use hot dipped galvanized or stainless steel grade 304 hardware for anchoring the bell to the structure. Include provisions to separate dissimilar metals to eliminate galvanic corrosion.

C Construction
Remove the bells from the roof before removing the existing roof. Inspect the bell before removing and report any cracks or damages to the engineer.

Use only a mild, soft detergent and warm water to clean the bell. Do not use abrasives of any kind so as to not scratch or mar the surface. Remove all old debris, including but not limited to paint, concrete, bird droppings, and any other accumulated dirt and debris.

Do not harm or remove the existing patina. Clean to the satisfaction of the engineer.

Reinstall the bell on the new bridge house roof as shown on the plans.

Submit shop drawings of the bell installation details accompanied by structural calculations stamped and signed by a professional engineer registered in the State of Wisconsin. Determine the dimensions and weight of the bell in the field. Include the anchoring of bell to the parapet wall, and anchoring of the parapet wall to the roof in the details and calculations.

D Measurement
The City will measure Refurbish and Reinstall Bridge House Bell as a lump sum unit for work acceptably completed.

E Payment
The City will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.173	Refurbish and Reinstall Bridge House Bell	LS

Payment is full compensation for removing and cleaning the existing bridge house bell; for submitting shop drawings; for furnishing fasteners; for reinstalling the bell; and for furnishing all material, labor, tools, equipment and incidentals necessary to complete the work. All rough carpentry, wall cladding, flashing, and sealing required for the bell installation will be paid for under the item "Bridge Operator's House".

51. Counterweight Machinery, Item SPV.0105.200.

A Description
This section describes providing and installing counterweight cables, sheaves, trunnion shaft, bearings, brackets, and pins. Adjust, paint, test and place in satisfactory operation the Counterweight Machinery in each pier.

The counterweight machinery consists of the following major components:

Item	Total
Counterweight Sheave	4
Counterweight Trunnion	4
Counterweight Bearing	8
Counterweight Bearing Support Weldment	8
Counterweight Cable	28
Counterweight Cable Bracket on Lift Leg	4
Counterweight Cable Bracket on Counterweight	4
Counterweight Cable Pin	16

Provide hardware and other material required to complete the assemblies shown on the plans incidental to this item. Galvanize and paint components as indicated on plans.

The Counterweight Cable Brackets that are located on the counterweights, are to be integral with the counterweight and are to be paid for under the bid item "Counterweight Ballast".

B Materials

B.1 General

Provide Counterweight Bearing support Weldment, Counterweight cable, Counterweight Cable Bracket on Lift Leg, Counterweight Cable Bracket on Counterweight, and Counterweight Cable pin in accordance with the requirements specified in Bridge Machinery - General provisions.

B.2. Counterweight Sheave

The counterweight sheaves shall be steel castings or steel weldments, fabricated from material as specified on the plans. If a weldment is used form the ring plate into a complete ring, grind the welds flush on all four sides, and inspect the butt weld(s) 100% using radiograph testing before welding onto the sheave assembly. Inspect the four circumferential welded joints in each sheave connecting web plates to the rim and hub ultrasonic testing 100 percent of each weld length. Where the joint detail prevents the use of ultrasonic tests, magnetic particle tests may be used. Fabricate each web from not more than two pieces of plate. Web welds, if used, shall be full penetration welds made with low-hydrogen procedure. Use automatic submerged-arc welding to the greatest extent practical. Radiograph inspect butt welds in plates making up sheave webs over 100 percent of their length. Stress relieve the sheave after completion of the weldment and before final machining. Turn all grooves such that the variation of the grooves from the required diameter in the sheaves does not exceed plus or minus 0.010 inch.

The forged hub of the counterweight sheave, which bear on the trunnion shafts, shall be bored for a FN2 fit.

B.3. Sheave Trunnion

Provide trunnions of forged steel. At the journals of the trunnion, provide a fit and finish as required by the bearing manufacturer. Provide a shop shrinkage fit in the counterweight sheave which may be made by cooling the shafts to the required temperature by packing in dry ice and then inserting them in the sheaves or by other approved means. Provide bore hole for alignment.

Turn the sheave trunnion for an FN2 fit with the hub of the counterweight sheave. Provide dowels with FN2 fit set in holes drilled into the sheave and trunnion.

B.4. Sleeve Bearings and Bushings

All split bearings shall have one half fitted to the other half as shown on the Plans. The surface between the cap and base shall be accurately machined. All caps shall be securely bolted to the bases with turned bolts and double nuts. All caps and bases shall be provided with flanged bronze bushings securely held against changing position under load by hexagonal-head steel cap screws, or brass dowels, unless otherwise shown on the Plans. All bushings shall fit the inside bore and end faces of the base and cap, with an ANSI Class LC1 clearance and location fit, and shall be scraped to fit the shaft journals, with an ANSI Class RC6 running fit. All caps shall be provided with a tapped hole for lifting eyebolt, which shall be furnished for the purpose.

Bushings for split bearings shall be finished-bored with the caps in place and with ¼ inch thick rolled bronze or brass liners. At least 1/8 inch of the liner thickness shall be of laminated construction capable of adjustment in increments of 0.003 of an inch. The edges of the liners toward the shaft journal shall be cut to fit the shaft shoulder fillets where they occur and shall be cut square and flush with the bushing flange if there is no change in shaft diameter. Except for a short distance from each end, the inside edges of the liners shall be cut back to form a grease groove along the shaft. All bolt holes shall be drilled through the liners.

For split bearings, each half bushing shall have spiral grease grooves connecting with the ends of the liner grooves and intersecting at the center of each half bushing, unless otherwise shown on the Plans. All grease grooves shall be machine-cut and smooth. The corners of all grooves shall be rounded to a radius of not more than half the width of the groove.

Provide a stainless steel shroud with a neoprene rubber flap over the shaft. The shroud completely covers the pillow block assemblies, while allowing inspection and servicing. Provide a neoprene flap over the shaft that can be easily displaced or removed by simply removing stainless steel wing nuts from welded stainless steel studs. In addition, provide base mounting bolts and lifting lugs to remove the entire shroud.

C Construction

C.1 Counterweight Cable Brackets

Install cable brackets on the span using high strength zinc coated bolts, zinc coated nuts and zinc coated washers.

C.2 Install and Adjust Counterweight Cables

Install counterweight cables. Measure and record the period of each cable when hand vibrated in the fundamental harmonic. Adjust cable tension by tightening or loosening nuts on threaded end stud until the measured periods of all cables, min value to max value, deviate 10% or less of the max value. Operate lift span 20 times and measure, record and adjust the cable tension if necessary. Operate lift span 20 more times and measure, record and adjust the cable tension if necessary.

D Measurement

The City will measure Counterweight Machinery, completed in accordance with the contract, as a single complete unit of work.

E Payment

The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.200	Counterweight Machinery	LS

Payment is full compensation for furnishing all labor, material, tools, and equipment necessary to manufacture, assemble, install, erect, lubricate, paint, and perform all incidental work to achieve a complete and acceptable installation.

Submit to the engineer a detailed breakdown of costs under this item. The engineer will evaluate this breakdown, and has the authority to revise the breakdown as, in his/her judgment, may be required to make the various components of work conform to their true values.

The contractor agrees that the detailed breakdown will not become effective until it has been approved by the engineer.

The approved detailed breakdown will be used as a basis of payment for the progress payments. The progress payments for Item "Counterweight Machinery" will be made in accordance with the City of Milwaukee, Department of Public Works and the City's standard payment practices and in the following manner:

1. Upon completion and acceptance by the City of shop fabrication, shop inspection, shop testing, and delivery and storage of materials, the contractor will be paid 30% of the bid price for the item.
2. Upon completion and acceptance by the City of the counterweight sheaves, trunnions, and bearings installation, alignment, bolting, and protection of materials, the contractor will be paid 20% of the bid price for the item.
3. Upon completion and final acceptance by the City of the counterweight sheaves, trunnions, and bearings inspection and field testing, the contractor will be paid 40% of the bid price for the item.
4. Upon completion of training and receipt and acceptance of approved Operating and Maintenance Manuals, the contractor will be paid the remaining 10% of the bid price for the item.

52. Span Guides, Item SPV.0105.201.

A Description

This section describes supplying, installing, and adjusting guide roller assemblies on the lift span. Install, adjust, paint, test and place in satisfactory operation the Span Guides.

The span guides consist of the following major components:

Item	Total
Fixed End Lower Guide Roller	6
Fixed End Lower Guide Shaft	6
Fixed End Lower Guide Bushing	6
Fixed End Lower Guide Roller Bracket	6
Expansion End Lower Guide Roller	2
Expansion End Lower Guide Shaft	2
Expansion End Lower Guide Bushing	2
Expansion End Lower Guide Roller Bracket	2
Fixed end Upper Span Guide Roller	6

Fixed End Upper Span Guide Shaft	6
Fixed End Upper Span Guide Bushing	6
Fixed End Upper Span Guide Roller Bracket	6
Expansion End Upper Guide Roller	2
Expansion End Upper Guide Shaft	2
Expansion End Upper Guide Bushing	2
Expansion End Upper Guide Roller Bracket	2
Guide Rails attached to the lift leg	8

Provide hardware and other material required to complete the assemblies shown on the plans incidental to this Item.

B Materials

Materials used to fabricate the new span guide components shall be as shown on the contract documents, and in accordance with the requirements specified in Bridge Machinery - General provisions.

Galvanize and paint components as indicated on the plans.

Construct the rollers and supports from steel conforming to ASTM A709, grade 36. Insert bushings in the roller with an FN2 fit. Supply the fits and finishes prescribed in AASHTO Movable.

C Construction

C.1 Guide Installation

Coordinate installation of rollers with structural design and construction. Obtain lift legs that are within 1/8” from a plumb line along their length. Align the guide rollers to have a 1/4” gap between guide roller and lift leg when the span is seated.

Measure the span guide gaps for 10 lift increments of the lift span. Adjust gaps as necessary to obtain the target gaps listed above. Record the final measured gaps and corresponding ambient temperature.

D Measurement

The City will measure Span Guides, completed in accordance with the contract and accepted, as a single complete unit of work.

E Payment

The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.201	Span Guides	LS

Payment is full compensation for furnishing all materials, labor, tools, and equipment necessary to manufacture, galvanize, assemble, install, erect, test, paint and perform all incidental work to achieve a complete and acceptable installation.

Submit to the engineer a detailed breakdown of costs under this item. The engineer will evaluate this breakdown, and has the authority to revise the breakdown as, in his/her judgment, may be required to make the various components of work conform to their true values.

The contractor agrees that the detailed breakdown will not become effective until it has been approved by the engineer.

The approved detailed breakdown will be used as a basis of payment for the progress payments. The progress payments for Item "Span Guides" will be made in accordance with the City of Milwaukee, Department of Public Works and the City's standard payment practices and in the following manner:

1. Upon completion and acceptance by the City of shop fabrication, shop inspection, shop testing, and delivery and storage of materials, the contractor will be paid 30% of the bid price for the item.
2. Upon completion and acceptance by the City of the Span Guides installation, alignment, bolting, and protection of materials, the contractor will be paid 20% of the bid price for the item.
3. Upon completion and final acceptance by the City of the Span Guides inspection and field testing, the contractor will be paid 40% of the bid price for the item.
4. Upon completion of training and receipt and acceptance of approved Operating and Maintenance Manuals, the contractor will be paid the remaining 10% of the bid price for the item.

53. Bumper Beam, Item SPV.0105.202.

A Description

This special provision describes fabricating a new bumper beam assembly, installing new bumper beam counterweight, adjusting bumper beam operation, painting, testing, and placing in satisfactory operation the Bumper Beam in both piers.

The bumper beam consists of the following major components:

Item	Total
Bumper Beam	2
Bumper Beam Posts	8
Bumper Beam brackets	11
Sheave with bronze bushings	8
Sheave Shaft	8
Sheave Bracket	8
Transverse Guide	4
Longitudinal Guide	4
Guide Roller	32

Guide Roller Bearing	64
1 1/2" diameter stainless steel rod	4
Stainless steel rod brackets, upper	4
Stainless steel rod brackets, lower	4
Bumper Beam Bushing Plate	4
Bumper Beam Counterweight Assembly	4
Bumper Beam Counterweight Cable	8

Provide hardware and other material required to complete the assemblies shown on the plans incidental to this Item.

B Materials

B.1 General

Materials used to fabricate the new bumper beam components shall be as shown on the contract documents, and in accordance with the requirements specified in Bridge Machinery - General provisions. Galvanize and paint components as indicated in the plans. Fabricate new 1½" stainless steel rods of material meeting the requirements of ASTM A276 Type 316.

B.2 Sheaves

Provide new 10-inch outside diameter roll forged steel sheave for one ½" diameter wire rope.

C Construction

C.1 Counterweight Balance

Each counterweight is estimated to weigh 7250 pounds per pier. The contractor is to calculate the final weight of the bumper beam assembly and bolt steel billets or plates to the top of the counterweight as necessary to achieve a 10% (approximately 725 pound) counterweight heavy condition. Blast clean and apply the approved three coat paint system to the counterweight steel.

D Measurement

The City will measure Bumper Beam, completed in accordance with the contract and accepted, as a single complete unit of work.

E Payment

The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.202	Bumper Beam	LS

Payment is full compensation for furnishing all materials, labor, tools, and equipment necessary to manufacture, galvanize, assemble, install, erect, test, lubricate, paint and perform all incidental work to achieve a complete and acceptable installation.

54. Centering Device, Item SPV.0105.203.

A Description

This special provision describes fabricating and installing a new centering device at the deck joint between fixed approach spans and the lift span; adjusting centering device operation, galvanizing, painting, testing, and placing in satisfactory operation the Centering Device.

The Centering Device consists of the following major components:

Item	Total
Wear Plates	8
Centering Device Mounting Brackets	4

B Materials

B.1 General

Materials used to fabricate the centering device components shall be as shown on the contract documents, and in accordance with the requirements specified in Bridge Machinery - General provisions.

B.2 Wear Plates

Fabricate the wear plates from hardened forged alloy steel ASTM A237.

B.3 Mounting Brackets

Fabricate mounting brackets from structural steel conforming to ASTM A709, Grade 50. Hot-dip galvanize and paint the brackets in accordance with the approved two-coat paint system.

B.4 Shims

Provide stainless steel shim packs at all locations shown on the plans.

C Construction

C.1 General

Install the centering device mounting brackets before placing the deck concrete. Maintain the clearance between wear plates as shown on the plans.

D Measurement

The City will measure Centering Device, completed in accordance with the contract, as a single complete unit of work.

E Payment

The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.203	Centering Device	LS

Payment is full compensation for furnishing all labor, material, tools, and equipment necessary to fabricate, galvanize, paint, install, and to perform all incidental work necessary to achieve a complete and acceptable installation.

55. Bridge Hydraulic System, Item SPV.0105.250.

A Description

The work under this Section shall consist of furnishing all labor, equipment and materials (including spare parts) as shown on the Plans and specified herein. The work includes designing, supplying, installing, adjusting, painting, lubricating and testing to place in correct, satisfactory operating condition the new bridge hydraulic system for the lift span. Also included is coordination with the removal and replacement of the Equipment Room's concrete block wall for the removal of the existing Hydraulic Power Unit and installation of new Hydraulic Power Unit, as well as miscellaneous structural steel components and coordination with other disciplines as required for complete installation of the Hydraulic System. Coordination with all other work is also required, including coordination with the installation of the electrical system and coordination with structural steel and concrete work, including those removing and replacing the concrete pedestals beneath the bases of the hydraulic jacking cylinders.

The bridge hydraulic system shall meet the requirements for hydraulic systems, components, and associated elements and hydraulically operated equipment for use in movable bridge operation and control, as described herein.

The bridge hydraulic system consists of the following major components:

MK	Item	Total
HPU	Hydraulic Power Unit	1
---	Hydraulic Piping and Supports	1 Lot
---	Hydraulic Jacking Cylinders	4

B Materials

B.1 General

All materials shall meet the minimum requirements specified herein or as specified on the plans. The plans and these specifications show equipment schedules listing the minimum design requirements for the new equipment.

All equipment and materials furnished under the items specified herein shall be brand-new. All equipment, materials and workmanship shall be first class in every particular, and shall be manufactured and installed to the satisfaction of the Engineer.

The design, workmanship and erection of all machinery and hydraulic components shall meet the applicable requirements of AASHTO 2007 LRFD Movable Highway Bridge Design Specifications and 2008 through 2012 interim revisions, hereinafter referred to as the AASHTO Specifications, except as otherwise specified herein or as shown on the plans.

Portions or all of certain recognized industry or association standards or specifications referred to herein as being a requirement of these Special Provisions shall be considered as binding as though reproduced in full herein unless supplemented and/or modified by more stringent requirements of the Contract Documents. Unless otherwise stated, the referenced standard or specification current as of the date of issuance of these Special Provisions shall be used. The following abbreviations are used herein and on the plans to designate specifications and standards for material and workmanship:

AASHTO	American Association of State Highway and Transportation Officials
AGMA	American Gear Manufacturers Association
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	ASTM International (formerly American Society of Testing Materials)
AWS	American Welding Society
DIN	Deutsches Institut fur Normung
JIC	Joint Industrial Council
NEMA	National Electrical Manufacturers Association
NFPA	National Fluid Power Association
NLGI	National Lubricating Grease Institute
OSHA	Occupational Safety and Health Act
SAE	Society of Automotive Engineers
SSPC	Steel Structure Painting Council
ISO	International Organization for Standardization

Hydraulic equipment shall be designed and assembled in accordance with standard Joint Industrial Council (JIC) and National Fluid Power Association (NFPA) hydraulic practices. Hydraulic power unit sections shall be completely pre-piped, pre-wired, tested, and painted prior to arrival at the job site. Open ports for field piping shall be securely capped with steel plugs. Changes or modifications in the field are not permitted. Should the power units require piping changes they shall be removed from the bridge, modified, and re-tested in the manufacturer's shop.

B.2 Bridge Hydraulic System Supplier and Installer

As part of this item, the Contractor shall be required to have a designated Bridge Hydraulic System Supplier and Installer attend the pre-construction conference, be present at the site during system installation, and train the City's personnel. Training shall be in accordance with the requirements stated under Operation and Maintenance Manuals, Lubrication Chart, and Training.

B.3 Qualifications

Hydraulic system fabrication, installation and startup shall be performed by a qualified Hydraulic System Designer/Manufacturer. This Bridge Hydraulic System Supplier and Installer shall have had at least ten years experience in the design, fabrication, and

installation of hydraulic systems of this size and type. Acceptable system suppliers include Bosch/Rexroth, Bethlehem, PA; Dan Krall & Co., Inc., Milwaukee, WI; Oilgear, Milwaukee, WI; or approved equal.

Piping and flushing shall be done under the direction of an NFPA Certified Fluid Power Technician with experience on similar systems, who shall oversee the installation crew. Certification number and experience shall be submitted for review and approval. Installation and adjustment of hydraulic components shall be by personnel with demonstrated skill in this type of work.

B.4 Warranty and Quality Control

All manufacturers shall warrant all products and associated hardware to be free of defects in material and workmanship for a period of five (5) years from the date of final acceptance of the completed bridge contract. Final Acceptance shall be in accordance with the City Specifications. Any defect within this period shall be repaired or replaced by the Manufacturer or Vendor, at total cost to the Manufacturer or Vendor, including labor, parts, and transportation.

The Contractor shall provide letters to the suppliers with copies to the Engineer, identifying the scheduled date of final acceptance of the bridge and therefore the date the warranty shall begin. If the date of final acceptance is extended, it shall be the Contractor's responsibility to extend the commencement of the warranties from the suppliers at no cost to the City.

The City reserves the right to receive on demand, at no cost to the City, a test report from an independent laboratory certifying the equipment furnished meets the requirements of these specifications.

The City reserves the right to reject an entire shipment of material covered by this specification if an item or items are found to be defective within a 30-day period following receipt of materials.

B.5 General Requirements

All components of the Bridge Hydraulic System shall be properly sized and selected such that no oscillation or vibration occurs during the operation cycle. The entire cycle shall be smooth regardless of operator command or weather conditions.

B.6 Submittal Requirements

Shop drawing submittals shall be made in accordance with Section 110. The Contractor shall submit complete pressure drop calculations based on the equipment proposed to be used by the Hydraulic Supplier to the Engineer for review. In addition, complete submittal data for the hydraulic system shall be submitted to the Engineer for review during the shop drawing process.

Minimum submittal requirements shall include the following:

1. Hydraulic schematic with bill of materials.

2. Certified dimensional prints for the hydraulic cylinders, hydraulic power unit, its manifolds, reservoir, etc., with all components to scale, plus certified dimensional prints for all separately mounted components.

3. HPU layout, dimensions, and component configuration.

4. Equipment layout showing clearances between equipment and bridge structure.

5. Engineering and performance data of all items supplied, including material specifications, pump efficiencies, component catalog cuts, etc.

6. Power unit electrical terminal cabinet, electrical relay cabinet (furnished separately under Electrical Control Equipment), and HPU panel wiring diagrams. (See requirements for electrical equipment submittals below.)

7. Initial hydraulic fill and field flushing procedure.

8. Hydraulic fluid specifications.

9. Calculations for design of jacking cylinder body and mounts including all factors of safety required by this specification.

10. Assembly drawings for hydraulic power unit, jacking cylinders, and their supports.

11. Complete piping layouts and details, including fittings, lengths, supports, clamps, calculations for factors of safety for all hydraulic plumbing, etc.

12. Complete system power analysis with pressure drop calculations, including component sizing calculations and pump efficiency ratings for flow and pressure for normal modes of operation.

13. The Contractor shall submit shop drawings of all fabricated components of the Bridge Hydraulic System, including power unit structural framing and assembly, reservoir, mechanical actuating components mounted thereon, jacking cylinders and cylinder attachments, to the Engineer for review and approval prior to fabrication.

14. The Contractor shall submit shop drawings detailing the dimensions of the supporting structures, the procedure for the alignment of the cylinder supports, and a full installation procedure. The Contractor shall submit for approval, in shop drawing format, the method to be used to locate the brackets. All procedures shall be submitted to the Engineer for review prior to the start of the work. Support brackets shall be aligned in all directions and dimensions to within 0.050 inches.

15. The Contractor shall submit a plan for flushing the entire Bridge Hydraulic System at completion of assembly to the Engineer for approval. The Bridge Hydraulic System shall not be installed until plan approval is received.

Electrical submittals related to the Bridge Hydraulic System shall include:

16. Dimensioned panel layout drawings with all components to scale. All components shall be labeled and referenced to a bill of materials.

17. Manufacturer's data sheets for all components (disconnects, switches, timers, fuses, circuit breakers, heat trace, etc.)

18. Schematic drawings showing wire numbers and field wiring.

19. Engraving schedule for nameplates.

20. Submittal data for each motor shall include horsepower, voltage, amps (full load and locked rotor), motor speed, NEMA frame size, insulation class, temperature rise, service factor, and optional equipment (encoders, thermal switch, space heater, etc.). Provide torque / speed performance graph.

B.7 Operation and Maintenance Manuals, Lubrication Chart, and Training

The Contractor shall furnish five (5) copies and two (2) CDs or electronic copies of Maintenance and Operation Manuals giving complete instructions relative to assembly, installation, operation, adjustment, alignment, lubrication, maintenance, disassembly of the new Bridge Hydraulic System. Complete parts lists and assembly drawings shall be provided as part of the Manuals. Manuals shall be furnished concurrently with working drawings, for review and approval by the Engineer.

A lubrication chart showing the location of all components requiring periodic lubrication or maintenance shall be included in the Manuals and shall also be furnished and installed near the hydraulic power unit. This shall include specific procedures for sampling and testing the hydraulic fluid to detect all types of contamination, including hose particles as well as wear metal particles and water, and recommended periods for testing. All procedures are subject to review and approval by the Engineer. The mounted lubrication chart shall be 24" x 36" in size, and shall contain permanent black letters on a white background. The chart shall be mounted on a rigid backing, covered with clear, rigid plastic sheeting, shall be weather-proof, and shall be mounted in locations easily visible to bridge personnel stationed at the HPU.

Training with regard to periodic maintenance required, on the basis of the lubrication chart provided, and troubleshooting procedures to be followed in the event of a malfunction, shall be provided to up to four City maintenance personnel to be designated by the City. The training session shall include a basic discussion regarding hydraulic operation of the lift span and a detailed discussion of the function and operational characteristics of each component or feature of system provided. The training session shall include demonstration of the lift span in all modes of operation, and of conditions and functions that may occur when the span is at rest. Safety procedures discussed shall include protection of hydraulic components and features, to prevent damage, as well as necessary procedures for the protection of operating and maintenance personnel against injury. A demonstration of manual operation to lower the span using the Instruction

Plates provided under Bridge Hydraulic System shall be performed during the training session. Certificates of Completion stating the name of the bridge and the training covered shall be issued to each participant who completes the training.

B.8 Capacities and Speeds

Capacities shown for the materials specified herein are based on an operating time to lift and lower the span of 75 seconds in each direction, using both motors and pumps, including basic acceleration and deceleration times of 10 seconds to and from full speed, and the following conditions and assumptions. Net load to lift at all four jacking cylinders, after counterweight is deducted, is approximately 100,000 lbs. including dead load friction, inertia, rope bending, unbalance, wind load, and ice load. Four hydraulic jacking plunger cylinders with a minimum 6.3" minimum diameter rod shall be used to lift the span on this basis. Basic fluid flow and pressure at the jacking cylinders shall be as required to meet the speed and load requirements for lifting the span using the pumps and lowering the span under an unbalanced condition of 60,000 lbs. Total system efficiency shall be determined, based on the equipment selected for the basic design, including all AASHTO required loads, lift span friction, and all losses beyond the pump from hydraulic components and piping. The bridge hydraulic system shall take all requirements into account in the design of the fixed displacement pumps and electric motors.

All equipment capacities shall be selected on the basis of the two pumps and motors operating at full capacity. Stainless steel pipe of the sizes indicated shall be used to the greatest extent possible to minimize pressure drop. Hydraulic fluid line sizes shown on the Plans shall not be decreased, and shall be increased if required to improve efficiency. The Contractor shall submit calculations to verify the design, using capacities and efficiencies of the equipment proposed by the Contractor.

B.9 Coatings

External surfaces of the HPU (including mounted components), piping, and cylinder assemblies, except for machined parts in sliding contact, shall be primed and coated in accordance to the requirements for the structural steel as stated elsewhere in the specifications. Surface preparation and application of coatings shall be in accordance with the coating manufacturer's recommended procedures and the applicable Steel Structures Painting Council (SSPC) Specifications. Final coat paint color(s) shall be as directed by the Engineer.

B.10 Weldments

Weldments for machinery base supports and cylinder brackets furnished shall be neat and shall have all exposed sharp corners and edges removed. Mounting surfaces of the support frames shall be straight and flat such that full contact with the equipment being supported or retained is achieved.

All welding required herein or called for on the plans shall be done in accordance with the requirements of AWS D1.5 and Subsection 506.3.19 of the Standard Specifications. Weldments shall be stress relieved by heat prior to final machining. The fitting up and

welding procedure shall be such that distortion of the work will be a minimum. If necessary to obtain this result, suitable welding fixtures shall be used. The Contractor shall submit welding procedures, together with the working drawings for the parts to the Engineer for approval.

All welds shall be inspected in accordance with requirements of AWS D1.5. Location of tests shall be selected at random so as to be typical for each size and type of weld. All weld basis of acceptance shall be in accordance with the requirements of AWS D1.5.

B.11 Mechanical Components for Hydraulic System: Dimensions, Fits, and Finishes
Fabricated mechanical components furnished or rehabilitated under hydraulic work shall meet the requirements for such components as described under the Special Provision – Bridge Machinery - General. Dimensions of machined parts are the finished dimensions after fabrication and machining. Unless otherwise specified, all dimensions for machine finished surfaces and parts shall be held within a tolerance of 0.010 inches. Fits for cylindrical parts shall also apply to the major dimensions of non-cylindrical parts. Fit, finish, and tolerance of manufactured parts and their mating parts shall conform to AASHTO Specification Article 6.7.8.

B.12 Span Drive
B.12.1 General
The movable span shall be powered by a multi-pump hydraulic power unit (HPU). The HPU shall have electric motors and pumps as shown in the Plans. Hydraulic jacking cylinders shall be provided as specified in the plans and these specifications.

The system shall be redundant such that if one of the main motors or pumps is out of service, the system can be operated at half speed by remaining components of the system. Normal operation of the bridge under all load conditions is with the two main motors and main pumps on the power unit operating. Emergency operation of the bridge will be under the same loading conditions with only one motor and pump on the power unit operating. Additional redundancy shall be furnished at various components by means of manual operators to supplement electrical control.

Corrosion resistant nameplates shall be provided for each hydraulic component, including jacking cylinders and all functional components on the HPU such as pumps, motors, safety features, indicating and control components, heaters, pressure gauges, test ports, valves, piping, etc. Nameplates shall clearly indicate the function of each device and, in the case of manually operated valves or controls, shall indicate the normal condition (normally open or normally closed) established for each position of the valves or control. Lettering on the nameplates shall be machine-engraved on plastic laminate with white characters on a black background. The nameplates shall be mounted in its respective location in a position that is easily visible to bridge personnel.

Normally closed shutoff valves shall be provided with corrosion resistant red handles. Normally open shutoff valves shall be provided with corrosion resistant green handles.

Color markings shall be durably bonded to the handle, and color shall not be subject to removal by normal wear.

Instruction plates for the manual control and emergency bypass of the hydraulic equipment shall clearly indicate the proper procedures and sequences of operations to activate the system, to operate the system, and to secure the system after completion of operation. All modes of operation shall be described, including normal operation, emergency operation, normal stop, emergency stop, power failure, and emergency lowering during electrical system failure. Instruction plates shall contain permanent black letters on a white background. Instruction plates shall be mounted on a rigid backing, covered with clear, rigid plastic sheeting and be weather-proof. Instruction plates shall be mounted in locations easily visible to bridge personnel at the HPU.

Electrical apparatus for controlling the operation of the span shall include an electrical terminal cabinet mounted on the HPU. All other conduits, cabinets, wiring, cables and other equipment required to extend the necessary electric circuits to the HPU terminal cabinet and to separately mounted components shall be furnished under Electrical Work and installed by others.

B.12.2 Hydraulic Power Unit for Span Operation

The hydraulic power unit (HPU) for span operation shall be of simple design and substantial construction. The arrangement of parts shall permit easy erection, hydraulic connection, electrical connection, adjustment, and replacement of defective parts, and shall be accessible for inspection, cleaning, lubrication, maintenance and repairing. The fastening shall be adequate to hold the parts in place under all conditions of service.

All parts, motors, pumps, valves, etc. shall be mounted over an integral drip pan to contain oil spills when servicing or replacing the unit. Drip pans shall be equipped with drain spigots and suitable clearance for drainage and collection. Drip pan material shall be ASTM A666 Type 304 stainless steel. Because the HPU is constructed in sections, the drip pans shall completely underlie the equipment on their respective portions with a common flange connection between them that includes an inverted V-shaped diverter between pans above a neoprene gasketed joint.

The entire hydraulic power unit shall be framed for ease of handling using a forklift, and the framing shall also include lifting lugs or lifting eyes to allow movement by come-along. The framing members shall be standard rolled steel shapes such as channels, angles, and wide-flanged beams.

The hydraulic power unit shall be completely pre-wired, in that all components requiring electrical power or control shall be connected to an electrical terminal cabinet furnished and installed on the end of the hydraulic unit, in the location shown on the plans.

The hydraulic power unit and all components shall be detailed to provide the intended functions of power and control. Unless otherwise noted, every component or assembly

shall be rated for the maximum flow and pressure it will be subjected, or to 3,000 psi, whichever is greater.

The Contractor shall be responsible for selecting components that provide the intended function and meet the specified performance criteria. Any component features not specifically mentioned herein, additional components, or additional piping required to adapt specific components to meet the design intent, including external drains, reducing valves, flow control valves, etc., shall be furnished at no additional cost.

The HPU shall have two identical pump/motor groups, both of which shall be used for normal operation and either one of which can be used separately for emergency operation. The lift span shall be raised under power and lowered by the span unbalanced weight. Manual overrides at the solenoid valves shall also be included should it be necessary to operate the valves without electrical control of the solenoids on an emergency basis. A placard with emergency instructions for immediate shutdown shall be located near the HPU, including a reference to the instruction plates (described above) for emergency lowering operation.

Hydraulic pumps shall be of fixed displacement gear type. Main pumps shall have a net volumetric output as required for the lifting of the span at required speeds at no less than 85% volumetric efficiency at a motor speed of 1725 rpm. Each pump shall be connected to a standard TEFC/NEMA C-faced electric motor. Electric motors shall be in accordance with the requirements as specified under Electrical Work.

The pumps and electric motors shall be connected by means of a suitable grid type flexible coupling with misalignment to be no more than the manufacturer's maximum recommendation. Coupling halves shall be keyed to their respective shafts. Coupling set screws shall be secured with a high quality thread locking material. The entire pump/motor assembly shall be mounted on commercially available vibration isolation shock mounts.

Power unit wiring shall conform to standard electrical practices. Seal-tite shall be used between HPU terminal box and HPU electrical components where runs will be less than two feet. For runs over six feet, PVC coated, zinc-coated rigid conduit shall be used in conjunction with seal-tite, keeping seal-tite runs under two feet in length.

Flow dividers shall be used to equalize flow to and from each of the four jacking cylinders, thereby keeping the lift span level. Additional means shall be provided to adjust the flow to and from each jacking cylinder as shown on the plans to prevent the liftspan from skewing and to bring it back to level should one or more jacking cylinders lose synchronization with the others. See Description of Operation for additional requirements.

B.13 Reservoirs

The hydraulic reservoir shall be fabricated from stainless steel ASTM A276 Type 316. The reservoir shall have a minimum capacity of 2.5 times the maximum flow per minute

during normal operation, plus 15%, and shall be filled to the level of 2.5 times the maximum flow per minute when the jacking cylinders are completely retracted and the entire hydraulic span piping system is filled to capacity. The thickness of the wall material for the reservoirs shall be sufficiently designed for all components mounted to the reservoir. The reservoir shall also be designed to allow removal and reinstallation at the top of the HPU, and shall be designed so that it can be moved in and out of the Equipment Room shown on the plans through the removable cinder block wall from and to the area behind the pier. The reservoir top shall be designed and constructed to shed any fluid that may collect on the top without draining into the reservoir. In addition, the top surface shall be of such construction that it can be easily wiped to remove contaminating substances.

A minimum of two removable clean out covers shall be installed on the front/exposed faces of the reservoir on which no components are mounted. Each reservoir shall have suitable baffles to assist in fluid conditioning, and each area between the walls of the reservoir and the baffles, and between the baffles, shall be accessible by use of the clean out portals. A water vapor barrier-type 3-micron breather shall be installed on the sealed reservoir. Breather assembly shall be spin-on type with visual clogging indicator and a 100 cfm capacity. A provision shall be made such that new fluid can only be added to the sealed reservoir by pumping it through the return filter.

In addition to the general features required in all hydraulic reservoirs, the following items shall be incorporated into the hydraulic span drive reservoir. All switches shall be furnished with one normally open and one normally closed contact, the extra contact to be considered a spare for future use. The positions or settings of all switches shall be easily adjustable by at least 20 gallons in either direction for level switches, and by at least 30 degrees in either direction for temperature switches:

1. Low level float switches – two positions. These shall include low fluid level indication switch [FS 1], contact to close if fluid level falls below level of 60% of filled capacity (adjustable), and low fluid level interlock switch [FS 2], contact to close if fluid level falls below level of 40% filled capacity (adjustable).

2. High fluid level console indication switch [FS 3], contact shall close if fluid level rises above level of 110% filled capacity (adjustable).

3. Fluid level gauge, with visible level indication over the range of the fluid level switches (between 110% and 40% of normal filled capacity.

4. Fluid temperature gauge (thermometer), with minimum visible range between 30 degrees F and 180 degrees F.

5. High fluid temperature indication switch [TS 1], contact shall close if temperature rises to 140 degrees F.

6. Low temperature indication switch [TS 2], contact shall close if temperature falls below 55 degrees F.

7. Future provisions shall be provided for the addition of a heat exchanger for the reservoir. At a minimum, two ports shall be provided at one end of the reservoir that will allow connection of 1.5 inch diameter tubing at appropriate fluid levels for optimum installation of a commercially available heat exchanger unit. Catalog cuts shall be provided on the proposed unit. A diagram and schedule listing all material required for future heat exchanger installation shall be furnished with the shop drawings.

8. Pump suction butterfly shutoff valves with flex connection and contacts for position indication.

9. Hydraulic oil fill connection that permits oil fill only through a 10 micron filter (return filter).

10. Reservoir drain port with shutoff valve.

11. Fluid sampling port.

In addition, the hydraulic power unit and the remainder of the hydraulic circuits shall have all features shown or indicated on the plans or described herein.

B.14 Manifolds and Subplates

Manifolds and subplates shall be used to house and mount all valving and other components as specified or shown on the plans. Unless otherwise specified or shown, manifolds shall be constructed from corrosion resistant steel or aluminum alloy as required for the specified working pressures. Subplates shall be provided to mount all separately mounted components, as required.

In exposed areas under the lift span, hydraulic components shall be provided with removable steel covers with gasket seals for protection.

B.15 HPU Terminal Cabinet

An electrical terminal panel specifically for the hydraulic power unit shall be furnished and installed on the HPU as part of Hydraulic System. The enclosure shall conform to NEMA 12 standards. All components shall be UL listed for the intended application and indoor use.

Switches and indicator lights provided on panel door shall be JIC oil tight type.

Terminals and fuse holders shall be in accordance with the requirement for Electrical Work.

B.16 Bridge Hydraulic System Operating Components

All main system valves and other operating components shall be rated for intended flow and pressure. ANSI standard sub-plate mounted valves shall be used for ease of servicing.

B.16.1 Cam Operated Proportional Flow Control Valve Assemblies (Accel/Decel Valves)

The main speed control valves shall be cam operated proportional flow control valves capable of controlling smooth starts and stops, and capable of providing the entire amount of fluid required for smooth acceleration, deceleration, and operation of the jacking cylinders. Cam operated valves shall be as manufactured by Parker/Manatrol, Cleveland, OH; Bosch/Rexroth, Bethlehem, PA; ZATRAN, Elyria, OH; or approved equal.

The main spool of each valve shall be a metering control spool, spring loaded to the normally closed position. As the cam depresses the plunger, flow through the valve shall gradually increase in a linear manner to a full open condition. As the cam is withdrawn to allow the plunger to extend under spring loading, flow through the valves shall gradually decrease to a full closed condition. Engineering data, including a chart of flow characteristics at various plunger positions and pressures, shall be submitted for approval. Valve plungers shall be actuated by means of hydraulic actuators with wedge shaped rod end attachments to be used as cams, as shown on the plans.

Modular assemblies for subplate mounting of all these components shall be provided as shown on the plans to provide slow and fast speeds in sequence. These assemblies shall consist of subplate(s) for nominal Slow and Fast speeds, with cam operated flow control valves, hydraulic cylinder actuators with wedge shaped rod end cam attachments, and mechanical limit switches at the ends of stroke for both actuators. Protective covers of 10 gauge (min.) steel shall be furnished and bolted over the assembled components to protect them from damage, and to protect personnel from injury during operation. The assemblies may also include the solenoid operated directional control valves controlling the hydraulic cam actuating cylinders, and their adjustable flow controls.

The actuators and rod-attached cams, cam operated valves, and the limit switches for each speed shall be fully installed and aligned on the subplate(s) in the shop. The assemblies shall be fully tested in the shop to ensure proper operation. The positions of the cams and the limit switches shall also be field adjustable to the extent necessary to ensure full actuation and retraction of the cam operated valve, with electrical indication fully adjustable from both ends within the range of stroke.

One or two cam-operated valves may be used to provide the flow required within each nominal speed range, for both fast and slow speeds. Flow through the valves shall be fully reversible for raising and lowering the span at the required speeds. The valves shall have the operating stroke dimensions shown on the plans. Any changes required for the cam actuators, cams, limit switch arrangements, or any other components because of differences in capacity or stroke shall be made by the Contractor at no cost to the City.

B.16.2 Cam Actuating Cylinders

Double acting hydraulic cylinder actuators with special wedge-shaped rod end attachments shall be furnished and installed as part of the cam actuated valve assemblies for the control of the cam operated flow control valves. The actuators shall be aligned

with the cam operated valves so that the cam operated valves open gradually to full flow from the closed position as the actuator extends, and close gradually from the open position to the closed-to-flow position as the actuator retracts.

Actuators shall be at least 1.5 in. diameter bore x 3 in. stroke, with rod diameter and all components suitable to withstand the cam loading to be applied. The rod diameter shall be limited so that the effective pressure area of the piston while retracting is at least 75% that of the pressure area when extending.

Actuator rods shall not rotate as the actuator rod extends or retracts, and shall have the capability to withstand side loading of the actuator rod as it extends while actuating the cam operated valve. Rod end wedge attachments shall be specially machined to no less than the minimum dimensions specified by the cam operated valves for this purpose. The position of the cam attachments on the rod ends shall be adjustable by means of the threaded end of the rod and the use of a jam nut.

Cam Actuating Cylinders shall be as manufactured by Bosch/Rexroth Corporation, Bethlehem, PA; Air-Dro Cylinders, Decatur, AL; or approved equal.

B.16.3 Flow Control Valves

Adjustable flow control valves shall be furnished and installed in the locations shown on the hydraulic schematic in the plans.

For the cam actuating cylinder control, the flow control characteristics shall be such that the slow speed cam actuator can be adjusted to extend over 0 to 5 seconds, and such that the full speed cam actuator can be adjusted to extend over a period of 0 to 5 seconds.

In the manifold in the top portion of the flow divider assembly, each flow control valve shall be adjustable from zero to 5% of full flow through the output leg of the flow divider to which it is attached.

In all other locations, the adjustment shall range from zero to the full flow required in that portion of the circuit. Flow control valves shall be as manufactured by Bosch/Rexroth, Bethlehem, PA; Parker-Hannifin, Cleveland, OH; Dana/Weatherhead, Maumee, OH; or approved equal.

B.16.4 Shutoff Valves

Shutoff valves shall be furnished and installed in locations indicated on the hydraulic schematic. A red handle shall be furnished and installed at shutoff valves that should be kept normally in the closed to flow position. A green handle shall be furnished and installed at shutoff valves that should be kept normally in the open to flow position. If closing or opening a particular valve during operation of the span should not be permitted, in that it would be detrimental to the equipment or dangerous to personnel, the handle shall be furnished with a padlock and hasp to prevent adjustment of the valve without a key. Shutoff valves shall be as manufactured by Stauff, Waldwick, NJ; Bosch Rexroth, Bethlehem, PA; Dynaquip, Fenton, MO; or approved equal.

B.16.5 Electric Motors
Electric motors for both pumps on the main HPU shall be totally enclosed, squirrel cage AC motors suitable for pump operation. See the Electrical Specifications for additional motor requirements.

B.16.6 Accumulator
A piston type accumulator of approximately 5 gallon capacity shall be furnished and installed at the HPU for the purpose of pre-pressurizing the hydraulic system prior to operation. Accumulator shall be as manufactured by Parker Hannifin, Cleveland, OH; Oil-Air Hydraulics, Houston, TX; or approved equal.

B.16.7 Accumulator Safety Block
An accumulator safety block for the purposes of de-pressurizing the hydraulic system between operations shall be furnished and installed in the location indicated by the hydraulic schematic. The purpose of this safety block is to ensure that the accumulator is fully discharged when not required between span operations. Accumulator safety block shall be as manufactured by Parker Hannifin, Cleveland, OH; Oil-Air Hydraulics, Houston, TX; or approved equal.

B.16.8 Check Valves
Check valves shall be furnished and installed in the locations indicated by the hydraulic schematic to provide free flow in one direction and prevent any flow of hydraulic fluid from occurring in the other direction. Check valves shall be as manufactured by Bosch/Rexroth, Bethlehem, PA; Dennison Hydraulics, Marysville, OH; Parker Hannifin, Cleveland, OH; or approved equal.

B.16.9 Relief Valves
Relief valves shall be furnished and installed where shown and as indicated to prevent excessive high pressure from occurring in the Bridge Hydraulic Systems. Pressure settings shall be adjustable. Relief valves shall be as manufactured by Bosch/Rexroth, Bethlehem, PA; Parker Hannifin, Cleveland, OH; or approved equal.

B.16.10 Shuttle Valve
A shuttle valve shall be furnished and installed in the location indicated by the hydraulic schematic. It shall be located between two incoming lines, as indicated, and shall cause fluid flow and pressure to be transmitted into the outgoing line by the incoming line of the highest pressure. Shuttle valves shall be as manufactured by Bosch Rexroth, Bethlehem, PA; Parker-Hannifin, Cleveland, OH; or approved equal.

B.16.11 Solenoid Operated Directional Valves
Solenoid operated directional control valves with manual over-ride features shall be furnished and installed in the locations indicated on the hydraulic schematic. They shall be of the required capacity to accommodate the flow and pressure requirements of the components downstream. With no electrical power available, the bridge shall be capable of lowering (only) by means of manual and backup battery operation of SOLENOID VALVES (24)[SV13, SV14, SV23, and SV24] at the JACKING

CYLINDERS (23), in conjunction with manual operation of SOLENOID VALVE (14)[SV1]. A system similar to that now used at the Clybourn Street Bridge shall be provided. Directional valves shall be as manufactured by Bosch/Rexroth, Bethlehem, PA; Parker Hannifin, Cleveland, OH; or approved equal

B.16.12 Pressure Switches

Bridge Hydraulic System pressure switches shall be furnished and installed in the locations indicated by the hydraulic schematic. The pressure switches shall be capable of indication and adjustment in the range of pressure required. Pressure switches shall be as manufactured by Allen-Bradley, Milwaukee, WI; Barksdale, Los Angeles, CA; Bosch/Rexroth, Bethlehem, PA; or approved equal.

B.16.13 Pressure Gauges

Pressure gauges shall be furnished and installed in the locations indicated by the hydraulic schematic. All pressure gauges shall be rated for 3000 psi (min.) service, but shall indicate the required range of pressure reading. Faces of pressure gauges shall be of a clear flexible material not subject to cracking or fracture by impact. Pressure gauges shall be as manufactured by Parker Hannifin, Cleveland, OH; Bosch/Rexroth, Bethlehem, PA; No Shok, Cleveland, OH; or approved equal.

B.16.14 Temperature Gauges

Temperature gauges to indicate the temperature of the hydraulic fluid shall be furnished and installed in accessible locations, easily viewed with respect to the configuration of the machinery room, on the reservoir of the hydraulic power unit. Temperature gauges shall be as manufactured by Parker Hannifin, Cleveland, OH; Vescor; or approved equal.

B.16.15 Temperature Switches

Temperature switches shall be furnished and installed in the locations indicated by the hydraulic schematic. These shall indicate higher or lower than acceptable fluid temperatures by closing contacts to send a signal to the electrical system for indication and interlock. Temperature switches shall be as manufactured by ITT-Neodyne, Valencia, CA; or approved equal.

B.16.16 Level Gauges

Level gauges to indicate the level of fluid in the reservoir shall be furnished and installed in accessible locations, easily viewed with respect to the configuration of the machinery room, on the reservoir of the hydraulic power unit. Level gauges shall be as manufactured by Parker-Hannifin, Cleveland, OH; Vescor, South Elgin, IL; or approved equal.

B.16.17 Level Switches

Level switches to indicate acceptable and unacceptable levels in the hydraulic reservoir shall be furnished and installed in the reservoir of the hydraulic power unit. These shall indicate higher or lower than acceptable fluid levels by closing contacts to send a signal to the electrical system for indication and interlock. Level switches shall be as manufactured by Barksdale, Los Angeles, CA; GEMS Sensors, Plainville, CT; or

approved equal.

B.16.18 Flow Divider Assembly

A flow divider assembly shall be furnished and installed as shown on the plans, consisting of a two-displacement flow divider and a four-displacement flow divider connected in series, together with adjustable solenoid-actuated and manually actuated flow control lines that are arranged in parallel. See required Flow Control Valve capacity, below. The flow dividers shall have high flow division accuracy, negligible pressure pulsations, high efficiency, and no throttling losses. For same pressure outlet level, volumetric accuracy shall be within 1 percent. The unit shall have the ability to be a flow combiner as well as a flow divider, with the same accuracy, although impact on pressure drop shall be considered. Main seals shall be repairable with a seal kit provided by the manufacturer.

As with all equipment provided under this Item, a Buy America waiver may be required for the unit if manufactured overseas.

B.16.19 Heat Exchanger

If required, an air radiation-type heat exchanger of the capacity required to keep the oil in the reservoir under 140 degrees F. during times of frequent operation in hot weather shall be furnished and installed on the hydraulic power unit reservoir. The heat exchanger shall have the capability to dissipate the amount of heat generated by continuous operation of the main pump at maximum pressure, while discharging over the relief valve at its specified setting, for four hours in ambient temperatures of 100 degrees F. On this basis, the temperature of the oil shall never exceed 140 degrees F. when starting from a temperature 80 degrees F. Heat exchanger proposed shall be as manufactured by Hayden, Thermal Transfer Systems, Dallas, TX; or approved equal.

B.17 Hydraulic Jacking Cylinders.

B.17.1 General

The hydraulic jacking cylinders shall be of the single acting plunger-type, fed through the piston rod, as designed and manufactured by Bosch/Rexroth Corporation, Bethlehem, PA; Air-Dro Cylinders, Decatur, AL; or approved equal. Material for the hydraulic cylinder shall be a high strength carbon or alloy steel. Cylinder tubes which have been welded shall be stress relief heat treated and all welds shall be radiographed or magnetic particle tested, including those on the end mounts. Material for the piston rod shall be high strength carbon or alloy steel with a ceramic or nickel-chrome coating.

If used, the ceramic coating shall be a minimum of 150 micrometers (0.006 inch) thick, have a surface finish of 0.10-0.30 micrometers (4-12 microinches) rms, surface hardness of 67 Rc minimum, impact resistance of 7-15 Nm (5-11 lb-ft), modulus of elasticity of 360 to 415 Gpa ($52x10^6$ - $60x10^6$ psi), linear expansion coefficient of $7.2x10^{-6}$/degree C ($4.0x10^{-6}$/degree F), and be capable of withstanding a fracture force of 280 Mpa (41 ksi) minimum. Rings, bearings, packing, packing rings, retaining rings, seals, wiper-scrapers, etc., shall be fabricated from the finest selected quality materials as recommended by the manufacturer to provide zero leakage. Mounting and bracing, and rod end attachments shall be as shown on the plans. Connection pins shall be fabricated from ASTM A564 /

A564M, Type 630, condition H-1150 stainless steel. The ceramic layer shall withstand at least 1000 hours of continuous salt spray testing according to ASTM B117.

A stainless steel drip edge with drain shall also be provided at the top of the cylinder to catch any leakage that may occur over time from the seals of the hydraulic jacking cylinder. A ¼ inch diameter conduit shall extend from the drain to an oil container of at least 5 gallons capacity to be furnished and installed at the base of each hydraulic jacking cylinder.

B.17.2 Material Strengths

Hydraulic cylinders for operation and holding of the span shall meet the minimum material strength requirements defined herein. Higher strength materials shall be provided as required to meet the design requirements depending on the manufacturer's design, detailing, and construction methods.

Hydraulic cylinders for span operation shall be of the single-acting, heavy duty mill type as shown on the plans. The working pressure rating of the cylinders shall be 3,000 psi. Cylinders shall have a minimum NFPA theoretical static failure as required by AASHTO. Cylinders shall have minimum bore, stroke, and rod diameter as indicated in the plans. Cylinder ports shall be SAE standard sized as shown in the plans. Cylinder head shall be bolted to the body flange.

B.17.3 Cylinder Mounts

Cylinders shall be designed and manufactured for mounting as shown in the plans. Cylinder mounts permanently attached to the cylinder and all associated bearings and hardware shall be supplied by the cylinder manufacturer and shall be included in the cylinder shop drawing for review by the Engineer.

B.17.4 Rod Ends

Rod ends shall be fabricated from steel, cast or structural, as required to meet the design application strength and geometry. Cast steel shall be ASTM A27 or ASTM A148, grade as required, or equal. Structural steel shall be ASTM A709 or ASTM A579, grade as required or similar. Mechanical property certification shall be provided for steel used for rod ends. Design calculations verifying strength in accordance with the design Specifications shall be provided with the shop drawings. Weldments shall be per this Specification. Rod ends shall be per plan details and shall be designed and fabricated for easy field removal of hydraulic fluid piping to allow for disconnecting a cylinder from the span to remove it from service.

B.17.5 Cylinder Tube

Cylinder tube shall be machined from ASTM A519, grade as required for rated pressure, heavy wall seamless steel tubing, and shall have the bore honed to 16 micro-inches rms surface finish or better. Cylinder body ends shall be chamfered or tapered to facilitate manufacturing. Body flanges shall be welded to the tube. Welding shall be in accordance with applicable ASME Section IX, boiler and pressure vessel codes. Weld

procedures and filler materials shall be submitted for review with the cylinder shop drawings.

B.17.6 Cylinder Heads

Cylinder heads and caps shall be fabricated from ASTM A576, grade 1018, steel bar stock or equivalent and machine finished on all surfaces. The cylinder head shall be equipped with rod seal and external dirt wiper, and shall have rod bushings piloted into the head to ensure concentricity. Except as otherwise noted in the plans, cylinder heads shall be bolted to the body tube with through bolts, double nutted. Bolts shall be grade 8 minimum with grade 2H nuts.

B.17.7 Pistons

Pistons shall be precision fitted to the cylinder body bore. Pistons shall be of a steel core with SAE 62 bronze coating 1/16" thick and shall be equipped with multiple lip-type seals. The design shall protect piston seals from blow-out and over-squeeze. Pistons shall be positively secured to the piston rod by threading onto the rod and secured by set screws. Piston bearing and packing sealing surfaces shall have a 32 micro-inch rms finish.

B.17.8 Piston Rods

Piston rods shall be made of medium carbon steel of yield strengths of 55 to 70 ksi high tensile strength using ASTM A108, grade 1045 or equivalent. Rods shall be case hardened, polished to 8 micro-inch rms surface finish or better, and ceramic coated. Ceramic material thickness shall be 150-350 micrometers. Piston rods shall be constructed to provide a minimum factor of safety of 3 against buckling. Factors of safety shall be based upon a maximum working pressure of 3,000 psi and shall account for mounting conditions and self-weight or load induced bending and axial loads. Data and calculations regarding buckling shall be submitted to the engineer for review. Certified testing of each rod shall be performed. Tests shall indicate ceramic material thickness throughout the entire length of rod at intervals not to exceed 12". Test results shall be neatly tabulated and submitted to the Engineer for review.

B.17.9 Cylinder Pressure Rating

The manufacturer shall submit certification that each cylinder was hydrostatically tested to 4,500 psi with no evidence of leaking and that all dynamic seals are suitable for both frequent and infrequent operation and are capable of not less than 500,000 cycles of operation without failure.

B.17.10 Rod Seals

Rod seals shall be a standard seal system for the manufacturer selected, but shall be at least equivalent to the sealing provided by a double chevron seal. A hard polyester (hallite 38 or equal) scraper shall be provided. Rod seals and scraper shall be designed so that replacement can be performed in the field without removal of the cylinder. A leakage detection port with bladder shall detect if a leak in the rod seal has occurred. Rod seals shall be compatible with the hydraulic fluid.

B.17.11 Cylinder and Rod End Ports

Cylinder and rod end ports shall be SAE O-ring or SAE four bolt code 62 flange connections. Two main fluid pressure ports shall be provided for each unit, including a port at the end of the axially bored cylinder rod and a port of the same size at the bottom of the cylinder. The port at the end of the rod shall be used for installation of the hydraulic piping from the HPU. The second port at the bottom of the cylinder shall be available for connection in the future, and shall also be available for use to drain oil from the cylinder. Each cylinder shall also incorporate a hydraulic pressure sensing port at the lower end of the cylinder for measurement of hydraulic pressure. The pressure testing port shall be compatible with standard threads supplied on a common transducer for this application and shall be fitted with a suitable sealed plug. Port location shall be such that sensor(s) may be easily installed. Bleed ports with suitable plugs shall also be provided at each end of the cylinder. Leakage detection at the rod seals shall also be provided by a detection port and bladder.

B.17.12 Cylinder Control Module

A cylinder control module (manifold) shall be rigidly plumbed with Type 304 or Type 316 stainless steel tubing and fastened to each main drive cylinder jack. Details of the method of attachment shall be submitted to the Engineer for review and approval. Brackets, hardware, and fasteners shall be Type 316 stainless steel. This module shall include the pressure switches, solenoid valves, gauges, and other features shown in the proximity of each cylinder jack on the schematic, and shall positively lock the cylinders in any position even in the event of a fluid line failure by means of a solenoid valve. The hydraulic cylinders shall automatically close to provide instant braking and holding capability for the lift span should pressure be lost in the hydraulic piping system, and shall be capable of holding the lift span in any raised position for at least 4 hours without movement after the hydraulic power unit is turned off. This module shall provide the relief function through the action of the electrical system should pressure remain or build up in the cylinders between operations. Means for emergency manual lowering of the bridge shall be provided as shown in the hydraulic schematic. The manual operators shall be color-coded and be referenced by a placard located in the area describing emergency lowering procedures.

B.18 Hydraulic Cylinder Supports and Attachments

Hydraulic cylinder supports and attachments shall be hot-dip galvanized and painted, and shall be suitable for the new cylinders, the required piping, and the mounting and function of the cylinders and piping within the pier, as shown on the plans and defined herein. Supply all rod end attachments, support components, brackets, shims, pins, hardware, bearings, shrouds, grout, and anchor bolts as required. This work shall include surface preparation and leveling, installation and alignment.

The Contractor shall submit shop drawings of all fabricated components of the hydraulic cylinder supports to the Engineer for review prior to fabrication, together with complete assembly and installation drawings.

B.19 Hydraulic Fluid

All hydraulic fluid required for testing, storage, and to flush and install the system in working order shall be provided. The hydraulic fluid shall be Benz Oil Flomite 530, the same as that now used by the City in operating systems at other bridges, unless otherwise approved by the City. The selected hydraulic oil shall be in accordance to the hydraulic supplier requirements and oil specification data shall be submitted to the Engineer for approval. All components, seals, etc., shall be compatible with the approved fluid.

B.20 Filtration and Oil Sampling

The hydraulic system shall be fitted with filtration suited for the application.

The system shall be fitted with full flow pressure and return filtration. The pressure filters shall be sub-plate mounted to the main control manifold. The return filter shall be tank top mounted. Each filter shall have a bypass and a local visual indicators as well as electrical contacts as shown on the plans. The replacement filter elements shall be of quality construction with a 10 micron rating of beta 10>100 or better.

A drain valve shall be provided at the bottom of the HPU reservoir as shown on the hydraulic schematic. Fluid sampling shall be performed by the Contractor, and fluid shall be tested by a qualified testing service prior to acceptance of the structure. Testing shall include oil quality including analysis for levels of contamination. Wear particle detection shall include both metallic and non-metallic particles, including the detection and analysis of hydraulic hose particles. The oil shall also be analyzed for the presence of contaminating liquids such as water. Fluid testing shall be done both at the hydraulic power unit and at or near a hydraulic cylinder jack on the west pier.

Two oil testing services with the capabilities outlined above shall be identified by the hydraulic supplier. This information, together with recommendations and quotations for periodic sampling and testing, shall be furnished to the City prior to acceptance.

B.21 Seals

The seals for hydraulic components shall be Viton unless otherwise noted, suitable for the hydraulic fluid supplied.

B.22 Plumbing and Fittings

All hydraulic plumbing shall conform to current Bridge Hydraulic System standards as required by the AASHTO Specifications. Unless otherwise specified, rigid plumbing shall be seamless ASTM A269, Grade TP304 annealed stainless steel tube and ASTM A312 - Grades TP304 or TP316 stainless steel pipe as applicable. Fittings shall be SAE four bolt socket weld O-ring flange, 37° flare, or 37° O-ring seal. Threaded connections shall be SAE straight threads wherever possible, or fully welded. All piping located over the river shall be fully welded without bolted connections. All fittings shall be Type 316 series stainless steel. The use of hydraulic clamps is mandatory. All clamp fasteners, plates, and brackets shall be Type 316 series stainless steel. The Contractor shall follow clamp manufacturer’s specifications for spacing and installation.

Tubing and pipe shall be sized to provide a minimum factor of safety of four based on burst pressure. Factors of safety shall be based on the maximum working pressure as defined by the AASHTO Specifications. Fluid velocity in piping and hoses shall not exceed 20 FPS for pressure lines, 13 FPS for return lines and 4 FPS for suction lines. In addition, fluid lines shall be no smaller than those shown on the plans for any particular location.

Fluid lines on the hydraulic power unit, in the control house, and from the control house to the hose in the flexible enclosure on the west pier shall be annealed stainless steel tubing. Fluid lines beyond the hose in the flexible enclosure shall be stainless steel pipe.

The Contractor shall add to the Bridge Hydraulic System fluid lines in strategic locations any required ports or connection points deemed necessary to completely flush the system after assembly. The location of these ports and connection points shall be in accord with the Contractor's submitted plan of flushing, as approved by the Engineer. Such connection points and ports, together with all required components, shall be considered incidental.

B.23 Hydraulic Pipe and Tube Supports

Hydraulic pipe and tube supports shall be a strut mounted cushion clamp system. All clamps, fasteners, and channels shall be hot dip zinc-coated and painted or shall be Type 316 series stainless steel.

B.24 Hydraulic Hose Assemblies

Flexible hose shall be of the proper SAE rating, consistent with the working pressure encountered and having the working and burst pressures required by AASHTO. Hydraulic hose assemblies shall be provided between the west pier and the lift span. Additional use of flexible hose shall include: suction, drain, bypass, and pressure lines connecting all pumps to the system field plumbing. All hose assemblies shall be assembled with a proper sealant of high quality. Hose ends shall be FJICS 300 series stainless steel. Hose guards constructed of steel wire and plated to resist rust shall be used to protect and prolong the life of the flexible hose lines from abrasion, deep cuts, distributes bending radii, and kinking.

B.25 Hardware and Fasteners

All fasteners bolts, nuts, washers, and all other mounting hardware used on all the hydraulic equipment and power units shall be Type 316 stainless steel unless otherwise noted.

B.26 Anchors

Where specified in the plans, and as required, cylinder supports and other equipment shall be anchored to the concrete using anchor bolts as described in Bridge Machinery -- General.

All installation equipment including drills, drill bits, undercutting tools, tolerance gauges, and tensioning devices shall conform with the manufacturer's recommendations. The

Contractor shall submit his proposed list of equipment and installation methods to the Engineer for review.

The Contractor shall install the anchors in compliance with the manufacturer's recommendations. The Contractor shall employ at least one person with demonstrated experience in setting the anchors and shall arrange to have a qualified representative from the manufacturer on site to supervise the installation.

Contractor shall test bolts by using hydraulic jacks, recording the pressure and converting the pressure to pounds.

B.27 Epoxy Leveling Grout

Epoxy leveling compound shall be a two component, pourable epoxy based grouting compound for severe applications. Epoxy leveling grout shall be manufactured for use in a thickness range of ½" to 1-1/2".

Epoxy leveling grout shall have the following minimum properties:

Compressive Modulus of Elasticity:	1640 kips, ASTM C109
Maximum Compressive Strength:	19 ksi, ASTM C109
Fire resistance:	Self-extinguishing, ASTM D635
Maximum Izod Impact Strength:	3.4 in.lbs./in., ASTM D256
Maximum Linear Shrinkage:	0.0001 in./in., ASTM D2566
Maximum Tensile Strength:	2 ksi, ASTM D638
Maximum Coefficient Linear Expansion:	32°F-140°F, 15.4x10-6 /°F, ASTM D696

Grout shall be stored, mixed, placed, and finished in strict accordance with the manufacturer's recommendations.

B.28 Spare Parts

The Contractor shall furnish the following spare parts:

1	Flow divider assembly, complete with flow adjustment features.
1	Set of plugs for each actuator to seal off all ports.
1	Set of plugs for power unit to seal off check valves should pumps be removed from service.
2	Seal kits for hydraulic cylinders jacks.
2	Seal kits of each type and size for all other hydraulic components
1 each	High pressure hose assembly with fittings for each type of hose furnished and installed.
4	Pressure gages with hose and fittings for reading pressure in main drive actuators.
4 each	Replacement elements for all filters and breathers.

Spare parts shall be labeled and organized in such a manner that each spare can be readily identified and associated with the specific hydraulic component for which it is required. Spare parts shall be so placed in a steel cabinet with a padlocked door to be provided by the Contractor and installed in the operator house as directed by the Engineer.

B.29 Speed and Directional Control

B.29.1 General

The speed control of the Bridge Hydraulic System for the lift span shall be provided by mechanically actuated proportional flow valves used together with two fixed displacement pumps. The mechanical actuation of these proportional flow valves shall be by means of small actuating cylinders, controlled by solenoid actuated directional valves. There shall be an electrical panel on the HPU where the hydraulics shall interface with the bridge control system by means of dry contact inputs and outputs. See plans for hydraulic control schematic detail and HPU layout.

B.29.2 Control Theory - Normal Operation

The following is a brief description of operator actions and automatic interlocking during operation with regard to the Bridge Hydraulic System only. Other interlocks with regard to traffic control and sequence prior to operation, as well as more detail regarding the following, are part of the electrical design.

1. Both MOTORS (1)[M1 and M2] are selected. Upon turning on the MOTORS (1), PUMPS (3) will produce initial nominal pressure at the ACCUMULATOR (17), and subsequent flow over SOLENOID VALVE (14)[SV1] which is energized to divert flow back to TANK (42) prior to raising the lift span. ACCUMULATOR SAFETY BLOCK (33)[SV5] and SOLENOID VALVE (37)[SV6] shall be energized and remain energized when either or both MOTORS (1)[M1 and M2] are selected for raising or lowering.

2. Operator has the option to move joystick controller to “RAISE-SLOW” or “RAISE FAST” at will during raising, and to “LOWER-FAST” or “LOWER-SLOW” on the same basis during lowering to control the speed manually, or to stop the span at any time by moving the joystick controller to “STOP”. The pump motors will run when raising the span, and when the joystick is in the neutral position. The pump motors will shut down during lowering of the span, allowing the span to lower by gravity.

    a. Such actions will cause the SOLENOID VALVES (18) [SV3 and SV4] to act in sequence by means of limit switches contacted by the ACCEL/DECEL ACTUATORS (34) at the ends of their strokes. SOLENOID VALVE (14)[SV1] de-energizes after SOLENOID VALVE (18)[SV3] is actuated and LIMIT SWITCH [LS-3E] is contacted.

        (1) When raising or lowering, the selection of “RAISE-FAST“ or “LOWER-FAST” shall initially cause SLOW SPEED SOLENOID VALVE (18) [SV3] to energize, causing the SLOW SPEED ACCEL / DECEL ACTUATORS (34) to extend over a 5 second period (subject to hydraulic adjustment by

means of SLOW SPEED FLOW CONTROL VALVE (35)). When the SLOW SPEED ACCEL / DECEL ACTUATORS (34) is fully extended, thereby having accelerated the span to approximately 1/2 of full speed, a LIMIT SWITCH [LS-3E] shall be contacted that will allow FAST SPEED SOLENOID VALVE (18) [SV4] to be energized. Provided the span has traveled beyond the Nearly Closed position, and has not attained the Nearly Open position (or vice-versa when lowering), this shall cause the FAST SPEED ACCEL / DECEL ACTUATORS (34) to extend, bringing the span to full speed over a 5 second period (again subject to hydraulic adjustment, by means of FAST FLOW CONTROL VALVE (35))

(2) Moving the joystick controller to "RAISE-" or "LOWER-SLOW" from "RAISE-" or "LOWER-FAST" shall cause FAST SPEED SOLENOID VALVE (18) [SV4] to de-energize. This shall cause the FAST SPEED ACCCEL / DECEL ACTUATORS (34) to retract, bringing the span back to approximately 1/2 of full speed over a 5 second period (hydraulically adjustable, as described above).

(3) Moving the joystick controller to "STOP" from "RAISE-" or "LOWER-FAST" shall initially cause FAST SPEED SOLENOID VALVE (18) [SV4] to de-energize. This shall cause the FAST SPEED ACCEL / DECEL ACTUATORS (34) to retract, bringing the span back to approximately 1/2 of full speed over a 5 second period (hydraulically adjustable, as described above). At this point, LIMIT SWITCH [LS-4R] shall be contacted to allow SLOW SPEED SOLENOID VALVE (18) [SV3] to de-energize, causing SLOW SPEED ACCEL / DECEL ACTUATORS to retract over a 5 second (hydraulically adjustable) period, bringing the span to a smooth stop. LIMIT SWITCH [LS-3R] shall be contacted at the fully retracted position of the SLOW SPEED ACCEL / DECEL ACTUATORS.

b. Random movements of the joystick controller by the operator, crossing "STOP" from a "RAISE" speed position to a "LOWER" speed position (or vice versa), without allowing the span to come to a full stop, should be prohibited. However, if such actions by the operator are performed, the following shall occur:

(1) Moving joystick controller from a "FAST" or "SLOW" position in one direction, to "SLOW" or "FAST" position in the opposite direction, shall initially cause FAST SPEED SOLENOID VALVE (18) [SV 4] to de-energize, but shall also cause the pumps to immediately shut down (if running) causing the span to rapidly reverse direction. The Emergency Stop switch only should be used if an emergency stop is required. Otherwise, a normal stop should be used. This will cause the FAST SPEED ACCEL/DECEL ACTUATORS (34) to retract, bringing the span back to approximately ¼ of full speed over a 7 second period (hydraulically adjustable, as described above). At this point, LIMIT SWITCH [LS-4R] shall be contacted to allow SLOW SPEED SOLENOID VALVE (18) [SV 3] to de-

energize, causing SLOW SPEED ACCEL / DECEL ACTUATORS (34) to retract over a 3 second (hydraulically adjustable) period, bringing the span to a smooth stop. LIMIT SWITCH [LS-3R] shall be contacted at the fully retracted position of the SLOW SPEED ACCEL / DECEL ACTUATORS (34).

c. Random movements of the pump (drive) selector switch between ”BOTH” and ”PUMP A” or “BOTH” and “PUMP B” during operation should also be prohibited. However, if these operator actions are performed, it is anticipated that operation will cease momentarily prior to any operation of the pump (drive) newly selected.

3. Power failure during operation shall cause all motors to cease operation and all solenoid valves to de-energize momentarily prior to secondary power source being accessed, provided any delay occurs in the automatic transfer switch.

4. The “EMERGENCY STOP” push button can be used to cease all operation by de-energizing all SOLENOID VALVES and MOTORS. This shall effectively cause the span to stop while the Bridge Hydraulic System depressurizes.

5. If hydraulic pressure is lost in the Bridge Hydraulic System at any point during raising or lowering, as indicated by PRESSURE SWITCH (22) [PS2], all SOLENOID VALVES and MOTORS shall de-energize in the same manner as would occur during an emergency stop.

6. During periods of inactivity, during which the Bridge Hydraulic System remains idle, PRESSURE SWITCHES (22)[PS 14, 24] shall remain energized to detect excess pressure in the JACKING CYLINDERS (23). If a pressure build-up is detected at the JACKING CYLINDERS (23) during an idle period when the span is fully closed, SOLENOID VALVE (24)[SV 14, 24] shall open momentarily to allow the excess pressure to be removed from the JACKING CYLINDERS (23). This feature shall be de-activated during bridge operation and when the span is in any raised position.

B.29.3 Control Theory – Operator Skew Adjustment

See Bridge Electrical Work for resolver indications transmitted to operator console. Upon action by the operator in response to those indications, SOLENOID VALVES [SV31, SV32, SV33, or SV 34] will be energized to cause any high corner of the lift span to be lowered by allowing fluid from the jacking cylinder at that corner to return to the reservoir, thereby causing the jacking cylinder to retract.

B.29.4 Control Theory – Periodic Skew Adjustment

If skew adjustment is required by the operator during each operation consistently, FLOW CONTROL VALVES on the FLOW DIVIDER ASSEMBLY (26) MANIFOLD may be used to adjust the amount of flow to and from an individual JACKING CYLINDER (23) by means of bypassing the FLOW DIVIDERS with a minor amount of flow through the

associated parallel path of controlled flow. Adjustment by opening or closing a FLOW CONTROL VALVE will affect speed of jacking cylinder in both directions.

B.29.5 Control Theory - Emergency Operation

The description of operator actions and automatic interlocking during operation with regard to the Bridge Hydraulic System is identical to that for Normal Operation, except that only one MOTOR (1)[M1 or M2] and PUMP (3) are used to raise the span. Interlocks with regard to traffic control and sequence prior to operation, as well as more detail regarding the following, remain part of the electrical design.

B.29.6 Control Theory - Emergency Lowering

With no electrical power available, the bridge shall be capable of lowering (only) by means of manual and backup battery operation of SOLENOID VALVES (24)[SV13, SV14, SV23, and SV24] at the JACKING CYLINDERS (23), in conjunction with manual operation of SOLENOID VALVE (14)[SV1].

C Construction

C.1 General

Power Technician with prior experience on similar sized systems. Submit back-up information on technician showing prior experience to the Engineer for review and approval.

The Contractor shall be totally responsible for the coordination of the various subcontractors for this project and specifically the coordination of the mechanical, hydraulic, and electrical work in order to assure proper fit up and operation of the various components of the mechanical, hydraulic, and electrical systems. The Contractor shall also be responsible for the shop adjustment and for fine adjustment in the field at the time of start-up.

C.2 Electrical Requirements

All hydraulic equipment shall be wired and connected to the electrical system under ELECTRICAL CONTROL EQUIPMENT unless otherwise noted. The HPU electrical panel shall be installed in the lowest floor of the operator house near the hydraulic power unit as directed by the engineer.

C.3 Hydraulic Cylinder Supports, Bracing, and Attachments

Baseplates and bracing shall be hot-dip galvanized and painted, and shall be set such that the cylinders are within 0.050 inches of the dimensions shown in the plans, both vertical and horizontal in the longitudinal and transverse directions.

All cylinder support component alignments shall be verified by use of laser level or other approved method prior to final mounting of cylinder support components.

Supply all temporary templates, leveling screws, blocking, jacking screws, etc., as required to locate and install cylinder bracing and brackets.

Cylinder supports shall be painted in accordance with the requirements for painting of structural steel.

C.4 Flushing

Using the Contractor's approved plan for flushing the Bridge Hydraulic System after installation, the Contractor shall ensure that all portions of the Bridge Hydraulic System are completely flushed in accord with the following.

The hydraulic fluid shall be used to flush the lines through pressure and return filters to remove any foreign particles from the hydraulic power unit and from the hydraulic lines installed on the approach span. Temporary return hoses, previously flushed with filtered fluid individually, shall be used to connect between various portions of the system and the reservoir while the remainder of the system is isolated. Circulate fluid for at least one hour while consistently monitoring filter-clogging indicators. Repeat one hour flushing procedure for each remaining portion of the Bridge Hydraulic System. Replace filters after flushing is completed.

In portions of the Bridge Hydraulic System that the Contractor deems not practical for flushing using the hydraulic power unit, in accord with the Contractor's approved plan, a portable pump and filtration unit together with any other required equipment, provided by the Contractor, shall be used to accomplish total flushing. The portable filtration unit assembly shall include pressure and return filters of the same filtration capability characteristics as those used in the hydraulic power unit. The portable filtration unit, if necessary, shall become the property of the City at the end of the Contract.

Initial system filling and flushing should be done through a 10 micron filter with an efficiency rating of beta 10<50. Flushing should be done only when atmospheric particles are at a minimum (no current or recent sandblasting or painting). Check reservoir condition through clean-out covers. All surfaces should be clean of dirt, rust or moisture. Once the reservoir has been determined to be clean, charge the reservoir with the proper fluid for final use in the system. Replace return filter once reservoir is filled for final use. Spares shall not be used as replacements.

C.5 Inspection, Testing, and Final Acceptance

C.5.1 General

Fabrication of the hydraulic power units, cylinders and control panel shall be done in a qualified shop. The City will send an inspector to the shop for verification of compliance and witnessing of shop testing prior to shipment of any equipment to the field. Prior to testing, the Contractor shall notify the Engineer three (3) weeks in advance for the ability to witness the components during testing. No testing shall be performed without the presence of the Engineer or Engineer's representative unless the Contractor has been otherwise directed, in writing, by the Engineer.

Shop testing shall be required of the HPU, flow divider assembly, jacking cylinders, and HPU terminal panel as a unit. The procedure shall be comprehensive and shall test the equipment system for functionality at full power under simulated loads and load changes

and shall incorporate the assembled HPU panel. Each cylinder shall be tested through 50 cycles while under a simulated maximum load for the full stroke of the cylinder. This test procedure shall be submitted to the Engineer for review.

All malfunctions shall be recorded and corrected and re-tested before release from the manufacturer's shop. After each cylinder and HPU, including the HPU panel, have passed the test a Certificate of Compliance shall be submitted with the test reports to the Engineer for review.

In the event the Contractor should propose an alternate design which deviates from the designs shown in the plans, it shall become the responsibility of the Contractor to provide sufficient back-up data and working examples to demonstrate the functionality of the design. These working examples shall be of large dynamic structures similar in concept to a vertical lift bridge. This data shall be compiled and neatly organized and submitted to the Engineer along with the proposed hydraulic drive system for review. No material submitted shall relieve the Contractor from performing the hydraulic power unit testing as required of this Specification.

When testing the HPU, the assembled HPU control panel shall be present and interfaced to the HPU to provide required signals for control.

C.5.2 Shop Testing

Additional requirements for shop testing are as follows:

1. Hydraulic Power Unit Testing
    a. Full flow pump testing
    b. Pressure test to 1.5 times the maximum specified working pressure (1.5 times the main relief valve setting).
    c. No visible external leakage permitted.
    d. Electric motor performance at various pressure levels.
    e. Verify limit / pressure switch and warning functions at the HPU panel.

2. Cylinder Testing
    a. Pressure tested to 4,500 psi each direction. The use of compressed air to retract at end of test is not allowed.
    b. No visible external leakage permitted.
    c. Verify manifold operation and manual release of solenoid valves.

In addition to the above requirements, the Contractor shall complete two checklists, one for the cylinder manifold assembly shop test report and one for the HPU shop test report. The following information shall be provided in the report:

1. Cylinder Manifold Assembly
    a. Is block free of chips and dirt?
    b. Are all customer's connections per drawing?
    c. Do components agree with parts list?

d. Are all labels affixed?
e. Are all bolts properly torqued?
f. Is manifold complete per assembly drawing and parts list?

2. Cylinder Manifold Test
   a. What type of fluid used to test manifold?
   b. Flow tested at manifold
   c. Pressure tested at manifold
   d. Are components adjusted according to schematic?
   e. Do labels agree with schematic?
   f. Is external leakage zero?
   g. Does manifold function according to schematic?

3. HPU Assembly
   a. Visually check reservoir inside (Free from moisture, rust, slag or chips)
   b. Are pipes routed correctly?
   c. Electric Motor requirements (Model, Make, Type, Voltage, Amps, RPM, Hz, Frame, Service Factor, and Class)
   d. Are fittings correct and per the parts lists?
   e. Are all down pipes in reservoir clean?
   f. Do components agree with parts list?
   g. Is power unit built according to the contract drawings and approved shop drawings?
   h. Do connections agree with schematic and arrangement drawings?
   i. Does piping agree with schematic requirements?
   j. Are filters accessible for changing?
   k. Are manual overrides accessible?
   l. Are direction of rotation arrows in place and correct?
   m. Does unit have required labeling affixed?
   n. Has correct fluid been supplied?
   o. Fluid installed using required pre-filtration?

4. HPU / Flow Divider Assembly / Jacking Cylinders System Test
   a. Does reservoir leak? Check seams and welds.
   b. Test electronics on unit (Temp, Level, etc.)
   c. Pump settings (Pressure and Flow)
   d. Voltage and amperage of motors while running.
   e. Are components set properly and according to the schematic and shop drawings?
   f. Are all fittings and flanges tight?
   g. Do jacking cylinders extend and retract at an equal rate with simulated load applied to all jacking cylinders?
   h. Is skew adjustment successful by means of both operator control (through the use of solenoid valves on the flow divider assembly) and by manual adjustment of flow control valves?

During placement of any of the new Bridge Hydraulic System in operation, the Bridge Hydraulic System Supplier and Installer shall be on site to inspect the installation of the hydraulic system to ensure it is installed to the supplier's requirements and tolerances. The Bridge Hydraulic System Supplier and Installer shall furnish a letter to the Engineer after the inspection certifying that the installation is acceptable and in conformance to the requirements of the Bridge Hydraulic System Supplier and Installer.

The City shall be notified to have a representative present during field testing of the main drive system.

C.5.3 Field Testing

Field test requirements shall demonstrate full operation of the system under all potential conditions including the following:

1. After all components (tubing, valves, etc.) of the fluid system have been physically torqued and inspected, obtain power source for the motors.
2. All pressure relief valves and pressure switch settings which were not verified as part of the HPU testing in the shop shall be verified by testing that shall be recorded in the field.
3. Cylinders shall be tested for pressure being exerted during operation, and for any leakage.
4. Using the HPU control panel, fully open, close, and seat span. During this time, adjust flow control valves (35) to obtain correct speeds and ramps from Accel / Decel Valves (16) and (19).
5. After several operations of step 4, check all areas for leaks, fluid temperature, and motor current drain. Connect all control wiring for console system test.
6. Repeat using auxiliary mode and emergency power.
7. Demonstrate all interlocks, emergency stopping indications, etc.

After system start-up is complete and unit is properly adjusted, the Contractor shall draw an oil sample from the reservoir using accepted NFPA techniques and equipment. This sample shall be analyzed for particle content by a qualified laboratory. The report shall be forwarded, in shop drawing format, to the Engineer for review and approval. Cleanliness level shall be 18/14 based on ISO DIN 4406 Standards. If this level is not achieved, the Contractor shall be responsible to clean oil until proper cleanliness level is verified through re-sampling of the fluid.

The Contractor shall operate the bridge ten (10) times consecutively both on the main drive and on the auxiliary drive system, without problems, prior to final acceptance.

D Measurement

The City will measure Bridge Hydraulic System, completed in accordance to the contract and accepted, as a single complete unit of work.

E Payment

The City will pay for the measured quantity at the contract unit price under the following bid item.

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.250	Bridge Hydraulic System	LS

Payment is full compensation for furnishing all labor, material, tools, and equipment necessary to manufacture, assemble, install, erect, lubricate, paint, and perform all incidental work to achieve a complete and acceptable installation. Submit to the engineer a detailed breakdown of costs under this item. The engineer will evaluate this breakdown, and has the authority to revise the breakdown as, in his/her judgment, may be required to make the various components of work conform to their true values. The contractor agrees that the detailed breakdown will not become effective until it has been approved by the engineer.

The approved detailed breakdown will be used as a basis of payment for the progress payments. The progress payments for Item "Bridge Hydraulic System" will be made in accordance with the City of Milwaukee, Department of Public Works and the City's standard payment practices and in the following manner:

1. Upon completion and acceptance by the City of shop fabrication, shop inspection, shop testing, and delivery and storage of materials, the contractor will be paid 30% of the bid price for the item.

2. Upon completion and acceptance by the City of the hydraulic power unit, hydraulic cylinders and piping as a complete installation, including alignment, bolting, and protection of materials, the contractor will be paid 20% of the bid price for the item.

3. Upon completion and final acceptance by the City of the hydraulic system inspection and field testing, the contractor will be paid 40% of the bid price for the item.

4. Upon completion of training and receipt and acceptance of approved Operating and Maintenance Manuals, the contractor will be paid the remaining 10% of the bid price for the item.

Payment for furnishing electrical work associated with the bridge hydraulic system including wiring to motors, pumps, valves, and switches is not part of this item, but is paid for elsewhere in the Special Provisions.

56. Bridge Electrical Work, Item SPV.0105.300.

A Description

A.1 General

Under this item, furnish, install, test, and place in satisfactory operating condition the complete electrical system for control and operation of the St. Paul vertical lift bridge, including a control desk, switchboard cabinet, relay cabinet, closed circuit television

system, communication components, field start up service, spare parts and all required provisions for interlocking complete with all accessories as specified herein and as shown on the plans. In addition to the above, furnish, install, test and place in satisfactory operating condition a new remote control operation for the Michigan Street bridge from the St. Paul bridge including a new remote control panel, Programmable Logic Controller (PLC) for the remote control operation, closed circuit television system, intercom system and remote control system modifications of the Michigan Street Bridge as required and field start up service for the remote control operation.

The remote control system shall interface with existing relay based control system located at the Michigan Street Bridge and shall be fully compatible with the new PLC equipment provided for the remote operation from the St. Paul Bridge.

The control system specified herein for the St. Paul Bridge shall be coordinated as required, with the work of all other sections of the specifications and the plans, so that all installations shall operate as designed. Specific coordination is directed toward mechanical/hydraulic work.

The work also includes removal of the existing electrical system from the bridge. Carefully remove the existing control console, switchboard cabinets, traffic gates and navigation lights and deliver them to the city at a site provided by the city. Remove and dispose of all existing conduit and wiring.

Any apparatus, device, circuit, appliance, material, or labor not herein specifically mentioned or included, but that may be found necessary to complete or perfect the installation and equipment in a manner acceptable to the engineer, shall be furnished by the contractor as if specifically included in these specifications, and without extra cost to the City.

A.2 Reference Standards.

Portions or all of certain recognized industry or association standards referred to herein as being a requirement of these specifications shall be considered as binding as though reproduced in full herein unless supplemented and/or modified by more stringent requirements in this specification. Unless otherwise stated, the reference standard shall be the standard which is current as of the date of issuance of these specifications. Reference may be made to standards either by full name or, for the sake of brevity, by letter designation as follows:

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute, Inc.
ASME	American Society of Mechanical Engineers
AWG	American Wire Gauge

EPA	Environmental Protection Agency
IES	Illuminating Engineering Society
ICEA	Insulated Cable Engineer's Association
JIC	Joint Industrial Council
NEC	National Electrical Code of NFPA
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
UL	Underwriters' Laboratories, Inc.

A.3 Permits and Codes.
The electrical installation shall comply with the National Electrical Code and all applicable laws and ordinances in effect at the construction site and with regulations of the utility companies furnishing power and telephone services to the site.

Obtain approval from the Coast Guard for any temporary construction navigation lighting required.

File with the engineer a certificate of final electrical inspection and acceptance by the Board of Fire Underwriters or an approved inspection agency.

A.4 Drawings and Specifications.
A.4.1 General
Omissions from the drawings and specifications, or the mis-description of details of work which are evidently necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the contractor from performing such omissions and details or work, but they shall be performed as if fully and correctly set forth and described in the drawings and specifications. In any case of discrepancy in figures, catalog numbers, or descriptions in the drawings or in the specifications, the matter shall be properly submitted to the engineer who shall promptly make determination in writing. Any adjustment in the plans by the contractor without written approval shall be at the contractor's own risk and expense.

A.4.2 Equipment Locations. The layout drawings show, in general, the arrangements and location of all equipment. This shall be considered as illustrative and subject to the approval of the Engineer; the Contractor shall modify it as necessary, for complete and proper construction and operation. The location of the conduits, boxes, and equipment shown on the plan is diagrammatic only, and may be subject to shifting as required or as

the engineer may direct in order to conform to local conditions. The design drawings may be utilized in the preparation of the shop or as-built drawings showing the permanent construction as actually made.

A.4.3 Circuit-and-Raceway Schedules.
Specification and data sheets for most of the circuits and raceways are included in the drawings. These data sheets fully describe the raceways shown on the plan sheets, and fully describe the circuits enclosed in the scheduled raceways. Raceways and circuits used solely for lighting and general purpose receptacles are shown only on the plans, and are not included in the schedules.

The Raceway Schedule is keyed to the raceway numbers as they appear on the plan sheets. The schedule gives the raceway type (galvanized steel - GRS, PVC coated rigid steel - PVGRS, etc.), fill (total area of enclosed circuits) trade size (nominal inside dimension), and a list of the enclosed circuits.

The Circuit Schedules are keyed to the circuit numbers as they appear in the wiring diagrams. The schedules give the origin and destination of each circuit, the number of cables in the circuit, the description of each cable in the circuit (size in AWG, type per data sheets in this specification, and number of conductors in each cable), area of each cable, and a listing of all the raceways that the circuit is routed through.

B Materials.
B.1 General.
The Electrical Equipment and its installation shall be in accordance with regulations of the NEC and shall conform to Division II, Group B of the latest revision, for movable bridges of the American Association of State Highway and Transportation Officials except as otherwise provided herein.

All materials and equipment furnished under these specifications shall be new and, to the extent possible, standard products of the various manufacturers. Where more than one of any specific item is required, all shall be of the same type and manufacturer. Items of equipment or material which are not specifically defined herein shall conform to the general standard of quality established herein.

Each piece of electrical equipment and apparatus shall have a permanent type corrosion-resisting metal nameplate on which is stamped the name of the manufacturer, the catalog or model number, and the rating or capacity of the equipment or apparatus.

All electrical devices, printed circuit boards, including their components, and any other electrical or electronic parts, shall be completely identified in such a way as to be easily procured from a supplier of that device. All prints and drawings of same shall show complete circuitry and identify all components as to their specific use and function in the circuit.

Retain the services of a qualified control system integrator who shall have complete system responsibility for the detailed integration of all system components, in order to ensure a complete operating system is furnished and installed in accordance with specified requirements of this project. The control system integrator shall be responsible for ensuring total compatibility of all equipment and devices furnished and installed and shall provide supervisory assistance in the selection, installation and integration of all bridge control system and associated equipment. Components associated with bridge control system include but shall not be limited to control console, switchboard cabinet, relay cabinet, remote control console, programmable controllers, modems, computer and interfacing equipment and other facilities as may be required.

The control system integrator shall be responsible for the review of shop drawings, prior to submission to the engineer, to ensure that all components of the bridge operating system submitted for use are compatible in every respect and that all components meet or exceed the specific requirements and intent of the project. The total bridge operating system shall be subject to the approval of the engineer, based on the specified project requirements.

The control system integrator shall ensure maximum reliability and ease of maintenance for all components of the operating system and shall be responsible for all training of the bridge operator staff and for the supervision of all trial operations. The system integrator must have demonstrable competence in providing electrical control systems for movable bridges of various types, particularly vertical lift types, but including lift and swing type bridges utilizing programmable controllers and fiber optic communications. Such competence shall be demonstrated by identifying a minimum of (3) three movable bridges for which he has provided complete systems within the past five years.

The control system vendor shall be of a caliber and background similar to that of Link Controls, Inc. of Ronkonkoma, NY, (631) 471-3950, Panatrol Corp, Burr Ridge, IL, (630) 655-4700 or approved equal.

System integrator shall make available a field service staff with the capability of providing services for field coordination of construction and final adjustments to the control system and the remote control operation to the satisfaction of the engineer. Field staff shall be capable of responding, at the site, to an emergency within 24 hours.

Name and written qualifications of the proposed system vendor shall be included in the bid proposal and shall be subject to approval by the engineer.

All ferrous metal work shall be hot-dip galvanized in accordance with ASTM A123 or ASTM A153, whichever is applicable. If any galvanizing is damaged, the metal work shall be refinished by cleaning and painting, with two coats of approved galvanizing repair paint, or approved zinc chromium paint.

Lock washers shall be provided on all mechanical fastenings.

In order to prevent deterioration due to corrosion, all bolts, nuts, studs, washers, pins, terminals, springs, hangers, cap screws, set screws, tap bolts, brackets, and other hardware fastenings and fittings shall be of an approved corrosion-resisting material such as silicon bronze, or stainless steel. Hot-dip galvanizing, per ASTM Specification A-153, will be considered approved treatment for all non-moving ferrous hardware.

B.2 Shop Drawings

Within 90 days after execution of the contract, submit shop drawings to the engineer. Submit full size drawings for those items requiring construction from such drawings. Provide descriptive leaflets for standard catalog items which are mass produced.

Submit shop drawings for all cabinet enclosures, motors, panel boards, span brakes, transformers, switches, raceways, conductors, wiring devices, lighting fixtures, lamps, service equipment, boxes, control equipment, fasteners and other such equipment, and methods of fastening to structures. No equipment is to be purchased without approval of shop drawings. The control system vendor shall review, coordinate and prepare as necessary all shop drawings pertaining to the bridge operating control system before submitting these drawings to the engineer for his review.

Shop drawings shall include manufacturer's test data, shall be certified by the manufacturer, and shall identify the application for which they are proposed.

Equipment identification shall be the same as shown on the drawings. Standard drawings showing more than one model or size shall be marked to indicate the model or size proposed.

Shop drawings of cabinets containing electrical equipment shall include outside dimensions, areas for conduit penetrations, one-line and three-line diagrams, wiring diagrams, schematic and interconnection diagrams, terminal block arrangements and numbers if such terminal blocks are intended for connection of field wiring, and operating instructions.

Provide layout drawings and geographic wiring diagrams for the control desk and for the programmable controller cabinets.

Submit shop drawings when installation and mounting details of switches, fixtures, and devices are different from or not specifically detailed on the drawings.

If requested by the engineer, submit for inspection samples of the proposed substitute items at no additional cost to the City. Submit all support data in quintuplicate for checking. Neither the City nor the engineer will be liable for any materials purchased or work done or any delay incurred prior to their review. Failure of the engineer to note unsatisfactory materials as received will not relieve the contractor from responsibility. Deliver manufacturers' guarantees or warranties on materials to the engineer upon receipt of the materials.

Working drawings shall be made on standard 22 in. x 34 in. sheets. Catalog cuts and manufacturers' standard drawings may be submitted on their respective standard sizes. Submit them to the engineer for review and distribution.
The engineer will not be responsible for errors of working drawings, even though approval has been indicated, or for quantities or bills of material which may be included. Any failure of the engineer to correct errors on working drawings, or implied approval thereof, shall not relieve the contractor of the full responsibility for the safe and adequate execution of the work in accordance with the plans and specifications.

After review of the working drawings by the engineer, no changes shall be made without resubmission for approval by the engineer, and all changes or revisions later made shall be clearly marked and dated.

Before final payment is made, deliver to the department two sets of as-built drawings reflecting all changed or modifications made from the contract drawings having to do with the finished structure. One set of as-built drawings will be given to the city.

As-built drawings shall be suitable for permanent storage, and any reproducible material which is subject to fading when exposed to light will not be acceptable.

B.3 References
Reference to a particular product by manufacturer, trade name, or catalog number establishes the quality standards of material and equipment required for this installation and is not intended to exclude products equal in quality and similar in design. Whenever any article, materials, or equipment is defined by describing a proprietary product, or by using the name of a manufacturer or vendor, the term "or approved equal", if not inserted, shall be implied, except as otherwise noted.

B.4 Substitutions
Reference to a particular product by manufacturer, trade name, or catalog number establishes the quality standards of material and equipment required for this installation and is not intended to exclude products equal in quality and similar in design.

Equipment for which an acceptable manufacturer is not specifically named, or named equipment for which substitution is proposed, shall be manufactured by a company which has had a minimum of ten years of experience in the manufacture of similar equipment and which, in the engineer's opinion, has demonstrated its proficiency in the manufacture of such equipment. All equipment will be subject to the engineer's approval.

B.5 Structural Steel
Material for support of limit switches shall conform to the requirements of ASTM A36 structural carbon steel and be galvanized and painted. Bolts used shall be galvanized and painted per the section on Bridge Painting in these Special Provisions and conform to the requirements of ASTM A325 Type 1 bolts and hardened steel washers shall be provided as shown in the plans.

C Construction

C.1 General.

All construction and installation shall be made by workmen skilled in this type of work and under the supervision of an experienced and qualified electrical supervisor. In addition, the approved control system vendor shall provide supervisory assistance to the electrical contractor as specified herein. All work shall be executed in a neat and workmanlike manner and shall present a neat and mechanical appearance when completed. Upon completion of the contract, deliver to the engineer a corrected plan showing in detail all changes on construction from the original plans, especially location and sizes of conduits, complete schematic circuit diagrams and the like.

Provide all terminal strips with approved permanent terminal markings for each connected conductor in service. Place the marking on a material which will not be affected by age or moisture and apply two coats of clear lacquer after placing the markings.

C.2 Raceways.

C.2.1 General

All conduit shall be of the material called for in the plans. All conduits shall be free from blisters, cracks, or injurious defects. Wiring troughs (wireways) shall be NEMA 12 rated.

Raceway sizes shall be as shown on the plans, and shall be 3/4" minimum trade size.

C.2.2 Galvanized Rigid Steel Conduit

The conduit shall be UL listed and shall comply with the requirements of ANSI Standard C80.1 "Specifications for Rigid Steel Conduit (Zinc-Coated)". Manufacturers shall be Allied, Steel duct, Triangle, Youngstown, or approved equal.

All rigid steel conduit fittings shall be hot-dip galvanized after fabrication in accordance with ASTM-A153. Manufacturer shall be Appleton Electric, Crouse-Hinds, O.Z./Gedney, Pyle-National, Russell & Stroll, Thomas & Betts, or approved equal.

After field threading, re-galvanize all steel conduit with "Zinc Rich", "Zincilate 810", or "Galvanizing Powder M-321". Apply this material in the field, immediately after the conduit is threaded and cleaned.

C.2.3 PVC Coated Galvanized Rigid Steel Conduit

The PVC coated galvanized rigid conduit shall be UL listed. The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid metal conduit and be UL Listed. The PVC coated rigid galvanized steel conduit must be certified and authorized to apply the ETL Verification Mark “ETL Verified to PVC-001”. ETL Verified to :Intertek ETL SEMKO High Temperature H2O PVC Coating Adhesion Test Procedure. Continued compliance to this specification is monitored through production testing, quarterly inspections by Intertek ETL SEMKO at production facility and random sample testing. Ferrous fittings for general service locations must be UL Listed with PVC as the primary corrosion protection. All conduit and fittings must be

new, unused material. The PVC coating shall be gray, 40 mils in thickness, and be free of blisters, bubble, or pin holes. Applicable UL standards may include: UL 514B Standard for Safety, Fittings for Conduit and Outlet Boxes. Conduit and fittings shall be evaluated for reliability and performance. Certified test results are the respective test data that have been witnessed and certified to be accurate by an independent, recognized third party. Acceptable conduit and fitting PVC bonds shall be confirmed with a minimum average of 30 days in a heat and humidity test (ASTM D1151 and D2247) with the temperature at 150 degrees F and 95% humidity. Acceptable seal performance shall be confirmed at 15psig (positive) and 25 inches of mercury (vacuum) for 72 hours. Manufacturer shall be Perma-Cote Industries or approved equal by Plasti-Bond or Rob-Roy.

All conduit and fittings shall be hot-dip galvanized inside and out with hot galvanized threads prior to applying plastic coatings. All exterior surfaces shall be coated with a heat polymerizing adhesive not to exceed .0005" thick prior to plastic coating. The exterior plastic coating shall be bonded to the metal with a thickness of .040" nominal the full length of the pipe except the threads. Interior coating shall be 2 mil minimum urethane.

Repair any nicks or gouges in the PVC coating after installation with manufacturer's approved touch-up compound to restore corrosion protection.

All fittings, support struts, pipe clamps, etc, shall be PVC coated to meet all requirements of the conduit manufacturer.

C.2.4 Liquid-tight Flexible Metal Conduit

Liquid-tight flexible steel conduit shall be constructed of a flexible galvanized steel core made from continuous steel metal and an extruded PVC cover. Conduit shall be Anaconda Type UA, Electri-Flex Type LA, Rob-Roy Flex, or approved equal.

Fittings shall have insulated throat and be UL labeled. An "O" ring assembly shall be used on each fitting. Manufacturers shall be Appleton Electric, Ideal Industries, Thomas & Betts, or approved equal.

C.2.5 Rigid Nonmetallic Conduit

The conduit shall be rigid polyvinyl chloride, schedule 80, 90 degree C, of the sizes indicated on the plans and shall conform to the NEMA standards. Conduit shall be UL listed in conformity with Article 347 of the National Electric Code. Conduit, fittings, and cement shall be produced by the same manufacturer who shall have had at least five years experience in manufacturing these products. All joints shall be solvent welded in accordance with the recommendation of the manufacturer.

C.2.6 Wireways

Wireways shall conform to NEMA Standards for wireways. Installation of wireways are to be installed within the control tower only and are not permitted in the pier areas or in outdoor locations and shall be of the size indicated on the plans. Wireways shall be NEMA 1 rated and constructed from 14 gauge steel. Access covers shall be of the

hinge/screw type to permit easy access to lay in cables. Wireways shall be finishes with ANSI 61 gray polyester power coating both inside and out over phosphatized surfaces.

Provide wireways at the elevation and locations shown on the plans. The interconnections of the sections, fittings and other components shall provide a rigid mechanical assembly with splice plates properly installed to avoid structural weakness. Locate wireway splices at the ¼ points of the span between supports.

Wireways shall run parallel or perpendicular to the main structural lines of the building. Wireways shall be mechanically connected at joints, fittings, and terminations, and shall provide a continuous ground path.

Support wireways trays as shown on the drawings, at the midpoint of each horizontal bend and in accordance with manufacturer's recommendations.

C.2.7 Installing Raceways

Connect conduit sections to each other with screw couplings, made up so that the end of both conduits will butt squarely against each other inside of coupling and non-metallic conduit shall be solvent welded in accordance with the manufacturer's recommendations. Install conduits so as to be continuous and watertight between boxes or equipment. Protect conduits at all times from the entrance of water and other foreign matter by capping or well plugging overnight and when the work is temporarily suspended.

Install all conduits so that they will drain properly. Provide drainage tees at low points where required.

All field bends shall be long sweep, free from kinks, and of such easy curvatures as to facilitate the drawing in of conductors without injury. Conduit runs shall be made with as few couplings as standard lengths will permit, and the total angle of all bends between any two boxes shall not exceed 360 degrees. Long running threads will not be permitted.

Pull boxes shall be used wherever necessary to facilitate the installation of the conductors. Condulets shall not be used for pulling more than ten conductors or for making such turns in conduit runs or for branching conductors, except for indoor wiring to lighting fixtures and receptacles.

Galvanized rigid steel (GRS) conduit shall be installed only within the control towers and where the areas remain dry. PVC coated rigid steel (PVGRS) shall be installed within the pier areas and in areas where the conduit will be exposed to wet environments. Rigid non metallic (PVC) conduit shall be installed where ever the raceway is to be buried below grade or within concrete.

All conduit fittings shall be of the same type material as the conduit installed.

Where conduits pass through the floors or walls of the control room, galvanized rigid conduit sleeves shall be provided for free passage of the conduits. After the conduits are

installed, caulk the opening with an elastic fireproof compound and escutcheon plates provided on the interior walls, ceilings, and floors for airtight fits.

Where wireways pass through floors or where conductors are required through floors for access to electrical equipment as shown on the plans, fill the openings and caulk with a fire proofing sealant after all conductors are installed. Where conductors pass through floors without the use of a wireway, provide escutcheon plates. Where wireways pass through floors, access panels shall be removable on both sides of the floor penetration when applicable. Sealants shall be manufactured by Carborundum, Dow Corning, Nelson Fire Stop Products, or approved equal.

Exposed raceway runs shall be straight and shall be parallel or at right angles to the general structure lines. Attachment to steel or concrete in the pier areas shall be by PVC coated fittings, straps, or hangers held at not less than two points by stainless steel bolts or lag screws. Concrete inserts shall be Unistrut, B-line, Midland Ross, or approved equal, fabricated from stainless steel. Conduits mounted exteriorly on parts of the steel work shall be set not less than 2 inches clear from the supporting structure to prevent accumulation of dirt, and they shall be securely clamped to the steel work to prevent rattling and wear. The clamps, in general, shall consist of U-bolts attached to angle or channel iron supports bolted to the members. The spacing of the clamps shall not exceed 6 feet.

Supports for electrical work which are fabricated from structural plates or shapes bolted to structural members and which are shown or requested to be included on the steel drawings, will be paid for under the items shown on the plans. Additional alterations and supports not shown or requested, but that are found necessary after completion of steel fabrication plans, shall be included for payment and additional compensation will not be considered.

See "Bridge Hydraulics" for coordination with bridge hydraulic system.

At any point where a conduit crosses an expansion joint, or where movement between adjacent sections of conduit can be expected, install bronze or alloy expansion fittings equal to Type AX as made by the O.Z. Electrical Manufacturing Company, Inc., Hope, Spring City, or approved equal.

Use of flexible conduit is allowed only for the connection of motors, limit switches, and other devices that must be periodically adjusted in position. Connections between the rigid conduit system and all movable motors, and movable limit switches shall be made with flexible conduit with couplings and threaded terminal fittings. The flexible conduit shall be fully interlocked and shall be Type RT-6 as made by the Flexonics Corporation, Type UA-OR as Anaconda's Sealtite, Carflex by Carlon, or approved equal. Flexible conduit extensions shall not exceed 24 inches in length and shall be equipped with bonding jumpers.

All conduits shall be carefully cleaned, both before and after installation. Upon completion of the conduit installation, clear each conduit with a tube cleaner equipped with a mandrel of a diameter not less than 80 percent (80%) of the nominal inside diameter of the conduit, and shall then draw in the conductors.

Provide both ends of each conduit run with a brass tag having a number stamped thereon in accordance with the conduit diagrams. Securely and permanently fasten these tags to the conduit ends with bare copper wire.

C.3 Conductors.

C.3.1 General

Furnish insulated conductors and conductor accessories in sufficient quantities for a complete installation. Installation shall be in accordance with the National Electrical Code, and shall include placement, splicing, terminating, identification, testing, and verification of each circuit and conductor.

Conductors at 480 volts (power conductors) potential shall not be routed in the same raceway as conductors at 120 volts potential or less (control conductors).

Cable types, as shown on the plans, shall be as shown on the cable data sheets. The "type" as shown on the circuit schedules in the plans is the "type" referenced to at the top of each cable specification sheet. Unscheduled conductors for lighting circuits shall be Type B.

The "Outside Diameter" is the nominal diameter used to calculate the required conduit size. If actual cables used are of larger diameter, the contractor shall increase the size of the affected conduits, as required by the NEC, at no additional cost to the City.

C.3.2 Acceptable Manufacturers

Acceptable manufacturers for types B, D, G, and H are American Insulated Wire, Okonite, Southwire or approved equal. Acceptable manufacturers for type E are Okonite, American Insulated Wire, Belden or approved equal. Acceptable manufacturers for type FO are Belden, Alpha, Anixter or approved equal.

Provide a durable marking on the outer surface of all cables or conductors at intervals not exceeding 24 inches. Marking shall include manufacturer's name, insulating material, conductor size, and voltage class.

Each conductor, of power, control and signal wiring, shall be color coded with colored insulation. Color coding of power wiring shall be black for Phase A or 1, red for Phase B or 2, blue for Phase C or 3, white for neutral, and green for equipment ground. Switch legs for local wall switches shall conform to local Code requirements.

C.3.3 Circuit Identification

Each circuit, as shown in the Circuit Schedule on the plans, shall be identified at both ends with an identification tag. Tags shall be of an opaque nylon material arranged to include a marker board, non-releasing holding device, and cable fastening tail. The marking board shall be not less than 3/8 inch wide x 3/4 inch long, and 25 mils thick, roughened on one side to hold black nylon marking ink from a permanent marking pen. Identification shall be permanent and waterproof. Once installed, the tie shall not be removable except by cutting it loose from the cable.

C.3.4 Installation or Placement

Draw the wire and cables into conduits without causing injury to the wires or their insulation or covering.

Install all cables as recommended by the manufacturer. Adhere to the manufacturer's recommended maximum pulling tension and minimum bending radius during installation. Use the necessary guides, pulleys, sleeves, and pulling aids to prevent abrasion and damage to the cables during installation. Use lubricants recommended by the cable manufacturer and acceptable to the engineer for the pulling of conductors or cables. Permanently and clearly tag both ends of every single length of conductor with approved tags marked in accordance with the same number and designation shown on the wiring diagrams. Connect all outgoing wires No. 8 AWG or smaller in the control desk, on the switchboards and panels and in terminal cabinets to terminal blocks.

Spare conductors of a multi conductor cable shall be left at their maximum lengths for possible replacement of any other conductors in the cable. Coil each spare conductor and then tape it to the conductors being used.

Twisted shielded pair conductors or instrument conductors shall not be terminated at any point except at point of origin or point of finish. When instrumentation cables are required to cross the channel, cable run shall be continuous without cuts or splices. Should an occasions develop instrument conductors may be required be cut and spliced in order to connect to other instrument conductors, the individual conductors and shielding shall be spliced in accordance with the manufacturer’s instructions. The splice connections shall then be taped and wrapped to ensure adequate seal from noise and environment in accordance with the manufacturer’s instructions.

Conductors inside terminal boxes and at the control panels and control desk shall be installed in plastic wire ways or shall be neatly formed into cables and laced with two strands of an approved wax-treated linen cord or plastic tie-wraps, with the individual conductors leaving the cable at their respective terminal points. These conductors shall be looped to allow not less than 3 inches of free conductor when disconnected. These formed cables shall be held securely away from the terminals and from contact with the cabinet by means of approved insulating supports. Wiring duct meeting JIC standards will be acceptable.

All terminal strips shall be provided with approved permanent terminal markings for each connected conductor in service. The marking shall be placed on a material which will not be affected by age or moisture and shall be given two coats of clear lacquer after the markings are placed thereon or as stated elsewhere in these Specifications.

Splicing of conductors will not be permitted except for wiring to service lighting fixtures and receptacles.

All splices, T-taps, and free ends of 600 volt cables shall be insulated. General use cables shall be insulated with type 33 tape. High ambient cable shall be insulated with type 70 tape.

Wherever it becomes necessary to terminate, joint, or branch conductors, terminal blocks in boxes shall be used.

Cable connections for No. 8 and smaller, for making terminations and splices shall be with high pressure indent type pressure connectors. Connectors shall be copper and as manufactured by Buchanan Products, Burndy, Thomas & Betts, or approved equal.

Cable connections for No. 6 and larger for making terminations, T-taps, and splices shall be with a high compression or bolted type pressure connector. Compression connectors shall be installed as recommended by the manufacturer using the recommended tooling for installation. Bolted connectors shall have a non-rotating pressure cap and as manufactured by Burndy, O.Z. Electric, Buchanan, or approved equal.

C.3.5 Tests after Placement

All insulated conductors shall be electrically tested after placement. All circuits, including lighting circuits, shall be tested with the circuit complete except for connections to equipment. All splices shall be complete prior to testing. Any circuit failing to test satisfactorily shall be replaced, or repaired and retested as directed by the engineer. All equipment and labor required for testing shall be provided by the contractor.

All insulated conductors shall be tested for continuity and conductor identification. In addition, all insulated conductors of multi-conductor cable shall be tested for short circuits. Furnish portable, battery powered, ring testers, and other test equipment as required for these tests.

(1) Continuity tests shall include all tests necessary to confirm that each conductor is continuous throughout its entire length.

(2) Identification tests shall include all tests necessary to confirm that the conductor being investigated originated and terminates at the locations designed in the Circuit List or indicated on the drawings.

(3) Short circuit tests shall include all tests necessary to confirm that no conductor of a multi-conductor cable is short circuited to another conductor in that cable.

(4) Power and control cable rated below 2,000 V. - All insulated conductors, except instrumentation cable, rated less than 2,000 v. shall be tested with a 1,000 v. megger or an equivalent testing device. Insulation resistance measurements shall be made between each conductor and ground and between each conductor and all other conductors of the same circuit. Minimum acceptable resistance values shall be in excess of 100 Megohms.

(5) Instrumentation cable - All insulated conductors of supervisory and communication cable shall be tested with a 500 v. megger or an equivalent testing device. Insulation resistance measurements shall be made between each conductor and the cable shielding tape and between the two conductors in each pair. Minimum acceptable resistance values shall be 50 Megohms divided by the actual cable length in miles.

TYPE B

600 Volt Single Conductor Flame Resistant Power Cable

DESCRIPTION:

Reference: ICEA S-66-524

Conductor: Class B Stranding, 90 DEG C, Standard Round Uncoated Copper

Insulation: Flame Resistant Cross Linked Polyethylene

Jacket: None

UL Listing: THWN

Tests: Flame Test Requirements per IEEE 383, using a gas burner flame source.

DETAILS:

Size (AWG)	Number of Strands	Insulation Thickness-Inches	Outside Diameter-Inches
12	7	.030	0.16
10	7	.030	0.18
8	7	.045	0.24
6	7	.045	0.28
4	7	.045	0.35
2	7	.045	0.40
1	19	.055	0.46
1/0	19	.055	0.51
2/0	19	.055	0.57
3/0	19	.055	0.60
4/0	19	.055	0.66
250	37	.065	0.73
350	37	.065	0.84
500	37	.065	0.97

TYPE D

600 Volt Multi-conductor No. 12 AWG
Flame Resistant Control and Power Cable

DESCRIPTION:

Reference: ICEA S-66-524

Conductor: 12 AWG, 7 Strand, Class B Stranding, 90 DEG C, Standard Round Uncoated Copper

Insulation: Flame Resistant Ethylene Propylene (FR-EP), .030 inches thickness

Shield: None

Jacket Cable Assembly: Chlorinated Polyethylene over Polyester-film Tape

UL Listing: Each conductor, XHHW; Assembly shall meet NEC art 340 requirements for tray cable type TC, and shall be sunlight resistant.

Tests: Each conductor and the finished cables shall meet the flame test requirements per IEEE Standard No. 383.

Conductor Identification: ICEA Method 1, Table K2, Colored Compounds with Tracers

DETAILS:

Number of Conductors	Jacket Thickness-Inches	Outside Diameter-Inches	Nominal Area Square Inches	
2	.045	0.365	0.105	
4	.045	0.422	0.140	
7	.060	0.501	0.197	
9	.060	0.614	0.296	
12	.060	0.689	0.373	

TYPE E

600 Volt Single Pair Flame Resistant
Shielded Control Cable

DESCRIPTION:

Reference:	ICEA S-19-81, ICEA S-68-516 (Interim Standard No. 1)
Conductor:	16AWG, 7 Strand, Class B Stranding, 105 DEG C, Standard Round Coated Copper
Insulation:	Ethylene Propylene, 25 mil Thickness
Twisting:	Approximately 4 Turns/Foot Staggered
Shield:	Each pair, and the composite cable assembly-coated copper 20 AWG drain wire and aluminum/mylar tape over insulated conductors.
Jacket:	Conductor and cable assembly - flame resistant chlorosulfonated polyethylene, IPCEA S-19-81, fifth edition, part 4.
Conductor Identification:	One black and one white conductor per pair.
Tests:	Each conductor and each finished cable shall meet the flame test requirements per IEEE Standard No. 383.
UL Listing:	Each cable assembly shall meet NEC art 340 requirements for Type TC, and shall be sunlight resistant.

DETAILS:

Number of Pairs	Jacket Conductor	Cable	Outside Diameter-Inches
1	15 mils	45 mils	0.42
4	19 mils	60 mils	0.81

TYPE G

Bare Grounding Wire

DESCRIPTION:

Conductor: Standard Round Uncoated Soft-drawn Copper

Stranding: Sizes 8 AWG and smaller, solid; Sizes 6 AWG and larger, 7 strand, class B stranding

Insulation: None

DETAILS:

Size (AWG)	Diameter (inches)
8	0.13
6	0.16
4	0.21
2	0.26
1/0	0.37

TYPE H

600 Volt Three Conductor With Ground Power Cable

DESCRIPTION:

Reference: ICEA S-66-524, ICEA 5-19-81

Conductor: Standard round, Class B stranding, uncoated copper, 90 degrees C

Insulation: Flame resistant Chlorosulfonated polyethylene

Jacket: Conductor; none. Cable assembly: chlorosulfonated polyethylene

Conductor Identification: Colored compound or colored coating

Ground: Single or three insulated copper ground conductors.

DETAILS

Phase Conductor Size (AWG or MCM)	Ground Conductor Size (AWG)	Thickness - Inches Conductor Insulation	Assembly Jacket	Overall Diameter - Inches
10	10	0.045	0.060	0.58
8	10	0.060	0.060	0.75
6	8	0.075	0.080	0.94
4	3x10	0.075	0.080	1.05
2	6	0.075	0.080	1.19
1/0	6	0.100	0.080	1.43
2/0	4	0.100	0.080	1.56
4/0	4	0.100	0.110	1.86
250	3	0.130	0.110	2.07
350	3	0.130	0.110	2.34
500	2	0.130	0.110	2.65

TYPE S

Multi-Conductor Special Purpose
Communication and Data Cable

DESCRIPTION:

Reference:	ICEA S-19-81, UL 2250
Type 22S8 Conductor:	22AWG, 7 Strand, 4 pair with Individual Shielding, XLP Insulation, PVC Jacket, 300 Volt, 90 degree C
Twisting:	Each pair twisted, approximately 4 turns/foot
Use:	Process Control, Span Position Data
Conductor Identification:	Red/Black, White/Black, Green/Black, Blue/Black
Suitable Mfgr:	Belden No. 9330, Alpha Wire No. 6054

C.4 Boxes.
All exterior surface mounted pull, junction, splice, and terminal boxes shall be 14 gauge stainless steel, NEMA 4X, and shall be provided with hinged, overlapping covers of the same material, with pad-lock provisions and shall be by Hoffman Engineering Company, Hammond Manufacturing or approved equal. Exterior boxes mounted on the bridge steel work shall be primed and painted the same color as the bridge. Wall-mounted boxes installed in the new control house shall be NEMA 12. Junction boxes and terminal cabinets mounted in the machinery rooms shall be NEMA 4X, 14 gauge stainless steel as described above.

Furnish and install junction and pull boxes, reducers, and other fittings as required by these specifications or where required by the NEC or where required to facilitate pulling, whether shown on plans or not.

Provide drain holes in the boxes. Provide all boxes with mounting lugs and securely fasten to the structure with not less than four bronze or monel metal through-bolts. All cast-iron boxes shall be bossed, drilled, and tapped for threaded conduit ends, which shall enter squarely. Sheet metal enclosures shall be drilled to receive the conduit ends, which shall be secured with insulated hub connectors. The conduit ends projecting into all boxes and enclosures shall be equipped with insulated bushings. No box or enclosure shall be drilled for more conduits than actually enter it.

Boxes for surface or exterior mounted wiring devices shall be weatherproof rated, cast-iron, hot-dipped galvanized, Type FS, FD, or approved equal.

Boxes for flush-mounted devices in finished areas shall be stamped galvanized steel.

Fasten device boxes to the mounting surface with not less than two bolts.

Fabricate framework for supporting boxes, switches, and other externally mounted electrical devices from structural steel Type A36 not less than 3/8 inch thick, or if material of thickness less than 3/8 inch is used it shall be hot-dip galvanized.

All mounting bolts, nuts, washers, and other hardware used for fastening boxes, disconnect switches, devices, lighting outlet boxes, conduit clamps, and similar devices shall be brass, monel metal, or stainless steel. Bolt heads and nuts shall be hexagonal, and bolts smaller than 3/8 inch diameter shall not be used except as may be necessary to fit the mounting holes in small devices, outlet boxes, and similar standard equipment.

C.5 Wiring Devices
General use, single pole, or 3-way switches shall be Arrow-Hart 1991 or 1993, Bryant 4901 or 4903, General Electric 5951-1 or 5953-1, Hubbell 1221 or 1223, or approved equal.

General use, duplex receptacles shall be Arrow-Hart 5262, Bryant 5262, General Electric 4065-1, or Hubbell 5262. GFI protection shall be provided by GFI circuit breakers or GFI

receptacles where required by the CEC or NEC and as shown on the plans. Devices installed indoors shall be brown color.

Devices installed outdoors shall meet NEC Art. 410-57 and shall be corrosion-resistant, with gray fiberglass weatherproof covers, suitable for wet locations and U.L. listed.

Cover plate for flush installations shall be 0.040 inch thick satin finished Type 302 stainless steel. Cover plates for indoor surface installation shall be cast aluminum or cadmium-plated cast-iron. Covers shall fit Type FS or FD boxes without overlapping edges or corners.

C.6 Nameplates

Provide nameplates for all major pieces of equipment named on the drawings, for all devices on the control desk and in panels, and shall be made of laminated micarta or textolite with chamfered edges, and shall be engraved to show BLACK letters on a WHITE background. They shall be mounted with monel or stainless steel screws. Nameplates for devices shall show the device designation used on the schematic wiring diagram. Fuse nameplates shall show the type, ampere, and voltage rating of the fuses.

C.7 Motors

Motors shall be built in accordance with NEMA standards. All exposed metal surfaces shall be protected with a moisture-proof corrosion-resistant polyester paint or coating. Exposed unpainted and uncoated metal surfaces shall be of a heavy-duty corrosion-resistant material. The rotors shall be balanced mechanically and electrically. All windings shall be provided with special insulation to retard decrease in insulation resistance due to excessive moisture. Each motor shall have Class B insulation.

Install the motors with approved sizes and types of wire terminals and splice fittings for the connection of the motors to the circuit wiring. Furnish each motor with a cast-iron frame, bearing brackets with re-lubrication fittings and conduit connection box.

Hydraulic pump motors, unless otherwise specified or indicated on the plans, having a horsepower of 1/3 HP or larger shall be 480 volt, 3-phase, 60-Hertz, totally enclosed, non-ventilated, continuous duty rated, squirrel cage induction motor. Traffic gate motors, having a horsepower of 1/3 HP or larger shall be 208 volt, 3-phase, 60-Hertz, totally enclosed, non-ventilated, 30 minute rated, squirrel cage inductor motor. Sump pump motors are similar but shall be continuous duty rated.

Motor horsepower shall be as shown on the drawings. Where motors are supplied as an integral part of another item, the motors shall be of a NEMA design and speed compatible with that item.

Where alternate equipment is provided, actual motor horsepower shall be at least 115 percent of the driven load.

Motor mounted solenoid brakes supplied with the traffic gate assemblies shall be motor-mounted, totally enclosed spring-set, solenoid-release, disc brake with hand release lever.

C.8 Panel Boards

Provide and install all surface mounted panel boards where shown on the drawings. Mounting height for wall mounted panel boards shall be 6'-6" at the top. Cabinet mounted panel boards shall be mounted as shown on the drawing. Construction shall be as follows:

(1) Cabinets. Panel shall be dead front type and enclosed in a code gauge galvanized sheet steel cabinet complete with hinged door, lock and two keys, finished in ANSI 61 Light Gray enamel paint, with circuit directory filled out in type and with all exposed metal surfaces prime coated and factory painted. All locks shall be keyed alike. Panel boards mounted within equipment rooms or cabinets shall be NEMA 12 rated. Panel boards mounted in outdoor locations or wet environments shall be NEMA 4X rated stainless steel.

Cabinets shall be of sufficient size to provide gutter space no less than that required by the Underwriter's Laboratories and in no case less than 4 inches.

(2) Mains. Branch circuits shall be changeable without additional machining, drilling or tapping. Branch circuit connections shall provide sequence phasing, with connections permanently identified on the face of the front of the panel interior.

Mains shall be equipped with automatic circuit breakers for branch circuit protection and shall have ratings as indicated. All single pole branches shall be rated 20 ampere, unless indicated otherwise.

Buses shall be rigid copper or copper alloy, installed to provide consecutive phasing. Solid neutral bus shall have solderless connectors, shall be insulated from the cabinet and shall have an ampacity equal to the ampacity of the phase buses. Equipment grounding bus shall be bonded to the cabinet, shall have solderless connectors and a main lug. All copper parts shall be plated to prevent corrosion.

(3) Branches. Circuit breakers shall be of the indicating type, providing distinctive "on", "off", and "tripped" positions of the operating handle. All multi-pole breakers shall be so designed that an overload in any one pole automatically causes all poles to open. Multi-pole breakers shall have a single operating handle. Single pole 15 and 20 ampere branch breakers shall be UL listed for switching duty.

Breakers shall be thermal magnetic type having inverse time delay thermal trip on overloads and instantaneous magnetic trip on short circuit. Circuit breakers shall be quick-break, quick-make on manual, as well as automatic operation. Each circuit breaker shall be independently removable without disturbing adjacent units or other bus connections and shall be fastened to the main bus bars with a bolt-on connection. All copper parts shall be plated to prevent corrosion.

All 100 ampere frame breakers shall have an interrupting rating of 10,000 amperes A.C. All larger frame size breakers shall have an interrupting rating of 22,000 amperes.

All panelboards shall be factory assembled, UL listed, Type NQOB as manufactured by Cutler-Hammer, Square D, Westinghouse, General Electric, or approved equal.

C.9 Dry Type Transformers

Furnish dry type transformers suitable for indoor mounting in the quantity, voltage, phase, KVA rating, and method of mounting as shown on the drawings. Transformers shall be UL 1561 listed and labeled "Suitable for non-sinusoidal current loads" with a K factor not to exceed a rating of K-30.

Transformers shall be Class AA. The temperature rating shall rise above ambient, as listed below. Primary taps shall be as listed below.

	Below Normal	Above Normal	Temp. Below Rise
Single phase less than 25 kva	Two 5 percent	---	115ºC
Single phase 25 kva and larger	Four 2-1/2 percent	Two 2-1/2 percent	80ºC

Provide transformers with electrostatic shields between the primary and secondary windings as shown on the plans.

Transformers shall have a rated sound level of 45 decibels or below when measured in accordance with NEMA Standards.

Furnish wall hanger brackets especially designed to accommodate the transformers with all wall mounted transformers.

Transformers mounted in outdoor environments shall be mounted in non-ventilated #316 stainless steel enclosures

Transformers mounted in indoor locations shall be fully ventilated enclosures. Enclosures shall be painted with a rust resisting primer coat and two or more finish coats of paint or enamel. Finish transformers with ANSI 61 Light Gray indoor paint.

Submit manufacturer's data on power/distribution transformers, including certification of transformer performance efficiency at indicated loads, percentage regulation at 100% and 80% power factor, no-load and full-load losses in watts, % impedance at 75 degrees C, hot-spot and average temperature rise above 40 degrees C ambient, sound level in decibels, and standard published data.

The transformers shall be as manufactured by General Signal Corporation, International Transformer Corporation, Sorgel Electric Corporation, or approved equal.

C.10 Motor Starters Contactors

The new starter contactors shall conform to NEMA Standards and shall be of the size and style as shown on the drawings. All motor starters shall be of the full voltage type with overload relays, auxiliary contacts and all accessories as required by the drawings and specified herein. Furnish motor overload elements to match motors provided in accordance with manufacturer's instructions.

Motor starters shall be 3-pole, 480 volt or 208 volt, full voltage, magnetic type as shown on the drawings. Circuit breakers for motor protection shall be of the adjustable instantaneous type sized for the motor to be connected.

Metering equipment and all accessories shown on the drawings or as required shall be mounted in the switchboard cabinet as shown on the drawings.

An incoming line transient voltage surge suppressor (TVSS) shall be provided and installed on the incoming line of the switchboard cabinet near the incoming line service breaker as shown on the drawings. The TVSS shall be a heavy duty unit with audible alarm, modular design, self test capability, modular design, rated for 160ka for service entrance protection at 480 volt grounded delta. Unit shall be UL 1449 listed, 200KAIC rated fusing, less than ½ nanosecond response time and provided with a 5 year warranty. Unit shall be by National Lightning Protection Inc. model Para II 5000 Plus or equal by MCG Electronics, Inc or EFI Electronics.

C.11 Service and Distribution

C.11.1 General

Commercial electric power for operation of the bridge and its auxiliaries will be supplied by dual feeds from We Energies at 480 volts nominal, 3-phase, 3-wire, grounded delta, 60-Hertz. Point of contact is Mr. Paul Novotny, City of Milwaukee, 414-286-3982.

C.11.2 Service Disconnect

Install one 200A fusible disconnect switch at the end of the east approach span where shown on the plans. Disconnect enclosure shall be NEMA 4X rated stainless steel. One 200A fusible disconnect switch shall be installed within the west control tower where shown on the plans. Disconnect enclosure shall be NEMA 12 rated. Install one 200A fusible disconnect switch at the end of the west approach span where shown on the plans.

Disconnect enclosure shall be NEMA 4X rates stainless steel. Fuses shall be Class K-5 dual element type and sized as shown on the plans.

The utility meters will be provided and installed by the power company. The meter packs shall be provided by the contractor.

C.11.3 Automatic Transfer Switch
Install one 200A rated automatic transfer switch in the control tower where shown on the plans. Each contact pole of the transfer switch shall be double break design, with solid silver cadmium contacts, capable of handling both non-conductive and inductive loads and allow for inrush currents of 20 times the continuous rating. Contact pressure shall be maintained by a coil sprint, not a part of the current-carrying path. The ampere rating of the transfer switch shall be sufficient to handle the capacity of the loads being transferred. The transfer switch enclosure shall be NEMA 12 rated and shall confirm to the requirements of UL 1008, IEC 947-6-1, NFPA 70, NFPA 99, NFPA 202, NFPA 110, ANSI C33.76 and NEMA ICS10.

C.11.4 Service Grounding
The 480-volt grounded wye power system shall be solidly grounded to the grounding grid assembly at the transformer or utility service metering equipment and to the grounding grid assembly within each pier.

Terminal lugs and the metal framing and enclosures of all electrical equipment such as control panels, control desk, panelboards, motors, and other apparatus shall be bonded to the grounding grid assembly.

Terminals of grounding system shall be solderless type, secured by means of hexagonal head, copper plated steel machine bolts with lock washers. Grounding system conductors shall be continuous unspliced connections between terminal lugs.

C.11.5 Structure Grounding
Ground cable shall be stranded, soft drawn, insulated copper, conforming to ASTM B3 Class B. Ground cables shall be interconnected or bonded to structural steel or connected ground rods by exothermic welds. Two coats of insulating varnish shall be applied over all exothermic welds and exposed cables.

Thermite welds shall be made with molds, cartridges, and accessories as recommended by the manufacturer of the molds for the items to be welded. Molds and powder shall be furnished by the same manufacturer, and shall be by Cadweld, National Lightning Protection, Approved Lightning Products Co., or approved equal.

Grounding system cable shall be a minimum of 380 pounds/1,000 foot copper unless otherwise indicated. Each strand shall be No. 14 AWG. Stands shall be basket or rope lay, cross sectional area shall be #1/0 AWG minimum. Cable interconnections shall be bolted. Cable terminations shall be on bonding plates, sized 6” x 6” x ¼”.

Component grounding cables shall be sized as required by the NEC but not less than #8 AWG unless otherwise indicated on the plans.

C.11.6 Ground Resistance
Ground resistance shall have a value of 5 ohms or less after connection to the service equipment and shall be measured with an approved ground tester.

Ground resistance measurements shall be taken as follows:

(1) The resistance of each individual ground rod shall be measured at the time of installation and before connection to the ground bus. If the resistance is greater than 25 ohms, a second rod shall be driven near the rod being tested.

(2) The resistance of the ground bus shall be measured, with all rods connected to the bus prior to connection to the service equipment.

(3) The resistance of the ground bus shall be measured with all rods connected to the bus after connection to the service equipment.

Forward a report of the test to the engineer.

It is preferable that all ground rods have approximately like resistances so that when paralleled all rods will carry very nearly the same current. In those instances where a wide variance of resistance is encountered, add additional sectional rods to those already installed that have the high resistance.

C.12 Lighting

C.12.1 Navigation Lights

Provide navigation lights, reflective markers, and signals during and after construction in accordance with the rules and regulations outlined in DG-208 of the United States Coast Guard, Part II, Number 208 of Volume 33 of the Federal Register. All phases of such work must be completed to the Coast Guard's satisfaction and approval.

All pier and center channel navigation lights, doors and lenses shall be gasketed, and the entire units shall be completely weatherproof. Fittings shall be noncorroding and the sockets shall be of porcelain, mounted on shock absorbers. All lenses shall be of permanent, rigid, heat-resistant glass, 187mm, standard regular marine Fresnel type.

Pier marker lights shall be cast aluminum, gasketed and a 180 degree red Fresnel lens. Locate and mount light fixtures as shown on the plans. Pier marker lights shall be Roadway Manufacturing type PL, B & B Electromatic model MS53 or approved equal.

Center channel navigation lights shall have an automatic latch mechanism to hold the light securely in the normal and service positions. The fixture shall be cast aluminum, have two lamp sections with upper section to have a 180 degree red Fresnel lens and the lower section to have a 180 degree green Fresnel lens. The center channel navigation lights shall display green at the fully-open position and red for all other positions as shown in the plans. Center channel navigation lights shall be Roadway Manufacturing type BS, B & B Electromatic model MS66 or approved equal.

Lamps for all navigation lights shall be of the four (4) tier LED style, 120 volt, with standard medium base. Lamps shall be rated for 100,000 hour life and white in color.

C.12.2 Decorative Lighting
Provide a decorative lighting system on the lift span and approach spans as shown on the plans.

Lighting fixtures shall be mounted to angle brackets along both sides of the lift span and approach spans as shown on the plans. Mounting hardware shall be stainless steel.

Light fixtures shall be Stringlight by Molex Incorporated and utilize a standard molded screw base socket to accept a standard A-19/E-26 medium base LED type lamp. Conductors shall be #12 AWG SOOW copper. LED lamp shall be 120 volt, 1 watt, 16 LED soft white lamp rated at 40 lumens for up to 50,000 hour lamp life.

Lamp strings for each section installed on the lift span and approach spans shall be continuous and installed without splicing of the conductors. Lamp sockets shall be spaced at 1 foot intervals. Provide each section with a 15 foot leader and a 6 inch tail section. Conductor and lamp socket color shall be black.

Light strings shall be by Light Efficient Design, catalog number LED-2010-SW or approved equal.

C.12 Heat Tracing
Disconnect the existing heat tracing system on the incoming water line and sewer discharge line and protect the wiring, heat tracing line and thermostat during construction. Reconnect the heating system to the new bridge distribution panel board. Existing heat trace system is 208 volt, single phase.

C.13 Sump Pump
Furnish and install a new sump pump in each pier pit. Sump pump be rated 1.5 horsepower, 208 volt, 3 phase. Sump pump shall be manually operated from a locally mounted motor starter NEMA 4X, stainless steel enclosure with a START/STOP control mounted on the front cover. Sump discharge line shall be field routed discharge to the river channel in PVC piping. Sump pump shall be Dayton Model 3BB95 rated at 2 HP, 60 Hz, 240/480 volt, 3 phase. Pump shall have a head of 165 GPM at 20 feet with a 2 inch NPT discharge, complete with a 20 foot, 4 conductor, #14AWG power cord. Pump shall be sized to fit in 24 inch diameter X 30 inch deep sumps. Electrical connections shall be made using the following components: Leviton BX230-V INL&RCPT Back Box, Leviton 420R9W 3 pole, 4 wire, 20 amp, 3 phase, 25 volt receptacle and a 420P9W Leviton 3 phase, 4 wire, 20 amp, 3 phase, 250 volt plug. Route discharge piping to the Milwaukee River similar to other city bridge structures.

C.14 Card Reader Access Security System
Furnish and install a card reader access security system for controlled entrance to the control tower. The security system shall be compatible with the existing security system used by the City of Milwaukee. Mount the card readers on the exterior wall of the control tower next to the entrance door where shown on the drawings.

The controller shall be by Software House model apC/L with an APS power supply or approved equal.

Card readers shall be digital type with a minimum of 6 inches sensing range. Card readers shall be environmentally sealed and weatherized for external use and shall be UV resistant. Card readers shall operate with humidity 5% to 95% condensing and temperature range -22 degrees F to +140 degrees F with optional heater kit. Card readers shall be equal to the RM series type RM2-P1 from Software House and compatible with other City of Milwaukee card readers. Install and connect shielded twisted pair cables, Belden 9841 and 8442/8461 or equal to each card reader.

Install on the entrance door a Schlage electromechanical door strike. Door strikes shall be tamper proof and shall be compatible with the installed doorframe and hardware. Make connections between the controller and door strike with manufacturer's approved cable and full mortise butt hinges with concealed wires.

The City of Milwaukee shall be responsible for telephone connections from the controller to the host, programming entry codes and supplying the digital cards for entry.

C.15 Horn Signal System

Furnish and install a complete horn signaling system consisting of two electric horns, swivel mounting bracket and all hardware required to be mounted where shown on the plans.

The electric horn shall be of 105db discharge intensity at 10 feet. The horn shall be of weatherproof construction made of corrosion resistant cast aluminum housings with a brass projector. Horn shall be finished in gray enamel. Horn shall be UL Listed for indoor and outdoor use and rated for 120 volts AC.

To be compatible with other horn systems in the City of Milwaukee, the horn system shall be Federal Signal Corporation Model 55 or approved equal.

C.16 Communications.

C.16.1 Inter-Communications

In order to provide means of intercommunication throughout the St. Paul bridge structure, throughout the Michigan Street bridge structure and between the St. Paul Bridge and the remote site at Michigan Street, furnish and install a multi-circuit industrial rated communication system. The equipment shall be as manufactured by Gai-Tronics, Reading, PA. Each bridge structure shall be provided with an intercommunication system as described below and the two systems shall be interconnected via fiber optic connections to permit the operator at the St. Paul Bridge to have one way communication between the St. Paul bridge operator and the pedestrians and mariners at the Michigan Street Bridge.

C16.1.1 St. Paul Bridge Intercom System

The operator's station shall be mounted at the St. Paul Bridge mounted on the side of the

control console as shown on the plans. Intercom stations shall be located at locations shown on the drawings. Stations located within the bridge piers shall by provided in NEMA 4 enclosures and be suitable for wet locations. Speakers for all units, except the desk top unit, shall have integral drivers, 30 watt rated and be corrosion resistant. Speakers shall be located within 5 feet of the station hand set. Wall mounted intercom stations shall be located 4'-6" above finished floor where shown on the Plans unless otherwise indicated. The intercom master station mounted on the side of the local control console shall be mounted on the right side of the console where shown on the drawings. This master station shall include 3 communication zones consisting of the internal communication network at the St. Paul Bridge (Zone 1), a one-way communication network with the roadway areas and the river channel areas at the St. Paul Bridge (Zone 2) and a one-way communication network at the Michigan Street Bridge with the roadway areas and river channel areas at the Michigan Street Bridge (Z0ne 3). The intercom system shall be capable of internal communications throughout the St. Paul bridge and one-way remote communications with the traffic gate and river channel speaker stations at the Michigan Street Bridge as shown on the plans. Intercommunications between the St. Paul Bridge and the speaker stations at the Michigan Street Bridge shall utilize existing fiber optic cables.

Furnish and install all handset, speakers microphones, environmental enclosures, mounting hardware and brackets as required to provide a complete and operational intercommunications system as described herein and shown on the plans. The inter-communications system shall enable the operator to communicate with individuals in and around the St. Paul bridge. The operator will need to alert all areas of the bridge when an operation is about to occur. All internal locations of the bridge will be zoned together to enable an "all call" feature. All intercom stations located outdoors or in unheated spaces will need to be able to withstand outdoor environmental conditions. These conditions will include rain, snow, dust, humidity, chemical pollutants, extreme temperatures (-40 F to 140 F), and other environmental hazards.

In order to provide a means of one-way communication with the vehicles, pedestrians and marine vessels, furnish and install a single circuit communication system as a part of the intercommunications system. The system shall consist of an amplifier and weatherproof speaker for each station (4 stations required) and mounted on the traffic signal poles and bascule piers as shown on the drawings.

Install the intercom cable from point to point in accordance with the manufacturer's recommendations as per the plans with no intermediate splices unless absolutely required. Should splicing be required, splice in accordance with manufacturer's recommendations keeping all shielding of conductors continuous to protect against noise induced on the intercom system. Route intercom cables in conduits in accordance with the requirement of these Special Provisions, Section C.2.

The operator's station shall be a desk top style, single party line with handset and built-in speaker, 3-zone selector switch, Gai-Tronics Model 93079 or equal. Desk set shall operate at 115 VAC, 60 Hz with an amplifier sensitivity of 0.5 VAC for the rated output,

have a frequency response of 250-4,000 Hz, +0, -3dB and a distortion of 1% maximum THD at 1,000 Hz, 12 watts and an operating temperature of -22 deg f to +158 deg F. Speaker shall be internal to the enclosure and the handset shall be mounted on the desk station with a 6 foot extended retractile cord. Intercom stations located on the Entry Level and Equipment Room Level of the control tower shall be Gai-Tronics Model 700-102 or equal. Statin shall operate at 115 VAC, 60 Hz with an output level of 1.5 Vrms nominal into a 33 ohm load and a gain of 55 dB nominal, adjustable from 40 to 63 dB and a frequency response of 250-4,000 Hz, +/- 1.5dB and a distortion of 1% maximum THD at 1,000 Hz. Enclosure shall be 16 gauge, cold-rolled steel/gray polyurethane suitable for wall mounting. Handset shall be dynamic, noise cancelling type with a 6 foot retractile cord and a Push-to-Page press bar and handset hook switch. Intercom stations located in the bascule pier areas and machinery areas shall have a similar output levels and requirements as the Model 700-102 and be housed in a non-metallic NEMA 4 weatherproof enclosures made of glass-reinforced polyester resin and be tropicalized for moist environments, Gai-Troncs Model 730-103 or equal. Speakers for all units, except for the desk top unit, shall have integral drivers, 30 watt rated, corrosion resistant, Gai-Troincs model 760-001 or equal weatherproof direct-radiating horn with an asymmetrical shape for efficient sound dispersion. Frequency response shall be 450 – 4500 Hz =/- 5dB. Horn shall be of high-impact, glass-reinforced polyester. Speakers shall be located within 5 feet of the station. Wiring shall be Gai-Troincs or equal. Cross channel wiring to the east pier shall be continuous without splicing unless necessary at the flexible loops between the piers and lift span.

To provide a means of on-way communications with vehicles and pedestrians at the traffic gate areas and with the mariners at the river channel at both the St. Paul Bridge (Zone 1) and with the same areas at the Michigan Street Bridge (Zone 3), speaker stations shall be mounted on the traffic signal poles and bridge piers, located such to direct the audio signal to the traffic gate areas on the east and west approaches and to the river channel areas approaching the lift span.

C.16.1.2 Michigan Street Intercom System

A similar intercom system provided for the St. Paul Bridge described above shall be provided for the Michigan Street Bridge with the exception that the master control station will only have 2 zones, one for internal communications (Zone 1) and for one way communication with the roadway and river channel (Zone 2). Remote internal communications within the bridge structure from the St. Paul Bridge is not required as shown on the plans. The one-way communications system between the St. Paul Bridge and the Michigan Street bridge shall utilize existing fiber optic cables between the two structures. Fiber Optic interface equipment shall be IFS model AR/AT1000 as shown on the drawings. Equipment provided for the Michigan Street Bridge intercom system shall be similar to the St. Paul Bridge intercom system described above.

C.16.2 Closed Circuit Television

C.16.2.1 St. Paul CCTV System

Provide and install a complete CCTV system including but not limited to four color cameras, four flat screen monitors, equipment cabinet, cable, conduit, mounting hardware, software and all necessary hardware to install a complete CCTV system as shown on the plans and described herein. The new CCTV monitors and camera controls shall be installed on the operator's level of the St. Paul Bridge control house as shown on the drawings.

Furnish and install four (4) color cameras located on the St. Paul Bridge. Cameras shall be as follows:

Camera #1 shall be located on the south end of the west pier. This camera shall face a northeast direction with a field of view including the northeast corner of the east pier. The camera will used to verify that a vessel has cleared the bridge before it can be lowered. The camera image will be displayed on the monitors in the St. Paul Bridge control house.

Camera #2 shall be located on the north end of the west pier. This camera shall face a south direction with a field of view including the southeast corner of the east pier. The camera will be used to verify that a vessel has cleared the bridge before it can be lowered. The camera image will be displayed on the monitors in the St. Paul Bridge control house.

Camera #3 shall be mounted on the new roadway lighting pole located as shown on the plans. This camera shall face east with a field of view including both traffic gates on the west side approach spans and extend over the bridge to include the east side traffic gates with as much detail as possible. The camera will be used to verify that a vehicle is not located under the traffic gates before lowering the traffic gate. It will also be used to be sure the spans are clear of pedestrians before and during operation of the bridge. The camera image will be displayed on the monitors located in the St. Paul Bridge control house.

Camera #4 shall be mounted on the new roadway lighting pole located as shown on the plans. This camera shall face east with a field of view including both traffic gates on the east side approach spans and extend over the bridge to include the west side traffic gates with as much detail as possible. The camera will be used to verify that a vehicle is not located under the traffic gates before lowering the traffic gate. It will also be used to be sure the spans are clear of pedestrians before and during operation of the bridge. The camera image will be displayed on the monitors located in the St. Paul Bridge control house.

The color cameras shall be Moog/Videolarm model AP8C-9 with a 23X manual zoom lens in an aluminum pressurized housing, sun shield and painted white. Pole mounted cameras shall utilize WM1500 mounting bracket and an APM16 pole mount adapter. Wall mounted cameras shall utilize WM1500 mounting bracket. Power supply shall be Pelco Model MSC 4-2.

The video matrix switch/controller shall be Pelco model CM6700-MX84 with a Pelco keyboard controller KBD100.

Equipment cabinet shall be wall/floor mounted, with solid steel door, black in color and sized at 48”h X 24”w X 25” d similar to Cooper B-Line part number VLWM4825SB or equal.

Furnish all material and coordination to install the cable from each camera in the system to the system control receiver as shown on the plans. Install the cable from point to point as shown on the plans with no intermediate splices. Route intercom cables in conduits in accordance with the requirement of these Special Provisions, Section C.2.

C-16.2.2 Michigan Street CCTV System

Provide and install a complete CCTV system including but not limited to four color cameras, cable, conduit, mounting hardware, software, fiber optic accessories and all necessary hardware to install a complete CCTV system as shown on the plans and described herein. The video shall be transmitted to the new CCTV system monitors and camera controls described above and installed on the operator’s level of the St. Paul Bridge control house as shown on the drawings. Video and data transmissions shall be by existing fiber optic cables between the St. Paul Bridge and the Michigan Street Bridge.

Furnish and install four (4) color cameras located on the Michigan Street Bridge. Cameras shall be as follows:

Camera #1 shall be located on the south end of the west pier. This camera shall face a northeast direction with a field of view including the northeast corner of the east pier. The camera will used to verify that a vessel has cleared the bridge before it can be lowered. The camera image will be displayed on the monitors in the St. Paul Bridge control house.

Camera #2 shall be located on the north end of the west pier. This camera shall face a south direction with a field of view including the southeast corner of the east pier. The camera will be used to verify that a vessel has cleared the bridge before it can be lowered. The camera image will be displayed on the monitors in the St. Paul Bridge control house.
Camera #3 shall be mounted on the new roadway lighting pole located as shown on the plans. This camera shall face east with a field of view including both traffic gates on the west side approach spans and extend over the bridge to include the east side traffic gates with as much detail as possible. The camera will be used to verify that a vehicle is not located under the traffic gates before lowering the traffic gate. It will also be used to be sure the spans are clear of pedestrians before and during operation of the bridge. The camera image will be displayed on the monitors located in the St. Paul Bridge control house.

Camera #4 shall be mounted on the new roadway lighting pole located as shown on the plans. This camera shall face east with a field of view including both traffic gates on the east side approach spans and extend over the bridge to include the west side traffic gates with as much detail as possible. The camera will be used to verify that a vehicle is not located under the traffic gates before lowering the traffic gate. It will also be used to be

sure the spans are clear of pedestrians before and during operation of the bridge. The camera image will be displayed on the monitors located in the St. Paul Bridge control house.

The color cameras shall be Moog/Videolarm model AP8C-9 with a 23X manual zoom lens in an aluminum pressurized housing, sun shield and painted white. Pole mounted cameras shall utilize WM1500 mounting bracket and an APM16 pole mount adapter. Wall mounted cameras shall utilize WM1500 mounting bracket. Power supply shall be Pelco Model MSC 4-2.

Fiber optic equipment shall be IFS model VR6010A/VT6010A. Video switching shall utilize the matrix switcher/controller provided as part of the CCTV system for the St. Paul Bridge described above and as shown on the plans.

Video from the Michigan Street Bridge shall utilize the LCD Monitors, Matrix Switcher/Controller and Keyboard Controller located at the St. Paul Bridge as shown on the plans.

Furnish all material and coordination to install the cable from each camera in the system to the system control receiver as shown on the plans. Install the cable from point to point as shown on the plans with no intermediate splices. Route intercom cables in conduits in accordance with the requirement of these Special Provisions, Section C.2.

C.17 Programmable Controller

C.17.1 General

All analog and digital logic functions required to control, interlock, and coordinate the bridge remote control system and associated components between the St. Paul Bridge and Michigan Street Bridge shall be performed by the programmable controller (PLC) equipment.

The PLC equipment shall be installed as shown on the plans or stated herein. The Michigan Street Remote Control Panel mounted in the St. Paul control tower shall include the PLC equipment for remote communications to the Michigan Street Bridge. This panel shall house the central processor units (CPU), input-output units (I/O's), and all other associated equipment. The PLC equipment panel shall interface the control desk and the control system located at the Michigan Street Bridge. Data communications between the St. Paul Bridge and Michigan Street Bridge shall be via existing fiber optic cables.

The PLC system shall be I/P addressable for remote access by the City of Milwaukee. Coordinate with the City of Milwaukee for I/P address(s) and interconnection procedures.

The contractor shall develop all software and programming to safely operate the Michigan Street Bridge from the St. Paul Bridge with a similar level of control operation and indication that is currently functioning for the remote control operation of the St. Paul Bridge control system from the Michigan Street Bridge remote control panel. These

level of controls shall include audible horn control, traffic signal control, traffic gate control, traffic gate position indications, raising and lowering of the lift span, emergency stop function and a touch screen display.

The existing remote control system for the control of the St. Paul Bridge from the Michigan Street Bridge shall be removed and all equipment turned over to the city. New remote control equipment provided at the Michigan Street Bridge shall be installed in locations used for the existing remote control operation. The new remote control operation for the Michigan Street Bridge shall be similar to the configuration and interface system used for remote operation of the St. Paul Bridge.

C.17.2 Quality Control

All PLC equipment (CPU, I/O frames, input cards, output cards, multiplexer, cables, etc.) shall undergo a minimum of 100 hours continuous burn-in prior to shipment. Burn-in shall be done while carrying temperature between rated limits of the device and cycling the equipment through a program.

PC equipment, including programming devices, shall be tested so as to ensure their proper operation in the presence of both radio frequency and electrical noise.

C.17.3 CPU Memory

Each central processor shall have a metal oxide semi-conductor memory with a battery backup power system or nonvolatile EEPROM memory. Batteries shall be able to support the memory for not less than three months without external power.

A key operated selector switch shall disallow changes in the stored program while in the "Operate" position.

The status of the inputs and outputs shall be checked at the time they are called for in the program rung the CPU is operating on.

The outputs shall be available to be turned "ON" or "OFF" as soon as its rung has been scanned.

The CPU shall check the parity of each word at the time it is scanning that word. The CPU shall contain "trouble" lights to indicate memory parity errors or processor malfunctions.

All CPU operating logic shall be contained on plug-in cards for ease of replacement. Chassis wired logic is not acceptable.

The memory unit shall have spare program capacity equal to 20 percent of the memory used.

C.17.4 Systems Input and Output (I/O's)

I/O frames shall be completely pre-wired for a full complement of I/O boards.

Additional I/O frames (up to the maximum PLC capacity) can be added at any time in the field.

I/O modules shall have key slots, which are unique for each card type, so that the wrong card type cannot be inadvertently installed in a slot that was programmed for a different card type.

I/O cards shall be replaceable without removing panel wiring.

I/O cards shall provide at least one common terminal for every two inputs or outputs.

Inputs and outputs shall be provided with reed relay or optical isolation between field circuits and internal circuitry.

Status lights shall be provided for each input or output amplifier indicating a signal is present to turn the input or output "ON".

Outputs shall be fused, and the fuses shall be easily removable without the use of special tools.

Output cards used only for pilot light service shall have a minimum continuous load capacity of 0.25 amperes at 120 VAC.

Output cards used for other loads shall have a minimum continuous load capacity of 1.5 amperes, and shall be capable of operating and withstanding the operating and surge characteristics of a NEMA size 4 starter.

Analog inputs and outputs shall have a range of 4 to 20 milliamperes. Conversions between external analog signals and internal numeric values shall have a resolution of no less than one part in 999.

Timers shall be available through programming of counters utilizing time base inputs to counters. Time bases shall be available in seconds and tenths of seconds.

Arithmetic capability shall include add, subtract, multiply and divide, in integer mode using numbers up to 999. See schematic legend sheet in the Plans for function descriptions.

C.17.5 Programming

The program shall be entered using an IBM format Compatible Lap Top Personal Computer. Software shall be fully compatible with the PLC equipment. Provide two (2) fully compatible computer systems complete with modem hardware and software with a baud rate suitable for the modem equipment provided. Each computer shall be provided with a Pentium 4 processor, 40 Gigabyte hard drive, 512 Megabyte memory, DVD/CDRW combo CD drive with a minimum 14 inch screen. In addition to the

software above, each lap top shall have Windows 7 and Microsoft Office 2010. The lap top computers and all software shall be turned over to the owner at the completion of the project. Storage of one computer shall be within the PLC cabinet on a fold down work table mounted to the PLC cabinet door.

Each of the following logic symbols shall take no more than one word of CPU memory:

1. coil with address
2. normally closed contact with address
3. normally open contact with address
4. branch open
5. branch close

The CPU shall automatically close gaps in memory when logic statements are removed, thus eliminating NOP's in memory.

It shall be possible, at any time by means of a permissive key interlock, to modify an existing program in memory by inserting one or more ladder diagram rungs between any two existing (previously programmed) rungs. This ability to insert rungs of unspecified word length shall be accomplished by the technique of automatic "gap open", not by the imprecise method of reserving "contingency" blocks of memory for future changes.

It shall be possible to connect programming equipment to the CPU while the CPU is running without interfering with the operation of the CPU.

It shall be possible to record programs stored in the CPU memory on magnetic disk. Disk drive hardware shall be provided with the lap top computer.

It shall be possible to copy programs stored on magnetic disk into the CPU memory.

It shall be possible to verify programs stored on magnetic disk against programs stored in the CPU memory.

It shall be possible to monitor the contents of the various timer and analog registers shown in the drawings. Numerical access pad and display unit shall be provided on the control desk.

It shall be possible to communicate with the CPU at the bridge site and the lap top computer located at a remote location via a modem. Modem equipment and necessary software shall be provided with the PLC equipment and the lap top computer.

C.17.6 Cabinet

Furnish cabinets as described later in this special provision.

C.17.7 System Hardware
The system shall be complete with all power supplies, racks, interface modules, fault monitors, and any other internal devices required.

C.17.8 Documentation
The supplier shall furnish Instruction Manuals described under "Instruction Books" in this special provision. In addition, these manuals shall include operation of the equipment, programming of the equipment, theory of operation, maintenance information, schematics of all cards or units within the system, and point-to-point wiring diagrams.

Provide documentation of the PLC program, which shall include:

(1) Ladder diagram printout.
(2) Rung address.
(3) Contact addresses and English contact description.
(4) Cross reference of rungs which control contacts.
(5) Cross reference of contact controlled by each rung.
(6) English comments before each series of rungs.
(7) Cross reference to relay numbers in plans.

C.17.9 Factory Tests
Pre-test the PC at the factory to ensure that the ramp functions operate in accordance with the plans.

The control console described in these specifications, or a test panel shall be provided to derive the control signals and indicators required to simulate span position.

Notify the engineer 30 days prior to the tests so that he can arrange for a witness to these tests.

The supplier's costs (if any) of debugging the schematics or adapting the program to his hardware, both at the shop and on the project site after installation, shall be included as incidental to the contract.

C.17.10 Manufacturers
The PLC equipment shall be Allen Bradley Compact Logix series and be fully compatible with existing Allen Bradley PLC equipment currently in use by the City and shall be IP addressable for communication between units for future use in the interfacing and control of several control systems from a central location.

C.18 Control Panels.
C.18.1 General
The following general requirements apply to all panels and enclosures. Specific requirements are included later in this special provision with the description of each panel.

Furnish the following panels and enclosures:

Main Control Console for operation of the St. Paul Bridge
Remote Control Panel for remote operation of the Michigan Street Bridge
Switchboard Cabinet
Relay Cabinet

Electrical indicating instruments, unless otherwise specified, shall be of the round face analog type, and shall be designed for semi-flush mounting. Instrument ranges and scales shall be as shown on the plans. Instruments shall be as manufactured by General Electric, Westinghouse, or LFE Corporation.

Push buttons, indicating lights, and non-illuminated selector switches shall be 30.5mm, heavy duty oil tight by Allen Bradley 800T, Square D type K or Cutler Hammer 10250T. Indicating lights shall be a one to four light display with individually controlled lamp and color lenses. Lens colors shall be as shown on the plans. Units shall have internal 120 VAC transformers and each lamp individually controlled. Lamps shall be LED type. Engraving shall be as shown on the plans.

Key switches shall be double pole, double throw spring return or maintained contact type, heavy duty oil tight, as shown on the plans, Cutler Hammer type 10250T or approved equal. Switches shall be keyed to match existing City of Milwaukee key styles currently in use. Key switches shall be keyed to type 'KD1' key.

Provide a new 2 position key switch on the existing Michigan Street control console for selection of either Local Control for operating the bridge locally or Remote Control for operating the bridge remotely from the St. Paul Bridge. Key switch shall be keyed to type 'KD1' key.

All load relays (R166, R170, etc.) shall be 10 ampere, 600 volt rated, Allen Bradley Type P, Square D Type X or Cutler Hammer type M-600 with normally open and normally closed power poles as shown in the plans.

All panels and enclosures shall be of the freestanding type. The construction shall be of steel plate of thickness described in the individual panel specifications and shall consist of a frame of suitably sized, formed structural steel members joined by electrical welding to ensure true surfaces and adequate support for the instruments mounted thereon.

All welds on the exposed surfaces shall be ground smooth. Finished surfaces shall be free from waves, bellies or other imperfections. Exterior surfaces shall be sandblasted, ground smooth, filled, primed, sanded and finished.

All instrument cutouts, mounting studs, and support brackets shall be located accurately. Unless specified otherwise, doors shall be hinged and shall have turned-back edges and

additional bracing where required to assure rigidity. Hinges shall be of the piano or concealed type. Door latches shall be of the three-point type to assure tight closing.

Before application of paint, all surfaces shall be carefully cleaned of all dirt, moisture, rust, scale, lubricants and other substances. Lubricants shall be removed by suitable solvents. Rust and scale shall be removed by sandblasting, power sanding, power grinding or power wire brushing.

Exterior finish of NEMA 12 enclosures shall consist of application of suitable primers and two or more finish coats of enamel, as required to provide a smooth, hard and durable finish. The finish color for control panels shall be ANSI 61 Light Gray.

Interior surfaces shall be finished with gloss white lacquer applied over suitable primers.

The supplier shall include six 16-ounce containers of touch-up paint in aerosol cans for each color specified above. Touch-up paint shall be of the same type and color as the finish paint used in the factory applied painting. Complete painting instructions shall accompany the touch-up paint.

Paint films shall be free of sags, checks, blisters, teardrops or fat edges. If any such defects appear, they shall be repaired by and at the expense of the supplier.

Provide interconnecting wiring between all electrical devices mounted in the panels and enclosures. If the devices are to be connected to external equipment, they shall be connected to terminal blocks. Conductors for connection of machine tool relays panel board circuits and other miscellaneous equipment shall be UL listed type THWN-MTW. Minimum size shall be No. 14 AWG. For internal conductors between the PLC I/O cards and the field wiring terminals shall be of similar type with a minimum size of No. 16 AWG.

Install all interior wiring neatly and carefully. Terminate at suitable terminal blocks. Make all wire terminations with ring tongue nylon self-insulating wire terminals. Install wire terminals using a high compression indenting crimping tool that assures a full crimp by releasing the terminal only when the crimp is complete. All control and instrument wiring used within the panels shall conform to NEC and NEMA standards and shall be installed and tested at the factory.

Wiring to each control switch shall be individually bundled. Install with a "drop loop" of sufficient length to allow its removal from the panel for maintenance without disconnecting the wiring.

Internal wiring in factory pre-wired electronic system cabinets may be installed according to the manufacturer's standard as to wire size, insulation, and method of termination on internal equipment.

Provide terminal blocks for conductors requiring connection to circuits external to the specified equipment, for internal circuits crossing shipping splits, and where equipment parts replacement and maintenance will be facilitated.

Provide terminal blocks with white marking strips. All terminal blocks shall be rated 600 volts and have strap screw terminals. Standard terminal blocks for 8 AWG and smaller conductors shall be channel mounted screw type in groups of 12 and shall be Square D 9080 GP6, Allen Bradley 1492-CA1, Tyco/Buchanan Series 900 or approved equal. Variations in number of terminal blocks per group shall be as shown in the drawings. Identify individual terminal blocks using the numbering system shown in the plans, using ABB/Enterlec marker-holder catalog number PEBM 0113 084.01 or approved equal.

Provide terminal blocks with corrosion resistant platings on non-ferrous hardware.

Group terminal blocks for easy accessibility unrestricted by interference from structural members and instruments. Provide sufficient space on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block.

Permanently label each terminal block, device, fuse block, terminal, and both ends of each conductor, to coincide with the identification indicated on the manufacturer's wiring diagrams. Terminal blocks and devices already numbered on the plans shall be so numbered on the equipment supplied. Identify mounted electronic components by marking with contrasting colored ink beside the component.

Identify individual conductors by permanent marking sleeves using handheld marking tapes or other computer generated software. The marking shall be done on a sleeve not less than 1/2 inch long. The inside diameter of the sleeve shall be such that it will slip snugly over the insulated wire. Mark each sleeve so that the identification shall be permanent and waterproof. Adhesive type labels are not acceptable.

Provide internal illumination in all panels and enclosures using 18" fluorescent strip fixtures. Install a lighting switch beside the access door inside the panels and enclosures. The control desk will not require internal lighting.

Provide a system of convenience outlets in each panel and enclosure for use with power tools, portable lamps, and other similar equipment. Furnish in each enclosure and the control desk a 120 volt AC circuit to feed the interior lighting, the convenience outlets and the illuminated indicators.

Prepare wiring diagrams on sheets approximately 22 inches by 34 inches. Where interconnecting wiring from different items of equipment or sectional wiring diagrams of the same item of equipment appear on different wiring diagram sheets, all interconnections shall be clearly identified.

Information indicated on the contractor's drawings shall include wiring of the individual panel items as they actually will appear in the panel, contact arrangements of switches, and internal wiring of relays and instruments.

Elementary diagrams shall be cross-referenced to terminal markings on the connection and interconnection diagrams, but need not show complete details of circuits external to the panels. Identify each item of panel mounted equipment indicated on the diagrams by item number and name.

Factory test all control panels for circuit continuity and operation.

Provide laminated phenolic nameplates on the panel faces for all instruments and devices mounted on the panel faces, except where the instruments or devices are themselves provided with a service engraving. Attach phenolic nameplates to the panels with double-sided adhesive tape.

All nameplates shall be WHITE with BLACK engraved lettering unless specified otherwise.

C.18.2 St. Paul Main Control Console

Furnish and install the Main Control Console in the St. Paul Bridge operator's tower where indicated on the plans, for operation of the span and its auxiliaries. All devices necessary for the local electrical control of the bridge shall be mounted on this console.

The control console shall be of neat, substantial construction, arranged as shown on the plans. It shall be fabricated from not less than No. 11 gauge sheet metal properly formed, and suitably reinforced by steel angles to provide adequate strength. The flat top and inclined portions of the console top shall be 10 gauge brushed stainless sheet steel. The top and front slope shall be of non-reflecting finish.

Provide removable doors in the front of each console, secured with 3-way latches. The console shall be neatly fitted up with close joints, and all rough edges or corners shall be ground off smooth and all projecting edges rounded off. All metal hardware shall be of substantial construction, and shall have a satin-chrome plate finish.

The bottom shall be of open type construction. The opening shall be framed with standard size strut, arranged to facilitate the clamping of cables or conduits.

Mount the span control switches and other control devices within the body of each console. Mount the indicating lights for each operation inside or adjacent to the control device governing that operation as indicated.

Provide a 12" x 12" shelf complete with knee braces for mounting of the St. Paul bridge intercom master control station as shown on the plans.

(1) Indicating Lights - Functions to be indicated, and the color of the caps for such indication shall be as shown on the plans. Each indicating light shall be as shown on layout. Each lens shall be provided with an engraved legend, as indicated on the plans, which shall be readily visible when the lamp is energized. Each indicating light shall be similar to type shown and it shall be suitable for mounting on the desk top provided.

(2) Span Operated Counter shall be 120VAC, 6-digit, panel mount, non-reset. Unit shall count 1/2 digit on a closed contact and 1/2 digit on an open contact.

C.18.3 Michigan Street Remote Control Panel

Furnish and install the Remote Control Panel in the St. Paul Bridge operator's tower where indicated on the plans, for operation of the Michigan Street bridge and its auxiliaries. All devices necessary for the remote electrical control of the bridge shall be mounted on this console.

The control panel shall be of neat, substantial construction, arranged as shown on the plans. It shall be fabricated from not less than No. 11 gauge sheet metal properly formed, and suitably reinforced by steel angles to provide adequate strength. The flat top and inclined portions of the console top shall be 10 gauge brushed stainless sheet steel. The top and front slope shall be of non-reflecting finish.

Provide removable door(s) in the front of the panel, secured with 3-way latches. The panel shall be neatly fitted up with close joints, and all rough edges or corners shall be ground off smooth and all projecting edges rounded off. All metal hardware shall be of substantial construction, and shall have a satin-chrome plate finish.

The bottom shall be of open type construction. The opening shall be framed with standard size strut, arranged to facilitate the clamping of cables or conduits.

Mount the span control switches, touch screen panel and other control devices on or within the body of the panel console. Mount the indicating lights for each operation inside or adjacent to the control device governing that operation as indicated.

(1) Indicating Lights - Functions to be indicated, and the color of the caps for such indication shall be as shown on the plans. Each indicating light shall be as shown on layout. Each lens shall be provided with an engraved legend, as indicated on the plans, which shall be readily visible when the lamp is energized. Each indicating light shall be similar to type shown and it shall be suitable for mounting on the desk top provided.
(2) Touch Screen Display Panel – The touch screen display shall be programmed to display the operational conditions of the Michigan Street Bridge before the operation begins and during operation of the bridge. The display screens shall include but not limited to the following:

- Main selection screen

- Bridge overview screen showing status of the traffic signals on/off, traffic gates raised/lowered, lift span position fully seated/fully open
- PLC Input status
- PLC Output status

Display screen shall be easy to read and understand and shall be similar in appearance to existing display screen operation currently in use by the City of Milwaukee. Submit a concept of each display screen for review and approval by the city and the engineer.

C.18.4 Relay Cabinet.

The Relay cabinet shall be of neat, substantial construction, arranged as shown on the plans. It shall be fabricated from not less than No. 12 gauge stainless steel properly formed, and suitable reinforced by steel angles to provide adequate strength. The door shall be 12 gauge stainless steel. The cabinet shall be Hoffman Engineering Co. catalog number A-726018SSFSDN4 with back panel or equal by Hammond Industries. The general arrangement may be varied to fit specific equipment used. The cabinet dimensions shall not be exceeded. The cabinet shall have a nameplate attached to the left hand door. Nameplates shall be not less than one inch high and shall be attached with stainless steel screws. Cabinet shall be mounted where shown on the plans and secures to the support shelf bracket using ¾" stainless steel bolts and hardware.

Factory test the Relay cabinet for circuit continuity and operation with associated equipment prior to shipment to the job site.

C.18.5 Switchboard Cabinet

The switchboard cabinet shall be of neat, substantial construction, arranged as shown on the plans. It shall be fabricated from not less than No. 12 gauge stainless steel metal properly formed, and suitable reinforced by steel angles to provide adequate strength. The doors shall be 12 gauge stainless steel. The cabinet shall be provided with flange mounted disconnect switch. The cabinet shall be Hoffman Engineering Co. catalog number A72X7318SSLPN4 with back panel or equal by Hammond Industries. The general arrangement may be varied to fit specific equipment used. The cabinet dimensions shall not be exceeded. The cabinet shall have a nameplate attached to the left hand door. Nameplates shall be not less than one inch high and shall be attached with stainless steel screws. Cabinet shall be mounted where shown on the plans and secured to the support shelf bracket using ¾" stainless steel bolts and hardware.

Factory test the switchboard cabinet for circuit continuity and operation with associated equipment prior to shipment to the job site.

C.18.6 Testing

Pre-test the complete electrical control system at the system integrators location. Testing shall include the control console, Relay cabinet and Switchboard cabinet. Make provisions to simulate the remote operation of the control system by simulating the inputs and outputs that will be performed over the fiber optics communication network.

External field devices such as limit switches, traffic gates etc., shall be simulated using a test panel capable of being switched to indicate different switch positions. Outputs to field devices shall be simulated using light panels.

Notify the engineer at least 30 days prior to the test so that he can arrange to witness the test.

The System Integrator's cost (if any) of debugging the control system shall be included in the contract.

C.19 Limit Switches

Limit switches shall be rated for not less than 250 volts AC or DC, and 10 amperes continuous AC or 0.4 amperes DC, and shall be of the following type:

Type 1 - Rotary cam, 6 circuit, NEMA 4X stainless steel enclosure, single pole/double throw contacts with timing dial and position resolver as specified elsewhere in these special provisions, Gemco type 1980R-406-X-SP-TD1-S, Link Controls type 72-610-4X-06-SD28 or approved equal.

Type 4 – Heavy duty, plunger operator, 2-circuit, NEMA 4, cast aluminum, epoxy coated enclosure, B&B Roadway Model LSP or approved equal.

Provide the limit switches with brass tags as they appear in the plans:

Switch Number	Type	Description
LS-EL	1	6-circuit rotary limit switch monitoring span height above seat position
LS-EL1	*	Closed Below 1.6 feet
LS-EL2	*	Closed Above 11.6 feet
LS-EL3	*	Closed Above 13.3 feet
LS-10SW/NW/ SE/NE	4	Opens when the lift span is fully seated

*Indicates switch is a portion of rotary limit switch LS-EL

C.20 Lift Cylinder Position Monitor System

The Lift Cylinder Position Monitor System shall consist of a lift cylinder resolver and a digital decoder/display unit. Four systems are required.

Mount one of the lift cylinder resolvers within the stainless steel rotary limit switch enclosure specified elsewhere in these special provisions. Mount the rotary limit switch where shown on the drawings. Mount the remaining three lift cylinder resolvers in a NEMA 13 enclosure provided with the resolver where shown on the drawings. Output shall be 3 digit decimal, programmable to correspond to 1,000 counts (0 through 999) for 359 degrees of shaft rotation.

The resolver unit mounted within the rotary limit switch enclosure shall be a size 11 transducer and shall be part number 1986A1XRX as manufactured by Gemco or approved equal. The unit shall be compatible with the programmable logic controller PLC equipment used. The remaining three resolver units shall be model 1986A1XRSA, all stainless steel construction as manufactured by Gemco or approved equal. The cable between the resolver and the decoder/display unit shall be Belden type 9330 or as recommended by the manufacturer and UL listed as tray cable.

The Digital Decoder/Display unit shall interface with the programmable logic controller to provide lift cylinder position for lift span skew monitoring and control. Provide PC handshake interface equipment as required. The digital decoder/display unit as manufactured by Gemco shall be Series 2120 or approved equal.

The Digital Decoder Display units mounted on the main control console shall be 3-digit decimal display and provide a 4-20 ma input analog output signal for use by the PLC for skew monitoring.

C.21 Traffic Gates

Traffic gates shall be as detailed on the drawings. Each gate shall have "jack knife" style vehicular gate arm of the length indicated on the plan, which shall open through an angle of 90 degrees from the horizontal to the vertical. Each gate shall have a welded steel housing, hot dipped galvanized after fabrication, arranged to provide a weather-tight housing for the motor, disconnect switch, gear train, limit switch and fuses for the warning lights. The transmission gearing for each gate shall be enclosed. Provide weather-tight, gasketed doors for access to the operating equipment.

The gate arms shall be a two-section combination aluminum and fiberglass unit configured to fold in a "jack knife" configuration when in the fully raised position. The first section closest to the gate housing shall be aluminum with the remaining sections made of fiberglass. Each assembled gate arm shall be designed for a 75 mph wind load. Gate arms shall be provided with a bumper rod with compression spring just above the folding point of the gate arm as shown on the plans to stop the travel at the closed position without undue shock.

All bolts, screws or other fastenings used in the gate arm assembly and for connection to the gate stand shall be of corrosion-resisting metal or shall be hot-dip galvanized.

The number of warning lights on the gate arms shall be as indicated on the plans. Each warning light shall be a weatherproof, two-way, cast aluminum unit with red Fresnel lenses front and back. The lights shall be interconnected with three-conductor portable cord using watertight connectors at the fixtures. The lights shall be connected so that adjacent units will flash alternately. The flasher unit shall be remote from the gate housing and located in the electrical equipment cabinets as shown on the plans. Fuses for the warning lights shall be midget cartridge fuses installed in molded rubber connection

kits. Provide cannon plug connectors from the gate housing to the gate arm for the warning lights. Lamps shall be LED type.

Provide an 8-circuit heavy-duty limit switch in each gate, operated by the gate mechanism. Each limit switch shall be a rotary, cam-type, switch and it shall be gear-driven from the transmission. The contacts shall be quick-break with silver alloy buttons. The limit switch shaft shall be stainless steel, and cams shall be secured thereto with setscrews.

The motor for each warning gate shall be furnished as part of the gate by the gate manufacturer. Each motor shall be a totally enclosed, 208 volt, three-phase, 60-cycle ball-bearing induction motor complete with solenoid released brake and shall be capable of withstanding instant reversal when running at full speed. Each motor and gear train shall be capable of raising and lowering the gate in about 11 seconds. A motor-mounted, spring-set, magnetically released disc brake shall be provided for stopping and holding the mechanism. Provide a watertight disconnect switch to permit disconnecting the motor and brake from the incoming power.

All internal wiring for each gate shall be brought to numbered terminal blocks inside the housing for the connection of external circuits. Provide internal space heater and utility receptacle within each traffic gate housing. Internal connection shall be as shown on the drawings.

Each gate arm shall be striped on both faces with alternate red and white reflectorized stripes 16 inches wide measured parallel to the edge of the gate arm. The stripes shall slope downward at an angle of 45 degrees toward the centerline of the roadway. The galvanized gate stands, gate arm channels and supports shall be painted in accordance with the requirements specified herein for painting structural steel.

Each warning gate shall be bolted to its concrete foundation as indicated on the plans. In erecting the gates, carefully attach the aluminum and fiberglass arms to the supporting members so as to make a rigid connection. The arms shall be counterbalanced and the limit switches adjusted so that the arms are stopped in a truly vertical or horizontal position.

Make provisions for hand operation, and furnish a hand crank for each gate. Furnish each gate with an adaptor that will enable a hand-held drill to be used for operation.

Traffic gate shall be B&B Roadway Manufacturing model VW-4 or approved equal.

C.22 Traffic Signals, Warning Gongs and Warning Bells

C.22.1 Traffic Signals

Each traffic signal assembly shall consist of a single-face, two-section, alternately flashing red signal head assemblies for vertical mounting as indicated on the plans. Each traffic light section shall be a weatherproof unit consisting of a separate polycarbonate housing with hinged lens holder and polycarbonate hood. The lens shall be 12 inches in

diameter and shall conform to the specifications of the Institute of Transportation Engineers. The reflector shall be silvered glass, and the socket shall be focused for use with a 116-watt, traffic signal lamp. The lens shall be encased in a weather-proof seal. Each traffic light assembly shall be LFE Automatic Signal Corp. series A-7003 or approved equal by B & B Roadway Manufacturing.

Each traffic light section shall be provided with a tunnel-type, detachable visor. Lenses shall have a combination of directing and diffusing prisms on the inner side of the lens to concentrate maximum candle power in the center of the beam. Lenses shall be furnished with a continuous soft rubber gasket completely surrounding the edge of the lens. The front portion of the gasket shall seat tightly against the door and the back portion shall press against the reflector support ring when the door is closed. The reflector assembly shall be hinged to the signal body.

The traffic signal flasher unit shall be mounted within the Relay Cabinet as shown on the plans. The flasher shall be rated 120 volts AC, consisting of two (2) flashing circuits. Each circuit shall flash .50 seconds on and .50 seconds off. Flasher output circuits shall be rated at 5 amps minimum at 120 volts. Flasher shall be B&B Roadway Manufacturing catalog number 120A60DFWS-ROA or approved equal.

The traffic signal poles shall consist of a tapered steel shaft complete with anchor base, anchor bolts, handhole, cast pole top, and a flange plate near the top of the pole for mounting the mast arm. Round tapered support beams shall be complete with a mounting flange plate, hanger clamp and outlet having a 1-inch ID rubber grommet for wiring each signal and a removable cap.

The shaft shall be made of 1 length steel fabricated from a minimum 7 Ga. high strength cold rolled steel and shall conform to the requirements of ASTM A595 Grade A. A 4"x8" handhole complete with cover shall be welded into the shaft 15" above the base. A J-hook wire support shall be welded near the top of the shaft. Furnish an opening near the top of the shaft to provide a cable entrance from the shaft into the bracket mast arm.

A one-piece cast steel anchor base of adequate strength, shape and size, shall conform to ASTM A27 Grade 65-35 and shall be secured to the lower end of the shaft by two continuous electric arc welds, approximately 2" apart. Provide four holes in the base to receive the anchor bolts, four holes for ventilation in the body of the base and four tapped holes for attaching the covers.

The tapered support beams shall be made of 7 Ga. steel and conform to ASTM A 595 Grade A. A flange plate shall telescope the large end of the beam and be welded by two continuous electric arc welds. The flange plate shall have four holes for the flange bolts conforming to ASTM A325. Each support beam shall have wire outlet holes on the bottom surface, with rubber grommet, located at each signal position. Poles shall be by Union Metal, Valmont or approved equal.

C.22.2 Traffic Gate Mounted Warning Bell

Provide and mount warning gongs on the on-coming traffic gates as shown on the plans. The warning gong shall be a twelve-inch motor driven gong type, and operate at 120 VAC. Each warning gong shall be B&B Roadway Manufacturing model G-12 or approved equal.

C.23 Milwaukee Metropolitan Sewer District (MMSD) Equipment

The contractor shall remove existing MMSD equipment, cabinets, associated conduits and miscellaneous items from the east pier where shown on the plans. This equipment shall include, but not limited to, a large green cabinet, a large stainless steel box, cast iron piping, all related conduit and miscellaneous items. All removed equipment shall be disposed of by the contractor as part of this contract.

Provide a 20 amp, 120 volt single phase circuit from the east pier panel board to the north end of the east pier as shown on the drawings. Provide a 6" x 6" x 4" stainless steel pull box at the end of the conduit run. Locate pull box 8'-0" above the pier walkway. Leave 10 feet of cable coiled for MMSD to use for connection of their equipment.

C.23 Instruction Books.

C.23.1 General

Furnish 5 hard bound copies each of two loose-leaf booklets and 2 electronic copies. The materials shall be bound into each booklet between rigid plastic or cloth binding covers. The instruction booklets shall be approximately 9 inches by 12 inches, and the diagram booklet large enough to contain the drawings without excessive folding so that they may be easily opened. The booklets shall be neatly entitled with a descriptive title, the name of the project, the location, year of installation, owner, supplier and engineer. Copies of drawings shall be in black on white background and shall be easily legible. The arrangements of the booklets, the method of binding, materials to be included, and the composite text shall all be reviewed and approved by the engineer.

C.23.2 First Booklet

The first booklet shall contain the following:

(1) Table of Contents.

(2) Operator's Instructions, which shall cover in full the step-by-step sequence of operation of the bridge and its auxiliaries, and shall note all precautions required for correct operation. Complete instructions for the following shall be included.

a. Selection of the power supply.

b. Normal operation of the span on commercial power source.

(3) Detailed maintenance instructions for adjusting, lubricating, and operating all of the electrical equipment, including manufacturer's recommended preventative maintenance lubrication schedule.

(4) A set of descriptive leaflets, bulletins, and drawings covering all items of equipment and apparatus made a part of the completed bridge operation and control. The catalog number of each piece, to be used in case it becomes necessary to order replacement parts from the manufacturer. This information shall be furnished for all electrical equipment such as motors, switches, circuit breakers, relays, cables, etc.

(5) Copies of all warranties on equipment supplied to the project.

C.23.3 Second Booklet

The second booklet shall contain legible reduced size photostatic copies of the following drawings, corrected to show the work as constructed:

(1) The complete spare parts list.

(2) All schematics and wiring diagrams.

(3) The control desk and control panel layouts and wiring diagrams for all equipment.

(4) The schedule of electrical apparatus.

(5) All submitted shop drawings.

(6) All conduit layout and installation drawings.

C.24 Training

Provide and conduct training sessions consisting of the following:

Bridge operators shall be fully trained on operation of the bridge both for local control and for remote control.

Maintenance personnel shall be fully trained on the maintenance aspects of the relay control system, PLC equipment, the system programming panel, skew monitoring system and skew correction procedures.

C.25 Field Tests

C.25.1 Preliminary Checkout Period

Arrange for and provide all the necessary field tests, as indicated herein and as directed by the engineer, to demonstrate that the entire electrical system is in proper working order and is in accordance with the plans and specifications.

The contractor shall be responsible for operation and maintenance, including all costs thereof, for systems or equipment temporarily placed in operation for testing and adjusting purposes or for the convenience or necessity of the contractor, prior to final acceptance by the engineer.

The contractor shall instruct the bridge operating personnel in the operation of equipment during test runs and prior to acceptance. This training session shall be video taped and given to the city at the completion of the training session.

C.25.2 Manufacturer Representatives
Appropriate representatives of the bridge electrical control equipment shall arrange to be on site.

These representatives shall be capable of making adjustments to the equipment, of locating faults or defects and correcting them if possible, and of obtaining from the manufacturers without delay, new parts for replacement of apparatus which, in the opinion of the engineer, do not perform satisfactorily.

C.25.3 Operational Testing Period
After the span is operating to the satisfaction of the engineer, the contractor and its manufacturers' representatives, an operational test period of not less than one week shall begin, during which time all aspects of the bascule span control system and remote control system will be tested and observed by the engineer. During this period, the contractor shall make any repairs necessary as a result of equipment failure due to faulty equipment or workmanship. Should preliminary checks or operational tests show that any piece of equipment furnished by the contractor, in the judgment of the engineer, is defective or functions improperly, such adjustments and/or replacements shall be made by the contractor as to make the installation completely acceptable to the engineer, and at no extra cost to the City.

C.26 Sequence of Normal Operation
The span shall normally be operated using the commercial electric power source. The span normally will be retained in the seated, closed position. The sequence of normal operation shall be as follows:

<u>Operating Procedure (Local)</u>

a. Preliminary Switch Settings

(1) Check supply voltage. Voltage should always be within 5% of 480V line-to-line.

(2) Verify the “Pump Select” control switch in the “BOTH” position. Placing the control switch in either Pump A or Pump B positions will operate the span at the half speed increasing the operating time to raise and lower the span.

b. To Open Span

(1) Three distinct blasts from vessel signifies that a bridge opening is required.

(2) Turn "Bridge Control" key switch to the "On" position.

(3) Activate the traffic signals by turning "Traffic Signals" control switch to "ON". This will turn on the warning bells and begin flashing the traffic signals.

(4) Signal vessel with the "Horn" pushbutton if the span is to be opened immediately, or with four distinct blasts if a delay is necessary due to a traffic jam, accident, or other causes.

(5) When on-coming traffic has stopped, lower both on-coming gates by turning and holding the NE and SW "Traffic Gate" control switches to the "Lower" position.

(6) When on-coming traffic gates are lowered and it is observed that the Span is clear of Off-Going traffic and pedestrians then lower both off-going gates by turning and holding the SE and NW "Traffic Gate" control switches to the "Lower" position.

Observe the indicating lights as follows:

Lamps	Color	Indication
Traffic Signals	Red	Signals set against traffic
Traffic Gates	Red	Gates Closed
Span	Green	Spans full seated

(7) Observe that no vehicles or pedestrians are near the movable span. Turn the “Pump Control” switch to the “ON” position to start the hydraulic pump motors.

The “Green” Pump Run light will go on, indicating that both hydraulic pump motors have started. Once the pump motors are running, move the bridge control “Joy Stick” from the “Stop” position to the “Slow Raise” position to begin moving the span. Observe the four (4) “Span Seated” lights go off and the amber “Near Closed” light comes on.

At approximately 18 inches above the seated position, observe the amber “Near Closed” light goes off. At this position, the “Joy Stick” can be placed to the “Fast Raise” position increasing the operating speed of the bridge. Placing the “Joy Stick” in the “Fast Raise” position before a height of 18 inches will not place the span in the faster speed of operation until the span has reached and passed the elevation of 18 inches above fully seated.

While the span is raising, observe the four lift cylinder position indicators to monitor the lift height of each cylinder. During operation, should the difference between any of the four cylinders exceed 3 inches, the Skew Warning light will illuminate on the control desk to alert the operator of an impending skew condition. If the difference should exceed 4 inches, the span operation will automatically stop and the Red “Skew Shutdown” light will come on. Follow the skew adjustment instructions listed on the control desk before continuing the bridge operation.

Observe the indicating lights, after bridge is moving, as follows:

Lamps	Color	Indication
Traffic Signals	Red	Signals are set against traffic
Traffic Gates	Red	Traffic Gates are lowered
Joy Stick	Red	Span Raising
Span	None	Span between "Near Closed" and "Near Open" positions

(8) As the span approaches about 11’-6”, as observed on the "Lift Cylinder Position Indicator" and the amber colored "Near-Open" indicating light, the span will automatically slow from the normal high speed mode and continue at the slow speed until the span reaches the full open position of 13.3 feet. The span will automatically stop when the span reaches the full open position.

Observe the indicating lights, after bridge is stopped, as follows:

Lamps	Color	Indication
Traffic Signals	Red	Signals are set against traffic
Traffic Gates	Red	Traffic Gates are lowered
Joy Stick	None	Span not moving
Span	Red	Span fully open

c. To Close Span:

(1) After confirming that the vessel has cleared the span and no vessels are approaching the span for passage through the opening, sound four short warning blasts, denoting the closing of the spans.

(2) Turn the “Main Pump” off by turning the “Pump Select” switch to the “Off” position. Place the “Joy Stick” to the “Slow Lower” position. Observe the span is beginning to lower and the red “Open” goes off and the amber “Near Open” light comes on. When the amber “Near Open” light goes off, place the “Joy Stick” in the Fast Lower” position.

While the span is lowering, observe the four lift cylinder position indicators to monitor the lift height of each cylinder. During operation, should the difference between any of the four cylinders exceed 3 inches, the Skew Warning light will illuminate on the control desk to alert the operator of an impending skew condition. If the difference should exceed 4 inches, the span operation will automatically stop and the Red “Skew Shutdown” light will come on. Follow the skew adjustment instructions listed on the control desk before continuing the bridge operation.

When each span reaches about 18 inches above seat, the span will automatically slow to the “slow speed”. The spans will continue at this speed until each span is fully seated.

Observe the indicating lights as follows:

Lamps	Color	Indication
Traffic Signals	Red	Signals are set against traffic
Traffic Gates	Red	Traffic gates are lowered
Joy Stick	None	Spans not moving
Span	Green	Spans seated

(3) Visually observe that the bridge span is down and that no pedestrians are near the traffic gates. Raise the traffic gates by turning the NW and SE traffic gate control switches to the “Raise” position, then turn the SW and NE traffic gate control switches to the “Raise” position. Limit switches will automatically stop the gates at the open positions. As an option, the “All Gates Raise” push button can be pushed and all four traffic gates will raise at the same time.

(4) When all traffic gates are at the open limits, set the Traffic Signal switch to the “Off” position. The warning bells will go off. Observe the indicating lights as follows:

Lamps	Color	Indication
Traffic Signals	Green	Signals are set allow traffic
Traffic Gates	Green	Traffic gates are raised
Span	Green	Spans seated

(5) The "Bridge Control" key switch should now be turned "Off". This key operated switch will prevent unauthorized tampering with the operation of the bridge and its auxiliaries. Remove the key from the key switch if the bridge is to be unattended for any period of time.

C.27 Spare Parts

Furnish the following spare parts:

(a) One circuit breaker of each kind and size installed in the panelboards.

(b) Three control relays with a minimum of one contact block with 4 contacts installed on the relay.

(c) A quantity of 30% (3 minimum) of the total for each size and type of thermal overload relay installed.

(d) For the control desk lights:

12 indicating lamps for each type installed
1 color cap of each color and legend

(e) For the programmable controller:

One each of each type circuit card or module containing solid state devices. If more than ten cards or units of a type are provided, two spares shall be supplied.

(f) For the traffic gates:

One completely assembled “jack knife” style gate arm complete with warning lights and bumper rod installed on the gate arm assembly.

Provide spare parts in sealed, uniform-sized cartons, with typed and clearly varnished labels to indicate their contents. Provide a directory of permanent type describing the parts. The directory shall state the name of each part, the manufacturer's number therefore, and the rating of the device for which the part is a spare. The spare parts shall also be marked to correspond with their respective item numbers as indicated on the elementary wiring diagram. Each circuit card requiring adjustments shall be adjusted at the bridge prior to final delivery to the City. Spare parts shall be delivered to the City for Milwaukee or at a location designated by the City of Milwaukee.

C.28 Painting

Exposed metal parts of the electrical equipment installation attached to the steel work of the bridge, such as raceways, boxes, and their accessories, shall be hot-dipped galvanized and shall be painted the same color as the steel work. Interior metal parts shall be primed and painted to match surrounding surfaces. Refer to Bridge Painting section of these Special Provisions.

C.29 Guarantee

The contractor shall be responsible for the proper performance in part and as a whole of the electrical equipment provided for the operation of the lift spans and related parts for a period of one year after the completion of the operational testing period. During the first year of operation, the contractor shall correct at his own expense any difficulties in the operation which may arise as the result of defects of material, equipment and manufacture. Responsibility for such correction shall include the repair, readjustment and replacement not only of such defective parts, but other parts which may have been damaged thereby. The Owner reserves the right to correct any such defects, and the contractor shall pay the cost thereof. The contractor shall give a written guarantee satisfactory to the Owner to insure the carrying out of the obligations.

C.30 Existing Equipment

The contractor shall carefully remove all major electrical equipment and associated cabinets shall be removed from the bridge as part of the demolition and turned over to the City of Milwaukee at a location determined by the city. This equipment shall include but not be limited to the following items, Brake Control Cabinets, Remote PLC Cabinet,

Operator Desk Top, Wall and Ceiling Heaters, Hot Water Heater, Bridge Position Limit Switches, Navigation and Pier Lights, Sump Pump Motor Starters, Telecenter and Video Card Cabinet, Traffic Gates and Gate Houses, CCTV Cameras, Electric Signal Horn or other equipment designated by the City of Milwaukee.

D Measurement

D.1 Bridge Electrical Work

The City will measure Bridge Electrical Work as a single lump sum unit acceptably completed. Spare electrical parts are excluded.

E Payment.

E.1 Bridge Electrical Work

The City will pay for the measured quantity at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.300	Bridge Electrical Work	LS

Payment is full compensation for removing and disposing the existing electrical system; for furnishing and installing the complete system as specified, ready for operation; for operation and maintenance manuals; and for furnishing all shop drawings, materials, labor, tools, equipment, incidentals and services (including control system vendor services) necessary to achieve a complete and acceptable installation.

At the preconstruction meeting, submit to the engineer for evaluation a full and complete breakdown of all costs under this item. The engineer has full authority to revise the breakdown to suit his/her judgment, and make the various tasks more in conformity with the adjudged true values. The contractor agrees the detailed breakdown will not be effective until it has been approved by the engineer. Progress billing payments will be based upon the approved breakdown.

A minimum of ten-percent of the bid item amount will be retained by the City until final acceptance of the bridge electrical system, the contractor and control system vendor have completed all items on their punch lists, and all aspects of bridge operation, operator and maintenance personnel testing, training, and control are complete. An additional five-percent of the bid item amount will be retained until final approval of the operation and maintenance manuals is granted by the engineer.

57. Bridge Operator’s House, Item SPV.0105.350.

A DESCRIPTION

Furnish all labor, material and tools required for the satisfactory completion of the bridge operator's house selective demolition and construction at the St. Paul Avenue Bridge in accordance with the drawings and as set forth in these specifications.

Included are the following:

0. Selective Demolition
1. Concrete Unit Masonry
2. Metal Fabrications
3. Rough Carpentry
4. Thermal Insulation
5. Sheet Metal Roofing and Wall Panels
6. EPDM Roofing.
7. Roof Hatch
8. Joint Sealants
9. Steel Doors and Frames
10. Aluminum Windows
11. Door Hardware
12. Glazing
13. Gypsum Veneer Plaster
14. Resilient Base
15. Painting
16. Fire Extinguishers
17. Plastic Fabrication
18. Roller Shades

Related Articles:

"Concrete Staining" for staining concrete for bridge operator's house
"Bridge Structural Steel" for bridge operator's house steel framing.

B MATERIALS
B.0 SELECTIVE DEMOLITION

Section includes:

Demolition and removal of selected portions of building or structure.
Salvage of existing items to be reused.

B.0.1 Definitions

Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B.0.2 Predemolition Meeting
Conduct meeting at project site.

B.0.3 Field Conditions
Hazardous Materials: It is not expected that hazardous materials will be encountered in the work. If suspected hazardous materials are encountered, do not disturb; immediately notify the engineer. Hazardous materials will be removed by City under a separate contract.

Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

B.0.4 Performance Requirements
Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

Standards: Comply with ANSI/ASSE A10.6 and NFPA 241

B.1 CONCRETE MASONRY UNITS
Provide concrete unit masonry and reset precast concrete window sill as shown and as specified.

Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

B.1.1 Submittals
Product Data: For each type of product indicated.

Mix Designs: For mortar and grout. Include description of type and proportions of ingredients.

B.1.2 Project Conditions
Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

B.1.3 Materials
Concrete Masonry Units (CMUs): ASTM C 90.

Integral Water Repellent: Provide units made with liquid polymeric, integral water repellent admixture that does not reduce flexural bond strength.

Products: Subject to compliance with requirements, provide the following

available products that may be incorporated into the Work include, but are not limited to, the following:

ACM Chemistries, Inc.; RainBloc.
BASF Aktiengesellschaft; Rheopel Plus.
Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

Density Classification: Normal weight.

Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.

Hydrated Lime: ASTM C 207, Type S.

Aggregate for Mortar: ASTM C 144.

Aggregate for Grout: ASTM C 404.

Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs, containing integral water repellent by same manufacturer.

Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

ACM Chemistries, Inc.; RainBloc for Mortar.
BASF Aktiengesellschaft; Rheopel Mortar Admixture.
Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 deformed bars, ASTM A 775/A 775M, epoxy-coated, with less than 2 percent damaged coating in each 12-inch bar length.

Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

Masonry Joint Reinforcement: ASTM A 951/A 951M, hot-dip galvanized, carbon steel, either ladder or truss type with single pair of side rods.

Wire Size: 0.148-inch diameter.

Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.

Ties and Anchors:

Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.

Anchors for Connecting to Concrete: Corrugated Metal Ties consisting of metal strips not less than 1-1/4 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.075 inch thick, steel sheet, galvanized after fabrication with 1-1/2 inch 90 degree bend with 9/32 inch diameter hole for fastening to concrete and sized to extend to within 4 inches into masonry.

Partition Top anchors: 0.105 inch thick metal plate with 3/8 inch diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene or urethane.

B.1.4 Mortar and Grout Mixes
Mortar: Comply with ASTM C 270, Type N, Proportion Specification.

Grout: Comply with ASTM C 476.

B.2 METAL FABRICATIONS
Provide metal fabrications and castings (except structural steel framing) as shown and as specified.

Included are the following:
Metal stairs, including platforms and landings
Handrails and guardrails for metal stairs
Guardrail at roof parapet
Roof hatch ladder
Light Coves

B.2.1 Submittals
Shop Drawings: Show fabrication and installation details for metal fabrications.

Include plans, elevations, sections and details of metal fabrications and their connections. Show anchorage and accessory items.

Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed

by the qualified professional engineer responsible for their preparation.

Welding Certificates: Signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" paragraph herein.

B.2.2 Quality Assurance

Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this project with a record of successful in-service performance and with sufficient production capacity to produce required units without delaying the work.

Installer Qualifications: Fabricator of products.

Engineer qualifications: A professional engineer licensed by the State of Wisconsin, experienced in providing engineering services of the kind indicated that have resulted in the installation of metal stairs similar to this project in material, design, and extent and that have a record of successful in-service performance.

Welding: Qualify procedures and personnel according to the following:

AWS D1.1, "Structural Welding Code--Steel."

NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

Pre-assembled Stairs: Commercial class.

Metal Bar Grating Standard: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."

Mockup: Build mockup for light coves, 24 inches long, to verify material selections and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B.2.3 Field Conditions

Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

Coordination:

Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

Coordinate fabrication and installation of light coves with Section 17 of this article, “Plastic Fabrications,” for related lenses and Article 61 “Bridge House Electrical Systems” for light fixtures.

B.2.4 Performance Requirements

Delegated Design: Design metal stairs, handrails and guardrails, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

Structural Performance:

Metal Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

Uniform Load: 100 lbf/sq. ft..
Concentrated Load: 300 lbf applied on an area of 4 sq. in..
Uniform and concentrated loads need not be assumed to act concurrently.
Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch, whichever is less.

Handrails and guardrails: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

Handrails:

Uniform load of 50 lbf/ ft. applied in any direction.
Concentrated load of 200 lbf applied in any direction.
Uniform and concentrated loads need not be assumed to act concurrently.

Top Rails of Guards:

Uniform load of 50 lbf/ ft. applied in any direction.
Concentrated load of 200 lbf applied in any direction.
Uniform and concentrated loads need not be assumed to act concurrently.

Infill of Guards:

Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
Uniform load of 25 lbf/sq.ft. applied horizontally.
Infill load and other loads need not be assumed to act concurrently.

Limit deflection of handrails and top rails of guards to 1/4 inch, when tested per ASTM E 935.

Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Temperature Change (Range): 140 deg F, ambient; 200 deg F, material surfaces.

B.2.5 Materials

Metal Surfaces: Provide materials with smooth, flat surfaces. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

Steel Plates, Shapes, and Bars: ASTM A 36.

Steel Tubing: ASTM A 500, cold-formed steel tubing.

Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

Wire Rod for Grating Crossbars: ASTM A 510.

Aluminum Sheet: Flat sheet complying with ASTM B 209 alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H32.

Abrasive Nosings: Cast-Metal Units: Cast gray iron, Class 20, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.

Configuration: Crosshatched angle-shaped units, same depth as bar-grating treads and 1 to 1-1/2 inches wide.

Manufacturers:

American Safety Tread Co., Inc.
Balco Inc.
Wooster Products Inc.

Fasteners: Provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at interiors. Provide

Type 304 stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

Anchor Bolts: ASTM F 1554, Grade 36.

Machine Screws: ASME B18.6.3.

Anchors: Provide chemical or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488.

Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

B.2.6 Fabrication, General

Shop Assembly: Pre-assemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

Form exposed work true to line and level with accurate angles and surfaces and straight edges.

Weld corners and seams continuously to comply with the following:

Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

Obtain fusion without undercut or overlap.

Remove welding flux immediately.

At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

B.2.7 Metal Stairs

Provide complete stair assembly, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

Stair Framing: Fabricate stringers of structural steel channels, plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; and bolt or weld newels and framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finish surfaces.

Treads and Platforms: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

Fabricate treads and platforms from welded steel grating with 1-1/4-by-3/16-inch bearing bars at 15/16 inch o.c. and crossbars at 4 inches o.c., NAAMM designation: W-15-4 (1-1/4 x 3/16) STEEL.

Bar Surface: Serrated.

Fabricate grating treads with cast abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.

Fabricate grating platforms with nosing matching that on grating treads. Provide toe-plates at open-sided edges of grating platforms. Weld grating to platform framing.

B.2.8 Handrails and Guardrails

Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, and anchorage, but not less than that needed to withstand indicated loads

Fabricate railings with welded connections, unless otherwise indicated.

Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

Non-welded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

Fabricate stair handrails and guardrail at roof parapet from 1-1/2 inch diameter steel tube or 1-1/4 inch diameter steel pipe.

Form changes in direction of railings by bending or by inserting prefabricated fittings..

Form curves by bending members in jigs to produce uniform curvature without buckling.

Close exposed ends of railing members with prefabricated end fittings.

Provide wall returns at ends of wall-mounted handrails.

Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

B.2.9 Roof Hatch Ladder

Comply with ANSI A14.3, unless otherwise indicated.

Side-rails: Continuous, 5/8-by-3-inch steel flat bars, with eased edges.

Rungs: 3/4-inch diameter steel bars, unless otherwise indicated.

Fit rungs in centerline of side-rails; plug-weld and grind smooth on outer rail faces.

Provide non-slip surfaces on top of each rung either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

Space side-rails 16 inches apart, unless otherwise indicated.

Support ladder at top and bottom with welded or bolted steel brackets.

B.2.10 Light Coves

Form light coves from 0.063 inch aluminum sheet with 1/8 inch thick face plates.

Coordinate size of coves, location of cutouts for electrical wiring, and method of attachment to adjoining construction.

Light coves may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.

Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.

Build in straps, plates, and brackets as needed to support and anchor light coves to adjoining construction. Reinforce items as needed to attach and support other construction.

Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.

B.2.11 Steel Finishes

Hot-dip galvanize steel fabrications, including hardware, after fabrication.

Comply with ASTM A 123/A 123M for hot-dip galvanized railings.

Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

Comply with ASTM D 6386 preparation for painting of hot dip galvanized steel except grating at stair treads and landings.

Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

Steel, except grating at stair treads and landings, shall be finished with 2 coat paint

system as specified in Article 20 “Painting Epoxy System”. Colors as selected by Architect and approved by the City.

B.2.12 Aluminum Finish

Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.

Color: Medium bronze

Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B.3 ROUGH CARPENTRY

Provide rough carpentry work as shown and as specified. Rough carpentry includes:

Framing with dimension lumber.
Rooftop equipment bases and support curbs.
Wood blocking

B.3.1 General

Wood products shall be factory-marked to identify type, grade, inspection agency, producing mill and other qualities as specified.

Obtain measurements and verify dimensions shown before proceeding with carpentry work.

Keep carpentry materials dry during delivery. Store lumber and plywood in stacks with provisions for air circulation within stacks. Protect bottom of stacks against contact with damp or wet surfaces. Protect exposed materials against weather. Do not store dressed or treated lumber of plywood outdoors.

B.3.2 Lumber

Lumber shall comply with U.S. Product Standard PS-20 for American Softwood Lumber, U.S. Dept of Commerce, and with rules of applicable manufacturer's association or authorized inspection bureau under which each species of lumber is produced.

Nominal sizes shown and specified refer to undressed lumber dimensions. Dress lumber four sides (S4S), unless otherwise shown or specified, and work to shapes and patterns shown. Detailed dimensions show actual sizes required.

Framing and miscellaneous lumber: Construction or No. 2 grade.

Species:

Hem-fir (north); NLGA.
Southern pine; SPIB.
Douglas fir-larch; WCLIB or WWPA.

Maintain 19% maximum moisture content for all pieces of construction lumber. Mark Lumber "DRY."

B.3.3 Plywood

Plywood shall comply with U.S. Product Standard PS-1 for Construction and Industrial Plywood, U.S. Dept. of Commerce, except as otherwise specified.

Plywood shall be exterior-type plywood, APA Grade CDX, in thickness indicated.

B.3.4 Pressure Preservative Treated Wood

Preservative treated lumber and plywood shall comply with the applicable requirements of AWPA U1, Use Category UC3b and shall bear quality mark of an inspection agency approved by ALSC's Board of Review.

Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

Pressure treat wood framing, sheathing, nailers and blocking and similar members in connection with roofing, flashing, and vapor retarders.

If wood is cut after treatment, coat cut surfaces with heavy brush coat of same preservatives used for treatment in accordance with AWPA M4.

B.3.5 Fasteners

Provide fasteners, anchors, etc., for proper assembly and erection. Fasteners shall be of size to rigidly secure members in place.

For pressure-preservative treated plywood sheathing and lumber, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B.3.6 Metal Framing Anchors
Products: Subject to compliance with requirements, provide either the basis-of-design products indicated on Drawings or comparable products by one of the following:

Alpine Engineered Products, Inc.
Cleveland Steel Specialty Co.
Harlen Metal Products, Inc.
KC Metals Products, Inc.
Simpson Strong-Tie Co., Inc.
Southeastern Metals Manufacturing Co., Inc.
USP Structural Connectors.

Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

B.3.7 Curved Light Gauge Metal Track
Hand bendable framing track fabricated from 0.033 inch thick (20 gauge) ASTM A 653/A 653M galvanized steel sheet, G60 coating designation.

Flange Height: 1-1/2 inches

Web Depth: To suit framing indicated.

Basis of Design Product: Ready-Track; Radius Track Corporation.

Subject to compliance with requirements, provide either the basis-of-design products or comparable products by another manufacturer.

B.4 THERMAL INSULATION
Provide either glass fiber blanket insulation or loose-fill insulation in framing of bridge operator’s house roof as shown and as specified.

Tapered insulation under EPDM membrane is specified in “EPDM Roofing” paragraph.

B4.1 Submittals
Manufacturer’s product data for each type of product indicated.

B.4.2 Materials
Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and

smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type I for pneumatic application or Type II for poured application; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

Polyethylene Vapor Retarders: ASTM D 4397, 10 mils thick, with maximum permeance rating of 0.13 perm.

Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

B.5 SHEET METAL ROOFING AND WALL PANELS

Provide custom-fabricated metal roofing and wall panels as shown and as specified. Metal roofing and wall panels include:

Copper standing seam roofing and wall panels.
Aluminum flat-seam soffit panels.
Copper gutters, downspouts, scupper, sump and coping.

B.5.1 Submittals

Product Data: For each type of product indicated.
Shop Drawings:

Include plans, elevations, sections, and attachment details.
Detail fabrication and installation layouts, expansion joint locations, fixed points, and keyed details. Distinguish between shop- and field-assembled work.
Include details for forming, including seams and dimensions.
Include details for joining and securing, including layout and spacing of fasteners, cleats, and other attachments. Include pattern of seams.
Include details of termination points and assemblies.
Include details of expansion joints, including showing direction of expansion and contraction from fixed points.
Include details of penetrations.
Include details of edge conditions.
Include details of special conditions.
Include details of connections to adjoining work.

Samples: For each exposed product and for each color and texture specified, minimum 3 inches x 5 inches..

Qualification Data: For fabricator.

B.5.2 Quality Assurance

Sheet Metal Fabricator Qualifications: Fabricated a minimum of 250,000 square feet of

metal roofing and wall panel systems of similar type to that specified that have a record of successful in-service performance.

Installer Qualification: Fabricator of sheet metal roofing and wall panels.

B.5.3 Delivery, Storage and Handling

Do not store sheet metal materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal materials away from uncured concrete and masonry.

Protect strippable protective covering on sheet metal from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal installation.

B.5.4 Performance Requirements

General Performance: Sheet metal roofing and wall panels system including, but not limited to, metal panels, cleats, anchors and fasteners, sheet metal flashing integral with sheet metal panels, fascia panels, copings, trim, underlayment, and accessories, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, or installation, or due to other defects in construction. Sheet metal roofing shall remain watertight.

Sheet Metal Roofing and Wall Panel Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or indicated on Drawings.

Copper Roofing and Wall Panel Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

Temperature Change: 130 deg F, ambient; 200 deg F, material surfaces.

B.5.5 Sheet Metals

Copper Sheet: ASTM B 370, cold-rolled copper sheet, H00 temper.

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:

Hussey Copper Ltd.
Revere Copper Products, Inc.

Weight (Thickness): 16 oz./sq. ft. unless otherwise indicated.

Finish: Mill.

Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

Thickness: 0.040 inch unless otherwise indicated.

Exposed Coil-Coated Finish:

Mica Fluoropolymer: AAMA 620. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Color: As selected by Architect from manufacturer's full range.

Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

B.5.6 Underlayment

Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
Grace Construction Products, a unit of W. R. Grace & Co.-Conn.; Ultra.
Protecto Wrap Company; Protecto Jiffy Seal Ice & Water Guard HT.
SDP Advanced Polymer Products Inc; Palisade SA-HT.

Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.

Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

B.5.7 Miscellaneous Materials

Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete roofing system and as recommended by primary sheet metal manufacturer unless otherwise indicated.

Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of panels.

Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed; with hex-washer head.

Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.

Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.

Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

B.5.8 Accessories

Sheet Metal Accessories: Provide components required for complete sheet metal roofing assembly including trim, copings, fasciae, clips, flashings, sealants, gaskets, fillers, metal closures, and similar items. Match material and finish of sheet metal panels unless otherwise indicated.

Cleats: Intermittent and continuous attachment devices for mechanically seaming into joints and formed from the following materials and thicknesses unless otherwise indicated:

Copper Panels: 16-oz./sq. ft. copper sheet.

Aluminum Panels: 0.0250 inch thick stainless steel.

Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum 0.018 inch thick.

Soffit Vents: Round aluminum louvers with grilled faces having openings no wider than 16x18 commercial screening, as RLS series round aluminum louver, available from Bestlouver.com, or equal.

Size: 2 inch diameter

Finish: As selected from manufacturer's standards.

B.5.9 Fabrication

Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions (panel width and seam height), geometry, metal thickness, and other characteristics of installation. Fabricate sheet metal roofing and accessories in shop to greatest extent possible.

Standing-Seam Roof and Wall Panels: Form standing-seam panels with finished seam height of 1 inch.

Flat-Seam Soffit Panels: Form flat-seam panels from metal sheets with 1/2-inch notched and folded edges.

Form exposed sheet metal work to fit substrates with little oil canning; free of buckling and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

Form and fabricate sheets, seams, strips, cleats, edge treatments, integral flashings, and other components of metal panels to profiles, patterns, and drainage arrangements indicated on Drawings and as required for leakproof construction.

Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item required. Obtain field measurements for accurate fit before shop fabrication.

Built-in Gutters: Fabricate to cross section required, with riveted and soldered joints, complete with end pieces, and other special accessories as required. Fabricate in minimum 96-inch- long sections. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.

Downspouts: Fabricate round downspouts to dimensions indicated, complete with

mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

Scupper and Sump: Fabricate to dimensions required, with 4 inch wide flanges and outlet tube.

Copings and Fascia: Fabricate in minimum 96 inch long. Fabricate joint plates of same thickness as copings and fascia. Furnish copings with continuous cleats to support edge of external leg and interior leg. Miter corners and solder watertight.

Fabricate from 24 oz./sq. ft. Copper.

B.6 EPDM ROOFING

Provide fully adhered EPDM sheet roofing, including insulation, as indicated on the Drawings and as specified herein.

B.6.1 Submittals

Product Data: For each type of product.

Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" paragraph.

Sample Warranties: For manufacturer's special warranties.

Maintenance Data: For roofing system to include in maintenance manuals.

B.6.2 Quality Assurance

Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

Source Limitations: Obtain all roofing material components from same approved membrane roofing manufacturer. Obtain roofing accessory components including roof insulation and fasteners for roofing system from manufacturer approved by membrane roofing manufacturer.

B.6.3 Field Conditions

Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B.6.4 Warranty

Special Warranty: Manufacturer agrees to repair or replace components of roofing system

that fail in materials or workmanship within specified warranty period.

Warranty Period: 15 years from date of Substantial Completion.

B.6.5 Performance Requirements

General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

Roofing System Design: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

Fire/Windstorm Classification: Class 1A-60.

B 6.6 Roofing Materials

EPDM Roofing: ASTM D 4637, Type I, nonreinforced, uniform, flexible EPDM sheet.

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Carlisle SynTec Incorporated.
Firestone Building Products.

Thickness: 60 mils, nominal.

Exposed Face Color: Black.

Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.

Bonding Adhesive: Manufacturer's standard. Provide manufacturer’s recommended primer for substrates where recommended by manufacturer.

Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3 inch

wide minimum, butyl splice tape with release film.

Splicing Adhesive: Butyl, single-component, and splice cleaner.

Miscellaneous Accessories: Provide lap sealant, water cutoff mastic, metal termination bars, metal battens, pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, cover strips, and other accessories.

B.6.7 Insulation Materials

Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 3, felt or glass-fiber mat facer on both major surfaces.

Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

> Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

B.7 ROOF HATCH

Provide roof hatch, including ladder-assist post, as shown and as specified.

Related requirements include:

> "Metal Fabrications" paragraph for metal ladders for access to roof hatch.

B.7.1 Submittals

Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

Shop Drawings: Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, and special conditions. Distinguish between plant-assembled and field-assembled work.

Operation and Maintenance Data: For inclusion in operation and maintenance manuals.

B.7.2 Field Conditions

Coordinate installation of roof hatch with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B.7.3 Performance Requirements
Roof hatch shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B.7.4 Materials
Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required, mill finished.

Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, mill finished.

Steel Tube: ASTM A 500, round tube.

Glass-Fiber Board Insulation: ASTM C 726, thickness as indicated.

Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
Underlayment:

Fasteners: Roof accessory manufacturer's recommended Series 300 stainless steel fasteners suitable for application and metals being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

B.7.5 Manufacturers
Subject to compliance with requirements, provide products by one of the following:

Babcock-Davis.
Bilco Company (The).
J. L. Industries, Inc.
Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
Nystrom.
O'Keeffe's Inc.

B.7.6 Fabrication
Aluminum roof-hatch units with lids and insulated single-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing and integrally formed deck-mounting flange at perimeter bottom.

Type and Size: Single-leaf lid, 30 by 36 inches.

Loads: Minimum 40-lbf/sq. ft**.** external live load and 20-lbf/sq. ft. internal uplift load.

Components:

Lid: 0.090-inch (11-gauge) aluminum sheet.

Insulation: 1-inch thick glass fiber.

Liner: 0.040-inch (18-gauge) aluminum.

Curb: 0.090-inch (11-gauge) aluminum with 3-1/2-inch deck flange with anchorage holes and integral metal cap flashing.

Height: 12-inches

Insulation: 1-inch thick rigid fiberboard on exterior of curb.

Hardware:

Automatic hold-open arm, with handle to permit one hand release

Pintle hinges

Compression spring operators enclosed in telescopic tubes

Positive snap latch with turn handles and padlock hasps inside and outside

Neoprene draft seal

Finish: Zinc plated and chromate sealed.

Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

Operation: Post locks in place on full extension; release mechanism returns post to closed position.

Height: 42 inches above finished roof deck.

Material: Steel tube.

Post: 1-5/8-inch-diameter pipe.

Finish: Manufacturer's standard baked enamel or powder coat.

Color: As selected by Architect from manufacturer's full range.

B.8 JOINT SEALANTS

Provide joint sealants as shown and as specified.

B.8.1 Submittals

Product Data: For each joint-sealant product indicated.

Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

Samples for Verification: For each type and color of joint sealant required. Install joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

B.8.2 Quality Assurance

Obtain elastomeric materials from manufacturers who will, if requested, send a qualified technical representative to advise installer of proper procedures and precautions for use of materials.

Employ only skilled, experienced tradesmen for sealant application.

B.8.3 Materials

Compatibility: Provide joint sealants, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

Colors: Provide colors of exposed joint sealants as selected by Architect from Manufacturer's standard range

Interior Sealants: One-part, siliconzied acrylic latex sealant, ASTM C 834, paintable.

Products:

Pecora AC-20 Latex Sealant
Tremco Tremflex #834 Siliconzied Acrylic Latex Sealant

Exterior Sealants: Medium Modulus (+/-50%) Structural Silicone Sealant: One-part, neutral cure; ASTM C 920, Type S, Grade NS, Class 50, Use NT, G, A, M, O.

Products:

Dow Corning 795 Silicone Building Sealant
GE SilPruf SCS2000
Pecora 895 Silicone Sealant
Tremco Spectrem 2 or Spectrem 3

Backer Rod: ASTM C 1330 cylindrical sealant backings of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

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.

Cleaners and Primers: Provide joint cleaners and substrate primers recommended by sealant manufacturer for applications indicated

B.9 STEEL DOORS AND FRAMES
Provide hollow metal doors and frames as indicated on drawings and as specified herein

Related sections:

"Door Hardware" for installation accessories.
"Painting" for field finishing of steel doors and frames.

B.9.1 Definitions
Minimum Thickness: Minimum thickness of base metal without coatings.

B.9.2 Submittals
Product Data: Include construction details, material descriptions, core descriptions, and finishes.

Shop Drawings:

Details of doors, including vertical and horizontal edge details and metal thicknesses.

Frame details, including dimensioned profiles and metal thicknesses.

Locations of reinforcement and preparations for hardware.

Details of anchorages.

B.9.3 Delivery, Storage, and Handling
Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Use vented plastic.

Deliver frame with two removable spreader bars across bottom of frames tack welded to jambs.

Store hollow metal work under cover at Project site.

B.9.4 Field Measurements
Verify actual dimensions of openings by field measurements before fabrication.

B.9.5 Manufacturers
Subject to compliance with requirements, provide products by one of the following:

Amweld Building Products, LLC.
Ceco Door Products; an Assa Abloy Group company.
Curries Company; an Assa Abloy Group company.
Kewanee Corporation (The).
LaForce.
Steelcraft; an Ingersoll-Rand company.

B.9.6 Materials
Exterior doors and frame shall be fabricated from galvanized metal.

Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B.2.3 Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.

Inserts, Bolts, and Fasteners: Hot-dip zinc-coated according to ASTM A 153/A 153M.

Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

Shop Primer: Manufacturer's standard, fast-curing, lead-free and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

B.9.7 Hollow Metal Doors
Comply with ANSI A250.8, except as modified below.

Design: Flush panel.

Thickness: 1-3/4 inches

Face Sheets: Fabricated from metallic-coated steel sheet. Comply with requirements indicated below by reference to ANSI A250.8 for level and model and ANSI A250.4 for physical-performance level:

Level 3 and Physical Performance Level A (Extra Heavy Duty, 0.053 inch thick (16 gauge) face sheets), Model 1 (Full Flush).

Core: Polyurethane; provide doors fabricated with thermal-resistance value (R-

value) of not less than 14.5 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

B.9.8 Hollow Metal Frames
Comply with ANSI A250.8 and with details indicated for type and profile.

Fabricate from 0.067 inch thick (14 gauge) metallic-coated steel sheet, with mitered or coped and full profile welded corners with seamless face joints.

Form door stops integral with frames, minimum 5/8 inch high.

B.9.9 Hardware Reinforcement
Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets and door frames.

Hinges: Minimum 0.123 inch (10 gauge), thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.

Lock Face, Closers and Other Surface-Mounted Hardware: Minimum 0.067 inch thick (14 gauge).

Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

B.9.10 Frame Anchors
Jamb Anchors:

or Masonry: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

For In-Place Concrete: Minimum 3/8 inch diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

Floor Anchors: Clip-type anchors, with two holes to receive fasteners, formed from same material as frames, not less than 0.042 inch thick (18 gage).

B.9.11 Fabrication
Fabricate hollow metal work rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.

Fabricate hollow metal work to tolerances indicated in SDI 117.

Doors: Provide weep-hole openings in bottom of doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

Provide countersunk, flat-head or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

Weld floor anchors to bottom of jambs with at least four spot welds per anchor.

Locate jamb anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the templates furnished as specified in "Door Hardware" paragraph.

Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

B.9.12 Finishes

Surface Preparation: Comply with ASTM D6386 preparation for painting of galvanized steel. Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

Priming: Apply shop primer immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils. Prime all surfaces of door and frame including inside of frame and bottom of door.

Steel doors and frames shall be finished with 2 coat paint system as specified in Section 20 “Painting Epoxy System”. Colors as selected by Architect and approved by the City.

B.10 ALUMINUM WINDOWS

Provide hollow aluminum windows as indicated on drawings and as specified herein

Related sections:

“Sealants” for sealants used during installation of aluminum windows.
“Glazing” for installation of glass in aluminum windows.

B.10.1 Submittals

Product data: Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

Product Test Reports: For aluminum windows, for tests performed by a qualified testing agency, showing that window units comply with performance requirements indicated.

Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

Samples: Exposed Finishes: 2 by 4 inches.

B.10.2 Quality Assurance

Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

Field Conditions: Verify actual locations of structural supports and dimensions of openings for aluminum windows by field measurements before fabrication and indicate measurements on Shop Drawings.

B.10.3 Warranty

Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

Failures include, but are not limited to, the following:

Failure to meet performance requirements.
Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
Faulty operation of movable sash and hardware.
Deterioration of materials and finishes beyond normal weathering.
Failure of insulating glass.

Warranty Period: 10 years from date of Substantial Completion.

B.10.4 Manufacturers

Basis-of-Design Product: Subject to compliance with requirements, provide 516 IsoPort Windows by Kawneer Company, Inc. or a comparable product by one of the following:

EFCO Corporation.
TRACO
Wausau Window and Wall Systems.
YKK AP America, Inc.

B.10.5 Performance Requirements

Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

Minimum Performance Class: AW.
Minimum Performance Grade: 60.

Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.42 Btu/sq. ft. x h x deg F.

Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a minimum CRF (frame) of 47.

Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Temperature Change: 140 deg F, ambient; 210 deg F material surfaces.

B.10.6 Materials

Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, not less than 16,000-psi minimum yield strength, and not less than 0.125-inch thickness at any location for the main frame and sash members.

Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components. Cadmium-plated steel fasteners are not permitted.

Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, non-corrosive, pressed-in, splined grommet nuts.

Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

Anchors, Clips, and Accessories: Aluminum, Type 304 stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions, providing sufficient strength to withstand design pressure indicated. Cadmium-plated steel anchors, clips, and accessories are not permitted.

Reinforcing Members: Aluminum, Type 304 stainless steel, nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions, providing sufficient strength to withstand design pressure indicated. Cadmium-plated steel reinforcing members are not permitted.

Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when aluminum window is closed.

Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2.

Sealants: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

B.10.7 Hardware

Provide manufacturer's standard hardware fabricated from aluminum or Type 304 stainless steel designed to smoothly operate, tightly close, and securely lock aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Cadmium-plated hardware is not permitted. Do not use aluminum in frictional contact with other metals. Where exposed, provide extruded, cast, or wrought aluminum, die-cast zinc with special coating finish or nonmagnetic stainless steel.

Operation Function: Ventilators securely close at sash frames without using additional manually controlled locking devices.

Provide the following operating hardware for casement windows:

Operator: Gear-type rotary operator located on jamb at sill.

Rating: C-C20 according to AAMA 901.

Hinges: Heavy-duty, concealed, four- or six-bar friction hinges with adjustable-slide friction shoes; designed to permit ventilator operation for inside cleaning of outside glass face; two per ventilator.

Lock: Lift-type throw, cam-action lock with keeper; two per ventilator.

B.10.8 Insect Screens

Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Provide for each operable exterior sash or ventilator.

Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, concealed fasteners and removable PVC spline/anchor concealing edge of frame.

Finish: Match aluminum window members.

Aluminum Wire Fabric: 18-by-16 mesh of 0.011-inch-diameter, coated aluminum wire.

Wire-Fabric Finish: Charcoal gray.

B.10.9 Fabrication

Fabricate aluminum windows, in sizes indicated, that comply with AAMA/WDMA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.

Fabricate aluminum windows that are re-glazable from inside of unit without dismantling sash or ventilator framing.

Provide thermal-break construction that has been in use for not less than five years and has been tested to demonstrate resistance to thermal conductance and condensation and to show adequate strength and security of glass retention.

Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.

Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

Sub-frames: Provide sub-frames with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch-thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units. Provide sub-frames capable of withstanding design loads of window units.

B.10.10 Aluminum Finish

Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

Color: Medium bronze.

Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B.11 DOOR HARDWARE

Provide door hardware for new hollow metal doors for the bridge operator's house as specified herein.

Package and label each hardware item separately with all screws, bolts and accessories required for a complete installation.

B.11.1 Submittals

Product Data: Catalog cuts and descriptive data of each product indicated.

Shop Drawings: Wiring diagrams for electrified door hardware.

Templates: Furnish hardware templates to doors and frames manufacturer as required for fabrication.

B.11.2 Quality Assurance

Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

Review methods and procedures related to electrified door hardware including, but not limited to, the following:

Inspect and discuss preparatory work performed by other trades.

Inspect and discuss electrical roughing-in for electrified door hardware.

Accessibility Requirements: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.

Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B.11.3 Hinges

Continuous Hinges: BHMA A156.26; extruded-aluminum, pinless, geared hinge leaves; joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

Minimum 0.120 inch thick hinge leaves with minimum overall width of 4 inches; fabricated 1 inch less in length than door height to accommodate full width surface sweeps, and to template screw locations; with components finished after milling and drilling are complete.

Manufacturers:

Select Products Limited
Bommer Industries, Inc.
Hager Companies
McKinney Products Company; an ASSA ABLOY Group company

B.11.4 Locksets

Cylindical Locks: BHMA A156.2; Grade 1, Series 4000.

Manufacturers:

Dorma, LR design.
Schlage, Rhodes design.
Sargent, LL Design.

Lock Throw: 3/4 inch.

Backset: 2-3/4 inches.

Function: Storeroom.

Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

Construction Cylinders: Standard Lock Cylinders, BHMA A156.5; Grade 1; with interchangeable cores; face finished to match lockset.

Number of Pins: 6.

Permanent Cores: Schlage Primus cylinders provided by Owner and exchanged for construction cylinders following substantial Completion.

B.11.5 Electric Strikes
BHMA A156.31; Grade 1.

Provide power supply by same manufacturer as electric strike.

Manufacturers:

Dorma Architectural Hardware; Member of The DORMA Group North America.
Adams Rite Manufacturing Co.; an Assa Abloy Group company.
Security Door Controls.
Von Duprin; an Ingersoll-Rand company.

B.11.6 Door Closers
BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

Manufacturer: LCN Closers; an Ingersoll-Rand company.

B.11.7 Wall-Mounted Stops
BHMA A156.16.

Manufacturers:

Trimco, 1270CX/CV series
Hiawatha, Inc., 1326 series
Ives Hardware; an Ingersoll-Rand company, WS406/407 series
Rockwood Manufacturing Company, 406/409 series

B.11.8 Overhead Stops
BHMA A156.8.

Manufacturers:

Architectural Builders Hardware Mfg., Inc.
Glynn-Johnson; an Ingersoll-Rand company.
Rockwood Manufacturing Company.

B.11.9 Kick Plates
Fabricate not more than 1-1/2 inches less than door width on stop side and not more than 1/2 inch less than door width on pull side, by the height indicated.

Base metal: Stainless steel, 0.050" (U.S. 18 gauge).

Manufacturers:

Trimco
ABH (Architectural Builders Hardware Mfg., Inc.)
CHMI (Custom Hardware Manufacturing, Inc.)
Rockwood Manufacturing Co.

B.11.10 Weather-Stripping
BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

Manufacturers:

National Guard Products.
Pemko Manufacturing Co.; an ASSA ABLOY Group company.
Reese Enterprises, Inc.
Zero International

B.11.11 Thresholds
BHMA A156.21; fabricated to full width of opening indicated.

Manufacturers:

National Guard Products.
Pemko Manufacturing Co.; an ASSA ABLOY Group company.
Reese Enterprises, Inc.
Zero International

B.11.12 Finishes
Provide finishes complying with BHMA A156.18.

Satin stainless steel 630 (US32D) or stain chrome 626/652 (US26D) except as otherwise indicated.

Interior Door closers: Aluminum painted or powder-coated

B.12 GLAZING
Insulating laminated glass units for aluminum windows, as indicated on Drawings and as specified herein.

B.12.1 Submittals
Product Data: For each glass product and glazing material indicated.

Samples: For glass specified, 12 inches square.

B.12.2 Quality Assurance
Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."

IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B.12.3 Warranty
Manufacturer's warranty, agreeing to repair or replace work which exhibits defects in materials or workmanship. 'Defects" is defined to include, but not limited to, leakage of water, abnormal aging or deterioration, failure of hermetic seals, edge separation or delamination of laminated glass, and failure to perform as required. Include requirement for removal and replacement of covering and connected adjacent work.

Warranty Period: Ten years from date of Substantial Completion.

B.12.4 Manufacturers
Subject to compliance with requirements, provide products of one of the following:

Guardian Industries Corp.
Oldcastle Glass, Inc.
Pilkington North America

PPG Industries, Inc.
Viracon, Inc.

B.12.5 Glass

Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

Overall Unit Thickness: 1 inch.

Outdoor Lite: Laminated glass with two plies of 5 mm (3/16 inch).fully tempered float glass.

Indoor Lite: 6 mm (1/4 inch) thick fully tempered float glass

Sealing System: Dual seal.

Spacer: Thermally improved warm edge type, fabricated from aluminum or steel with a polymer bridge, or extruded polymer.

Thickness: 3/8 inch

Interspace Content: Air.

Low-E Coating: Pyrolytic or sputtered on fourth and fifth surfaces.

Visible Light Transmittance: 43 percent minimum.

Winter Nighttime U-Factor: 0.28 maximum.

Summer Daytime U-Factor: 0.26 maximum.

Solar Heat Gain Coefficient: 0.31 maximum.

Fully Tempered Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear), kind FT.

Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.

Interlayer Thickness: 0.060 inch.

Interlayer Color: Clear.

B12.6 Installation Materials

Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

Glazing Tapes: AAMA 806.3, preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800.

Miscellaneous Materials: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

Cleaners, Primers, and Sealers: Types recommended by sealant or gasket Manufacturer.

Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

B.13 GYPSUM VENEER PLASTER

Gypsum veneer plaster and gypsum base for veneer plaster for the bridge house ceiling and repairs to the walls, including related metal framing.

B.13.1 Submittals

Product Data: For each type of product specified.

Sample: For each finish indicated, 12 inches x12 inches, on rigid backing.

B.13.2 Manufacturers

Source Limitations: Obtain gypsum veneer plaster products, including gypsum base for veneer plaster, joint reinforcing tape, and embedding material, from single manufacturer.

Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, those listed under "Products" paragraphs.

B.13.3 Materials

Steel Studs, Runners and Hat-Shaped Furring Channels: ASTM C 645.

Minimum Base-Metal Thickness: 0.018 inch.

Furring Channels Depth: 7/8 inch.

Flat Strap and Backing Plate: As required for installation.

Fasteners: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

Isolation Strip at Exterior Walls: Provide asphalt saturated organic felt or foam gasket.

Gypsum Veneer Plaster: ASTM C 587, ready-mixed, smooth, finish-coat veneer plaster Two-Component Gypsum Veneer Plaster: ASTM C 587, with separate formulations; one for base-coat application and one for finish-coat application over substrates.

Base Coat Products:

National Gypsum Company; Kal-Kote Plaster Base.
USG Corporation; Diamond Veneer Basecoat Plaster.

Smooth Finish Coat Products:

National Gypsum Company; Kal-Kote Smooth Finish.
USG Corporation; Diamond Interior Finish Plaster.

Gypsum Base for Veneer Plaster: ASTM C 1396/C 1396M.

Products:

CertainTeed Corp.; ProRoc Veneer Plaster Base.
Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; Tough Rock Veneer Plaster Base.
National Gypsum Company; Kal-Core Regular.
USG Corporation; Imperial Regular Gypsum Base.

Thickness: 5/8 inch or as required to match existing.

Joint Reinforcing Materials: Comply with joint strength requirements in ASTM C 587 and with gypsum veneer plaster manufacturer's written recommendations for each application indicated.

Joint Tape: Paper.

Embedding Material for Joint Tape: As recommended by gypsum veneer plaster manufacturer for use with joint-tape material and gypsum veneer plaster applications indicated.

Steel Drill Screws: ASTM C 1002.

B.14 RESILIENT BASE
Rubber cove base as indicated on the Drawings and as specified herein

B.14.1 Submittals
Product Data: For each type of product indicated.

Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

B.14.2 Materials
Rubber Wall Base: ASTM F 1861, Type TP (rubber, thermoplastic).

Group: I (solid, homogeneous).
Style B, Cove.

Manufacturers: Subject to compliance with requirements, provide products by the following:

Armstrong World Industries, Inc.
Burke Mercer Flooring Products, Division of Burke Industries Inc.
Johnsonite; A Tarkett Company.
Mondo Rubber International, Inc.
Nora Systems, Inc.
Roppe Corporation, USA.

Thickness: 0.125 inch.

Height: 4 inches.

Lengths: Coils in manufacturer's standard length.

Outside Corners: Preformed.

Inside Corners: Job formed.

Colors: As selected by Engineer from full range of industry colors.

Adhesives: Water-resistant type recommended by resilient base manufacturer for resilient

products and substrate conditions indicated.

Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B.15 PAINTING
Surface preparation and the application of paint systems as shown and as specified.

Paint bridge house interior walls and ceilings; interior fixtures, fittings and equipment, including pipes and conduit, that were previously painted.

Paint steel doors and frames; and new exterior metal fabrications in accord with provisions of item “Painting Epoxy System”.

B.15.1 Definitions
Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523,

B.15.2 Submittals
Product Data: For each type of product. Include preparation requirements and application instructions.

Samples: For each type of paint system and each color and gloss of topcoat.

Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B.15.3 Paint
MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

Material Compatibility: For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

Primers: As recommended in writing by topcoat manufacturer for each substrate encountered.

Paint for Walls and Ceiling: Latex, Interior, High Performance Architectural, (Gloss Level 3): MPI #139.

Paint for Interior Metal (except steel doors and frames): MPI #163, Light Industrial Coating, exterior, water based, semi-gloss (Gloss Level 5).

Colors: As selected by Architect from manufacturer's full range.

B.16 FIRE EXTINGUISHERS
Provide fire extinguishers and wall mounting brackets as shown and as specified.

Provide one unit on each floor level of the Bridge house.

B.16.1 Submittals
Manufacturer's product data and installation instructions.

B.16.2 Manufacturers
Subject to compliance with requirements, provide fire extinguishers and accessories by one of the following:

J.L. Industries
Larsen's Manufacturing Company
Potter-Roemer
Walter Kidde

B.16.3 Products
Fire Extinguishers: Dry chemical, 10 lb capacity, enameled steel container with pressure indicating gauge, for Class A, B, and C fires, charged, dated and bearing UL approval labels. Include manufacturer's standard wall mounting bracket with bottom support for each extinguisher.

B.17 PLASTIC FABRICATIONS
Provide plastic fabrications as indicated on the Drawings and as specified herein. Plastic fabrications include solid surfacing material window sills and acrylic sheet light cove lenses.

B.17.1 Submittals
Product Data: For each type of product

Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

Samples: For each exposed material and finish, 4 inches square.

B.17.2 Quality Assurance
Coordination: Coordinate fabrication and installation of acrylic sheet light cove lenses with light coves specified in Section 2 "Metal Fabrications."

Mockups: Provide acrylic sheet light cove lens for mockup specified in Metal Fabrications section

B.17.3 Materials

Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Avonite, Inc.: Avonite
E. I. du Pont de Nemours and Company: Corian
Formica Corporation: Formica Solid Surfacing.
LG Chemical, Ltd.: L G Hi-Macs
Wilsonart International; Div. of Premark International, Inc.: Gibraltar and Earthstone

Thickness: 1/2 inch

Colors and Patterns: As selected by Architect from manufacturer's standard range.

Acrylic Sheet (Plexiglass): Translucent thermoplastic sheet formed from polymethyl-methacrylate complying with ASTM D 4802.

Manufacturers:

Atoglas, Div of Arkema: Plexiglas MC
Cyro Industries: Acrylite GP
Lucite International: Lucite

Thickness: 3mm (1/8 inch

Colors and Patterns: As selected from manufacturer's standard range.

B.17.4 Fabrication

Fabricate plastic components to dimensions, profiles, and details indicated. Complete fabrication to maximum extent possible before shipment to Project site.

Fabricate window sills and light cove lenses in lengths as long as practicable. Comply with manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

Grind cut edges smooth and polish exposed edges.

B.18 ROLLER SHADES

Provide motor operated roller shades as indicated on the Drawings and as specified herein

B.18.1 Submittals

Product Data: For each type of product.

Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions and maintenance data for roller shades.

Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

Include details of installation and diagrams for power, signal, and control wiring.

Samples: For each exposed product and for each color and texture specified.

B.18.2 Quality Assurance

Installer Qualifications: Fabricator of products.

Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B.18.3 Manufacturers

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:

Draper Inc.
Hunter Douglas Contract.
Lutron Electronics Co., Inc.
MechoShade Systems, Inc.
Silent Gliss USA, Inc.

B.18.4 Roller Shades

Motorized Operating Mechanisms: Provide factory-assembled shade-operator systems of size and capacity and with features, characteristics, and accessories suitable for

conditions indicated and recommended by manufacturer for use with shades indicated.

Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Electric Motors: Manufacturer's standard for operating roller shades.

Electrical Characteristics: Single phase, 110 V, 60 Hz.

Remote Controls: Group wall-switch control stations.

Limit Switches: Adjustable switches, interlocked with motor controls and set to stop shade movement automatically at fully raised and fully lowered positions.

Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

Roller Mounting Configuration: Single roller.

Direction of Shadeband Roll: Regular, from back of roller.

Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.

Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

Shadebands:

Shadeband Material: Light-filtering woven fabric, stain and fade resistant.

Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Source: Roller-shade manufacturer.

Type: PVC-coated fiberglass.

Orientation on Shadeband: Up the bolt.

Openness Factor: 22 percent.

Color: As selected by Architect from manufacturer's full range.

Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

Type: Enclosed in sealed pocket of shadeband material.

Installation Accessories:

Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

Shape: L-shaped.

Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.

B.18.6 Roller-Shade Fabrication

Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

Shadeband Fabrication: Fabricate shadebands without battens or seams.

C. CONSTRUCTION

C.0 SELECTIVE DEMOLITION

C.0.1 Examination

Verify that utilities have been disconnected and capped before starting selective demolition operations.

Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

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 report in writing to the engineer.

C.0.2 Utility Services and Mechanical / Electrical Systems
Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

C.0.3 Preparation
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.

Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent building components and facilities to remain.

Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or damage to construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

C.0.4 Selective Demolition, General
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:

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.

Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

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.

Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

Dispose of demolished items and materials promptly.

C.0.5 Remove and Salvaged Items
Clean salvaged items.

Pack or crate items after cleaning. Identify contents of containers.

Store items in a secure area until delivery to Owner.

Protect items from damage during transport and storage.

C.0.6 Removed and Reinstalled Items
See specification article 50: Refurbish and Reinstall Bridge House Bell, Item SPV.0105.173.

C.0.7 Existing Items to Remain
Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by 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.

C.0.8 Disposal of Demolished Materials
General: Except for items or materials indicated to be reused, salvaged, 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.

Do not allow demolished materials to accumulate on-site.

Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent

Disposal: Transport demolished materials off Owner's property and legally dispose of them.

C.0.9 Cleaning
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.

C.1 CONCRETE MASONRY UNITS
C.1.1 Examination
Examine conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Proceed with installation only after unsatisfactory conditions have been corrected.

C.1.2 Masonry Installation

Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

Lay out walls in advance for accurate spacing of surface bond patterns with uniform 3/8 inch joint thicknesses and for accurate location of openings. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

Bond Pattern: Lay masonry in running bond; do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

Fill space between steel frames and masonry solidly with mortar.

Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

Fill cores in hollow CMUs with grout 24 inches under lintels.

Install compressible filler in joint between top of walls and underside of structure above.

Fasten partition top anchors to structure above and build into top of wall. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2 inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c.

Mortar Bedding and Jointing:

Lay hollow CMUs as follows:

With face shells fully bedded in mortar and with head joints of depth equal to bed joints.

With webs fully bedded in mortar in grouted masonry, including starting course on footings.

With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

Set precast sill units in full bed of mortar with full vertical joints. Fill dowel,

anchor, and similar holes.

Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

Wet joint surfaces thoroughly before applying mortar.

Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness.

Masonry Joint Reinforcement: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6°inches.

Space reinforcement not more than 16 inches o.c.

Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

Provide reinforcement not more than 8 inches above wall openings and extending 12°inches beyond openings in addition to continuous reinforcement.

Anchoring Masonry to Concrete: Anchor masonry to concrete where masonry abuts concrete to comply with the following:

Anchor masonry with anchors embedded in masonry joints and attached to structure.

Space anchors not more than 24 inches o.c. vertically.

Lintels: Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

C.1.3 Cleaning and Disposal

In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.

Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

Excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

C.2 METAL FABRICATIONS

C.2.1 Examination

Examine locations where metal fabrications are to be installed and verify that surfaces are prepared to receive work.

C.2.2 Installation

Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).

Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

Adjust railings before anchoring to ensure matching alignment at abutting joints.

Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

Field Welding: Comply with the following requirements:

Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
Obtain fusion without undercut or overlap.
Remove welding flux immediately.
At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

C.2.3 Adjusting and Cleaning

Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair

galvanizing to comply with ASTM A 780/A 780M.

C.3 ROUGH CARPENTRY

Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

Do not splice structural members between supports unless otherwise indicated.

Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

Plywood: Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

> Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

> NES NER-272 for power-driven fasteners.
> Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

C.4 THERMAL INSULATION

C.4.1 Installation of Thermal Insulation

Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

Extend insulation to envelop entire area to be insulated. Remove projections that interfere with placement.

Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

Install blankets according to ASTM C 1320.

Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

C.4.2 Installation of Vapor Retarders

Extend vapor retarders to extremities of areas to protect from vapor transmission. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

Seal joints in vapor retarders over framing by lapping no fewer than two studs.

Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.

Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

C.5 SHEET METAL ROOFING AND WALL PANELS

C.5.1 Examination and Preparation

Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that tops of fasteners are flush with surface.

C.5.2 Underlayment Installation

Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply at locations indicated on Drawings in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with

roller. Cover underlayment within 14 days.

Apply slip sheet, wrinkle free, before installing sheet metal roofing and related flashing.

C.5.3 Installation, General

General: Install sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to installation characteristics required unless otherwise indicated on Drawings. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required for complete roofing system and as recommended by fabricator for sheet metal roofing.

Install sheet metal panels true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

Anchor sheet metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

Field cutting of sheet metal roofing by torch is not permitted.

Flash and seal sheet metal panels with closure strips at eaves, rakes, and perimeter of all openings. Fasten with self-tapping screws.

Locate and space fastenings in uniform vertical and horizontal alignment. Predrill panels for fasteners.

Lap metal flashing over sheet metal roofing to direct moisture to run over and off roofing.

Thermal Movement: Rigidly fasten metal roof panels to structure at only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction.

Point of Fixity: Fasten each panel along single line of fixing located at lower edge.

Avoid attaching accessories through panels in manner that inhibits thermal movement.

Fasteners: Use fastener sizes that penetrate wood substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws, or as otherwise recommended by fastener manufacturer to achieve maximum pull-out resistance.

Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as

recommended by sheet metal manufacturer or SMACNA.

Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

C.5.4 Sheet Metal Panel Installation

Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering metal temper and reflectivity. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form hem on concealed side of exposed edges unless otherwise indicated.

Install cleats to hold sheet metal panels in position. Attach each cleat with at least two fasteners to prevent rotation.

Space cleats not more than 12 inches o.c. Bend tabs over fastener head.

Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in "Joint Sealants" section.

Standing-Seam Roof and Wall Panels: Attach standing-seam metal panels to substrate with double-fastened cleats spaced at 12 inches o.c. Install panels reaching from bottom to top before moving to adjacent panels. Before panels are interlocked, apply continuous bead of sealant to top of flange of lower panel. Lock standing seams by folding over twice so cleat and panel edges are completely engaged.

Loose-lock panels at eave edges to continuous cleats and flanges at roof edge at gutters.

Fold over seams after locking at top of roof; leave seams upright at top of walls.

Flat-Seam Soffit Panels: Attach flat-seam metal panels to substrate with cleats, starting at window edge and working outward toward fascia. After panels are in place, mallet seams tight and solder.

Attach panels with cleats spaced not more than 24 inches o.c.

C.5.5 Accessory Installation

Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

Install components required for complete sheet metal roofing assembly including trim, copings, seam covers, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items.

Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and install units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

Built-in Gutters: Join sections with riveted and soldered joints. Provide for thermal expansion. Slope to downspouts. Provide end closures and seal watertight with sealant.

Install underlayment layer in built-in gutter trough and extend to drip edge at eaves and under underlayment on roof sheathing. Lap sides minimum of 2 inches over underlying course. Lap ends minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with roofing nails. Install slip sheet over underlayment.

Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.

C.5.6 Cleaning and Protection

Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

Clean off excess sealants.

Remove temporary protective coverings and strippable films as sheet metal work is installed unless otherwise indicated in manufacturer's written installation instructions.

C.6 EPDM ROOFING

C.6.1 General

Install roofing system according to roofing system manufacturer's written instructions.

Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C.6.2 Insulation Installation

Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

Install tapered insulation under area of roofing to conform to slopes indicated.

Install insulation to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer

staggered from joints of previous layer a minimum of 6 inches in each direction.

Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

C.6.3 Roofing Installation

Unroll membrane roofing and allow to relax before installing.

Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeters.

Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.

Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

C.6.5 Base Flashing Installation

Install sheet flashings and preformed flashing accessories, and adhere to substrates.

Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

C.6.5 Protecting and Cleaning

Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report.

Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C.7 ROOF HATCH

C.7.1 Examination

Examine substrates, areas, and conditions to verify actual locations, dimensions, and other conditions affecting performance of the Work.

Verify that substrate is sound, dry, smooth, clean, and securely anchored.

Verify dimensions of roof opening for roof hatch.

Proceed with installation only after unsatisfactory conditions have been corrected.

C.7.2 Installation

Install roof hatch without warping, excessive oil canning, buckling, or tool marks.
Anchor roof hatch securely in place, capable of resisting indicated loads.

Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof hatch..

Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

> Coat concealed side of uncoated aluminum with bituminous coating where in contact with wood or ferrous metal.

Attach ladder-assist post according to manufacturer's written instructions.
Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.

C.8 JOINT SEALANTS

C.8.1 Project Conditions

Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

> When adverse or inclement weather conditions are impending or when ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturers.
>
> When joint substrates are wet due to rain, frost, condensation or other causes.

Joint Width Conditions: Do not proceed with installation of joint sealants when joint widths are less than recommended by joint sealant manufacturer for application indicated.

Inspection: Inspect joints indicated to receive joint sealants for compliance with requirements for joint configurations, installation tolerances and other conditions affecting joint sealant performance. Submit written report listing any conditions detrimental to performance of joint sealant work. Do not allow joint sealant work to proceed until unsatisfactory conditions have been corrected. Start of installation is evidence of acceptance of substrate.

C.8.2 Preparation

Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

C.8.3 Installation

Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

Do not leave gaps between ends of sealant backings.

Do not stretch, twist, puncture, or tear sealant backings.

Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

Install sealants using proven techniques that comply with the following and at the same time backings are installed:

Place sealants so they directly contact and fully wet joint substrates.

Completely fill recesses in each joint configuration.

Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

Remove excess sealant from surfaces adjacent to joints.

Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

Clean off excess sealant or sealant smears adjacent to joints as the work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

C.9 STEEL DOORS AND FRAMES

C.9.1 Examination

Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

Proceed with installation only after unsatisfactory conditions have been corrected.

C.9.2 Installation

Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

Install hollow metal frames in compliance with ANSI/SDI A250.11.

Set frames accurately in position; plumbed, aligned, and braced securely.

Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

Masonry Walls: Coordinate installation of frames to allow for solidly

filling space between frames and masonry with grout.

In-Place Concrete: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

Remove welded-in shipping spreaders.

Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

Jambs and Head: 1/8 inch plus or minus 1/16 inch.

Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of galvanizing repair paint and compatible air-drying, rust-inhibitive primer.

C.10 ALUMINUM WINDOWS

C.10.1 Examination

Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Verify rough opening dimensions, levelness of sill plate, and operational clearances.

Proceed with installation only after unsatisfactory conditions have been corrected.

C.10.2 Installation

Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

C.10.3 Field Quality Control

Testing Agency: City will engage a qualified testing agency to perform tests and

inspections.

Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

Testing Services: Testing and inspecting of installed windows shall take place as follows:

Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.

Air-Infiltration Testing:

Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.

Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

Water-Resistance Testing:

Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.

Allowable Water Infiltration: No water penetration.

Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.

Test Reports: Prepared according to AAMA 502.

Remove and replace noncomplying windows and retest as specified above.

Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Prepare test and inspection reports.

C.10.4 Adjusting, Cleaning and Protection

Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

Keep protective films and coverings in place until final cleaning.

Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

C.11 DOOR HARDWARE

C.11.1 Preparation

For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

Review methods and procedures related to electrified door hardware including, but not limited to, the following:

Inspect and discuss preparatory work performed by other trades.

Inspect and discuss electrical roughing-in for electrified door hardware.

C.11.2 Installation

Mounting Heights: Mount door hardware units at heights to comply ANSI/SDI A250.8.unless otherwise required to comply with governing regulations.

Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.

Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene sealant.

C.11.3 Adjusting

Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

C.12 GLAZING

C.12.1 Installation

Comply with combined written instructions of manufacturers of glass, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer.

Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites. Provide spacers for glass lites where length plus width is larger than 50 inches.

Provide edge blocking where needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

Glazing Tape:

Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

Center glass lites in openings on setting blocks and press firmly against tape.

Gaskets:

Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

Insert compression gasket between glass and pressure-glazing stop so it is securely in place with joints miter cut and bonded together at corners.

Install pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass.

Install gaskets so they protrude past face of glazing stops.

C.12.2 Cleaning and Protection

Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

C.13 GYPSUM VENEER PLASTER

C.13.1 Metal Framing

Installation Standard: ASTM C 754.and requirements in ASTM C 844 that apply to framing installation.

Install supplementary framing, and blocking to support fixtures, equipment services and similar construction.

Install framing system components at 16 inches o.c.

Install isolation strip between framing and exterior wall.

Install studs so flanges within framing system point in same direction.

Direct Furring:

Screw to wood framing.

Attach to concrete with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

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.

C.13.2 Gypsum Base for Veneer Plaster

Apply according to ASTM C 844 unless manufacturer's written recommendations are more stringent.

Erection Tolerance: No more than 1/16-inch offsets between planes of gypsum base panels, and 1/8 inch in 8 feet noncumulative, for level, plumb, warp, and bow.

Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

Install trim with back flanges intended for fasteners, and attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

Install control joints according to ASTM C 844 and in specific locations approved by Engineer.

Reinforce interior angles and flat joints with joint tape and embedding material to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.

C.13.3 Gypsum Veneer Plastering

Mixing: Mechanically mix gypsum veneer plaster materials to comply with ASTM C 843 and with gypsum veneer plaster manufacturer's written recommendations.

Application: Comply with ASTM C 843 and with veneer plaster manufacturer's written recommendations.

Base Coat: Hand trowel or machine apply base coat over substrate to a uniform thickness of 1/16 to 3/32 inch. Fill all voids and imperfections.

Finish Coat: Trowel apply finish-coat plaster over base-coat plaster to a uniform

thickness of 1/16 to 3/32 inch.

Where gypsum veneer plaster abuts only metal door frames, windows, and other units, groove finish coat to eliminate spalling.

Do not apply veneer plaster to gypsum base if paper facing has degraded from exposure to sunlight. Before applying veneer plaster, use remedial methods to restore bonding capability to degraded paper facing according to manufacturer's written recommendations.

Finish: Smooth-troweled finish unless otherwise required to match existing surfaces.

C.14 RESILIENT BASE

C.14.1 Preparation

Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

Do not install resilient products until they are the same temperature as the space where they are to be installed.

Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

C.14.2 Installation

Comply with manufacturer's written instructions for installing resilient base.

Apply resilient base to walls, pilasters, and other permanent fixtures in rooms and areas where base is required.

Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

Do not stretch resilient base during installation.

Preformed Outside Corners: Install preformed corners before installing straight pieces.

Job-Formed Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

Miter or cope corners to minimize open joints.

Comply with manufacturer's written instructions for cleaning and protecting resilient products.

C.15 PAINTING

C.15.1 Examination

Examine substrates and conditions for compliance with requirements affecting performance of the Work.

Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

Concrete: 12 percent.
Masonry (Clay and CMU): 12 percent.
Plaster: 12 percent.

Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

Proceed with coating application only after unsatisfactory conditions have been corrected.

Application of coating indicates acceptance of surfaces and conditions.

C.15.2 Preparation

Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

Remove incompatible primers and reprime substrates with compatible primers or apply tie coat as required to produce paint systems indicated.

C.15.3 Application
Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

Apply 1 coat primer and 2 coats finish. Apply additional coats when undercoats, stains or other conditions show through final coat of paint; paint film shall be of uniform finish, color and appearance.

> Omit primer on metal surfaces which have been shop-primed and touch-up painted, unless otherwise directed by the Architect.

Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.

Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

C.15.4 Cleaning and Protection
After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Engineer, and leave in an undamaged condition.

At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

C.16 FIRE EXTINGUISHERS
Install fire extinguishers and surface wall mounting brackets as directed by the Field Building Inspector. Securely fasten to structure, square and plumb, in accordance with manufacturer’s instructions.

C.17 PLASTIC FABRICATIONS
Install plastic fabrications level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

Scribe and plastic fabrications to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

Form joints window sills if necessary at center of mullions, with notches cut to allow

stems of mullions to pass. Fill joints and ease exposed edges to comply with manufacturer's written recommendations using adhesive of color to match sill. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C.18 ROLLER SHADES

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.

Proceed with installation only after unsatisfactory conditions have been corrected.
Install roller shades level, plumb, and aligned with adjacent units, according to manufacturer's written instructions.

Electrical Connections: Connect motor-operated roller shades to building electrical system.

Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

D Measurement

The City will measure Bridge Operator's House, completed in accordance to the contract and accepted, as a single complete unit of work.

E Payment

The City will pay for the measured quantity at the contract price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.350.	Bridge Operator's House	LS

Payment is full compensation for all materials, labor and incidentals for Bridge Operator's House, including concrete unit masonry, metal fabrications, rough carpentry, thermal insulation, sheet metal roofing and wall panels, EPDM roofing, joint sealants, steel doors and frames, aluminum windows, door hardware, glazing, gypsum veneer plaster, resilient base, painting, fire extinguishers and roller shades in accordance with the drawings and as set forth in these specifications.

58. Precast Concrete Planters, Item 0105.360.

A DESCRIPTION

Furnish all labor, material and tools required for the satisfactory completion of the precast concrete planters and planter bases at the St. Paul Avenue Bridge in accordance with the drawings and as set forth in these specifications.

Included are the following:

1. Precast Concrete Planters
2. Planter Accessories, including:
   Foam insulation
   Gravel/Stone Drainage Layer
   Porous Membrane
   Planting Soil

Comply with requirements of "Metal Fabrications" section of "Bridge Operator's House" article for planter bases, including "Painting" section for finish of bases.

B MATERIALS

B.1 PRECAST CONCRETE PLANTERS

B.1.1 Submittals

Product Data: For each type of product. Include concrete design mixes and manufacturer's color charts.

Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

Shop Drawings: Show fabrication and installation details for precast concrete planters including the following:

Elevations, sections, and dimensions.
Finishes.
Joint and connection details.
Locations and details of reinforcement and connection hardware.

Samples for Verification: Representative of finish, color, and texture variations expected, approximately 12 by 12 inches by actual thickness.

B.1.2 Quality Assurance

Fabricator Qualifications: A firm that assumes responsibility for engineering precast concrete units with a minimum of 5 years successful experience in manufacturing precast concrete units similar to those required

Designated a PCI-certified plant for Group A, Category AT

Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

B.1.3 Performance Requirements

Delegated Design: Engage a qualified professional engineer to design precast concrete units.

Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

B.1.4 Materials

Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed, ASTM A 775/A 775M, epoxy-coated, with less than 2 percent damaged coating in each 12-inch bar length.

Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet epoxy coated or galvanized.

Portland Cement: ASTM C 150/C 150M; Type I, or III.

For surfaces exposed to view in finished structure, use gray or white, as required for selected color, of same type, brand, and source throughout production.

Metakaolin: ASTM C 618, Class N.

Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

Gradation: To match approved sample.

Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate; to match approved finish sample.

Coloring Admixture: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.

Water: Potable; complying with chemical limits in PCI MNL 130.

Polymer-Curing Admixture: Acrylic thermoplastic copolymer dispersion complying with PCI MNL 130.

Air-Entraining Admixture: ASTM C 260/C 260M, containing not more than 0.1 percent chloride ions.

Chemical Admixtures: ASTM C 494/C 494M, containing not more than 0.1 percent chloride ions.

Sealer: Colorless, pure acrylic water-repellent penetrating sealer which maintains natural look of concrete surface with no glaze or gloss, darkening or color change.

Waterproofing: Bitumen-modified, polyurethane-based liquid membrane material, self-bonding to substrates and compounded specifically for application and slope of substrate indicated. Provide membrane with not less than 90% solids, minimum 6-month shelf life in uncured state and tested to comply with requirements of ASTM C 836.

Anchors and Connectors:

Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

Carbon-Steel Bars: ASTM A 108, Grade 1018, not less than 1/4 inch in diameter.

Bolts: ASTM A 307 or ASTM A 325.

Zinc-Coated Finish: Apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.

Cast-in Anchors, Inserts, Plates, Angles, and Other Hardware shall be hot-dipped galvanized and painted with the department approved 2 coat paint system.

B.1.5 Concrete Mixes

Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

Compressive Strength (28 Days): 5000 psi minimum.

Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

B.1.6 Fabrication

Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect

position of main reinforcement or concrete placement.

Furnish loose hardware items including steel plates, anchors and other hardware shapes for securing precast concrete units to supporting construction.

Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.

Reinforce precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover required.

Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

Place backup concrete mixture to ensure bond with face-mixture concrete.

Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.

Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

Identify pickup points of precast concrete units and orientation in structure with permanent markings.

Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Engineer's approval.

Tolerances: Fabricate precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

B.1.7 Finishes
Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved sample and as follows:

Color: As selected by Engineer from manufacturer's full range.

Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.

Finish unexposed surfaces of architectural precast concrete units with as cast finish.

Apply sealer to exposed surfaces.

Apply waterproofing to planter interior below soil line. Provide 60 mil (average) membrane thickness, with minimum 50-mil thickness.

B.2 PLANTER ACCESSORIES
B.2.1 Submittals
Product Data: For each type of product.

B.2.2 Materials
Foam insulation: Extruded-Polystyrene Board Insulation: ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

Type X, 15 psi

Gravel/Stone Drainage Layer: Crushed stone or gravel conforming to WisDot Standard Specification 310.2.

Porous Membrane: Geotextile filter fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

Structure Type: Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament.

Styles: Flat

Planting Soil: 50/50 Mixture of topsoil conforming to WisDot Standard Specification 625.2. and compost.

Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5

percent inert contaminants and free of substances toxic to plantings; and as follows:

Organic Matter Content: 50 to 60 percent of dry weight.

C CONSTRUCTION

C.1 PRECAST CONCRETE PLANTERS

C.1.1 Erection

Install clips and other accessories required for connecting planters to supporting members.

Install precast concrete planters level, plumb, square, and in alignment. Provide temporary supports and bracing as required to maintain position, stability, and alignment of panels until permanent connections are completed.

Connect precast concrete planters in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

C.1.2 Repairs

Repair precast concrete planters if permitted by Engineer. Engineer reserves the right to reject repaired units that do not comply with requirements.

Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

C.2 INSTALLATION OF PLANTER ACCESSORIES

Foam insulation: Set insulation units inside planters using manufacturer's recommended adhesive according to manufacturer's written instructions. Install in layers of thickness required to suit curvature of planters to a total thickness of 2 inches.

Gravel/Stone Drainage Layer: Install geotextile filter fabric over drainage hole in planter lapping 6 inch minimum over concrete and place drainage layer to depth indicated.

Porous Membrane: Cover top of gravel/stone drainage layer with geotextile filter fabric, lapping up sides of planter a minimum of 4 inches.

Planting Soil: Place according to WisDot Standard Specification 625.3.3.

D. Measurement
The City will measure Precast Concrete Planters, completed in accordance to the contract and accepted, as a single complete unit of work.

E. Payment
The City will pay for the measured quantity at the contract price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.360	Precast Concrete Planters	LS

Payment is full compensation for all materials, labor and incidentals for Precast Concrete Planters, including precast concrete planters, foam insulation, gravel/stone drainage layer, porous membrane and planting soil in accordance with the drawings and as set forth in these specifications.

59. Heating, Ventilating & Air Conditioning (HVAC) Systems, Item SPV.0105.400

A Description
A.1 Work Summary
This special provision describes the demolition of the existing heating and ventilating equipment and the installation of new HVAC systems.

A.2 Regulatory Requirements
A.2.1 State & Local Codes
Conform to all state and local code requirements.

A.2.2 Permits & Inspections
Obtain permits and request inspections from authority having jurisdiction and pay for all Permit fees incidental thereto.

A.3 Equipment Accessibility
Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

A.4 HVAC Installations
Coordinate HVAC equipment and materials installation with other building components. Verify all dimensions by field measurements. Arrange for chases, slots and openings in other building components to allow for HVAC installations. Install HVAC equipment to facilitate maintenance and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installation.

A.5 Quality Assurance
Electrical characteristics for HVAC equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified and costs associated for modifications are included as part of the contractor's work. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

A.6 Delivery, Storage & Handling
Deliver HVAC materials with appropriate protective packaging with labels in place. Deliver pipes and tube with factory-applied end caps. Maintain end caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture.

A.7 References
A.7.1 National Fire Protection Association (NFPA)
NFPA 54 (ANSI Z223.1) National Fuel Gas Code.
NFPA 255 Building Materials, Test of Surface Burning Characteristics.
NFPA 90A Installation of Air Conditioning and Ventilating Systems.
NFPA 90B Installation of Warm Air Heating and Air Conditioning Systems.

A7.2 American Society for Testing & Materials (ASTM)
ASTM C612 Specification for Mineral Fiber Block and Board Thermal Insulation.
ASTM B32 Specification for Solder Metal
ASTM B280 Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
ASTM A90 Test Method for Weight of Coating on Zinc-Coated (Galvanized Iron or Steel Articles.
ASTM A525 Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process.
ASTM A527 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Lock Forming Quality.
ASTM C553 Specification for Mineral Fiber Blanket and Felt Insulation (Industrial Type).

A7.3 Underwriters Laboratories (UL)
UL 723 Test for Surface Burning Characteristics of Building Materials.
UL 181 Factory-Made Air Ducts and Connectors
UL 441 Standard for Gas Vents

A7.4 American National Standards Institute (ANSI)
ANSI/ASHRAE 34 Number Designation of Refrigerants.
ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
ANSI/ASME B31.5 Refrigeration Piping.
ANSI/ARI 710 Driers, Liquid-Line.
ANSI/ASHRAE 90A Energy Conservation in New Building Design.

ANSI/ASHRAE 103 Heating Seasonal Efficiency of Central Furnaces and Boilers, Methods of Testing.

A7.5 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
SMACNA Low Pressure Duct Construction Standards.

A7.6 Air Movement and Control Association (AMCA)
AMCA 99 Standards Handbook
AMCA 210 Laboratory Methods of Testing Fans for Rating Purposes.
AMCA 300 Test Code for Sound Rating Air Moving Devices.
AMCA 301 Method of Calculating Fan Sound Ratings from Laboratory Test Data.

A7.7 Air Conditioning and Refrigeration Institute (ARI)
ARI 201/240 Unitary Air Conditioning and Air Source Heat Pump Equipment
ARI 530 Positive Displacement Refrigerant Compressors, Compressor Units and Condensing Units.

A.8 Submittals
A.8.1 Equipment and Material Shop Drawings
Submit shop drawings which include equipment information and product data for equipment listed below for review:

Furnace & Evaporator Coil & Accessories.
Thermostat Control.
Condensing Unit & Accessories.
Grilles and Diffusers.

A.8.2 Report & Manuals Submittal
Submit the Reports and Manuals requested for review:

HVAC Testing, Adjusting and Balancing (TAB) Report.
HVAC operating and maintenance manual including warranty documentation.

B Materials
B.1 Basic HVAC System Materials & Methods.
B.1.1 Pipe, Tube, and Fittings - General
Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B.1.2 Joining Materials - General
Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

B.1.3 Pipe Penetrations - General
Provide steel pipe sleeves with minimum wall thickness of 1/4 inch for pipes passing through beams and walls of concrete, brick, tile, or masonry, and 22 gage galvanized iron sleeves for pipes passing through other parts of construction. Provide steel pipe for all sleeves penetrating floors. Furnish each sleeve having inside diameter 1 inch larger than outside diameter of un-insulated and insulated pipe, unless wall or floor is a fire wall or barrier, in which case, only the pipe shall penetrate.

For pipes passing through floors, walls, and ceilings provide chrome-plated brass escutcheons having outside diameter to cover sleeved openings and inside diameter to fit pipe.

B.1.3.1 Non-rated surfaces
Stamped steel, chrome plated, hinged, split ring escutcheons or floor-ceiling plates for covering openings in occupied spaces.
In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water stop type wall sleeve.
At interior partitions where pipe penetrations are sealed, use Tremco Dymonic, Sika Corp. Sikaflex 1a, Sonneborn Sonolastic NPI, or Mameco Vulken 116 urethane caulk to affect the seal. Use galvanized sheet metal sleeves in hollow wall penetrations.

B.1.4 Duct Penetrations - General
Non rated surfaces. Fiberglass insulation fill at voids with galvanized steel sheet metal bank-off on both sides of duct penetration through walls and ceiling structures. Use fire resistant sealant for sealing and soundproofing.

B.2 Identification and Painting for HVAC Systems
B.2.1 Materials – Identification Systems
Color: Unless specified otherwise, conform with ANSI/ASME A13.1.

Snap On Plastic Pipe Markers: Manufacturer's standard preprinted, semi rigid snap on, color coded pipe markers, conforming to ASME A13.1

Plastic Duct Markers: Manufacturer's standard laminated plastic, color coded duct markers. Conform to following color code:
Yellow/Green: Supply air.
Blue: Exhaust, outside, return, and mixed air.

Plastic Equipment Markers: Laminated plastic, color coded equipment markers: Conform to following color code:
Green: Cooling equipment and components.
Yellow: Heating equipment and components.
Yellow/Green: Combination cooling and heating equipment and components.
Nomenclature: Include following, matching terminology on schedules as closely as possible:

Name and plan ID number.
Equipment service.
Size: Approximately 2½ by 4 inches (65 by 100 mm) for control devices, dampers, and valves; and 4½ by 6 inches (115 by 150 mm) for equipment.

Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, letter, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

B.2.2 Materials – Paint Systems
Acceptable Manufacturers
Tnemec.
Carbolene.
Or equal.

Painting Systems
Application on metal piping and pipe and equipment supports:
Non-submerged, normal conditions, indoors.
Generic Type: Polyamidoamine epoxy.
Finish Coat: Tnemec Series 69.
Interior: Two coats Series 69.
Exterior: One coat Series 69, one coat Series 74.
Primer Coat: Self priming.
Minimum Dry Mil Thickness: 5 to 8 mil.
Surface Preparation: Hand tool clean.

B.3 HVAC Ductwork Insulation
B.3.1 Manufacturers
Manufacturers: Subject to compliance with requirements, provide products by one of the following:
Glass Fiber:
- Knauf Fiber Glass
- Manville
- Owens Corning Fiberglass Corporation

B.3.2 Materials
Type A: Flexible Glass Fiber: ASTM C553 Type 1; "k" value of 0.29 at 75°F; foil scrim kraft facing with 0.02 perm rating.

Type B: Board: ASTM C 612, Class 2, semi-rigid jacketed board "k" value of 0.23 @ 75°F; FSK facing with 0.02 perm rating.

Adhesives: Waterproof fire-retardant type produced under the UL classification and follow-up service.

Lagging Adhesive: Fire resistive to NFPA 255 or UL 723.

Impale Anchors: Galvanized steel, 12 gage, self-adhesive pad.

Joint Tape: Glass fiber cloth, FSK backing.

B.4 Natural Gas Systems
B.4.1 Materials and Products
General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with NFPA 54 where applicable; base pressure rating on natural gas piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials that match pipe materials used in natural gas systems. Where more than one type of material or product is indicated, selection is Installer's option.

B.4.2 Basic Pipe and Pipe Fittings for Natural Gas Systems
B.4.2.1 Building Distribution Piping
Pipe Size 2 inches and Smaller: Black steel pipe; Schedule 40, malleable iron threaded fittings.
Pipe Size 2½ inches and Larger: Black steel pipe: Schedule 40; wrought steel butt-welding fittings.

B.4.3 Natural Gas System – Special Valves
General: Special valves required for natural gas systems include the following types:

B.4.3.1 Gas Cocks:
Gas Cocks 2 inches and Smaller: 150 psi non shock WOG, bronze straightway cock, flat or square head, threaded ends.
Gas Cocks 2½ inches and Larger: 125 psi non shock WOG, iron body bronze mounted, straightway cock, square head, flanged ends.
Pressure Regulators: Step down pressure regulator, lock-up type staging type, reduction and capacity as required.

Manufacturer: Subject to compliance with requirements, provide gas cocks of one of the following:

NIBCO, Inc.
DeZurik Corporation
Jenkins Bros.
Lunkenheimer Company
Rockwell International, Flow Control Division
Stockham Valves and Fittings
Walworth Company

B.5 Refrigerant Piping and Specialties

B.5.1 Piping

Copper Tubing: ASTM B280, Type ACR hard drawn or annealed.
Fittings: ANSI/ASME B16.22 wrought copper.
Joints: ANSI/ASTM B32, solder Grade 95TA or ANSI/AWS A5.8 BCup silver braze.

Factory precharged linesets are acceptable.

B.5.2 Refrigerant

Refrigerant: R-410A.

B.5.3 Moisture and Liquid Indicators

Indicators: Single or Double port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; suitable for system working pressure and temperature.

B.5.4 Refrigerant Piping Insulation

Flexible, close-cell elastomeric pipe insulation conforming to ASTM C534 Grade 1, Type I: AP Armaflex with appropriate adhesive; Armaflex 520.

B.6 Ductwork

B.6.1 Materials

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.

Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts, Stainless Steel where installed on stainless steel ducts.

General: Non-combustible or conforming to requirements for Class 1 air duct materials, or UL 181.

Steel Ducts: ASTM A525 or ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz per sq ft for each side in conformance with ASTM A90.

Stainless Steel Ducts: ASTM A167, Type 304, 2 gauges heavier than standard galvanized ductwork. (In lieu of stainless steel, rigid fiberglass ductwork can be substituted pending approval of the engineer.)

Flexible Ducts: Interlocking spiral of galvanized steel or aluminum construction or fabric supported by helically wound spring steel wire or flat steel bands; rated to 2 inches WG positive and 1.5 inches WG negative for low pressure ducts.

Fasteners: Rivets, bolts, or sheet metal screws. Use stainless steel fasteners on stainless steel ducts.

Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

Hanger Rod: Steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

B.6.2 Sealant Materials

Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

Joint and Seam Tape: 2 inches wide; glass-fiber-reinforced fabric.

Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.

Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

B.6.3 Hangers & Supports

Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

Hanger Materials: Galvanized sheet steel or threaded steel rod.
Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
Supports for Stainless-Steel Ducts: Stainless-steel support materials.
Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

B.6.4 Rectangular Duct Fabrication
Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
Manufacturers:
- Ductmate Industries, Inc.
- Nexus Inc.
- Ward Industries, Inc.

Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
Manufacturers:
- Ductmate Industries, Inc.
- Lockformer.
- Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
- Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

B.6.5 Round Duct and Fitting Fabrication
Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a

circumference equal to the perimeter of a given size of flat-oval duct.

Round, Spiral Lock -Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

Duct Joints: Ducts up to 48 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.

90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

Fabricate elbows using die-formed, gored, pleated, or mitered construction. Unless elbow construction type is indicated, fabricate elbows as follows:
Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
Ducts 3 to 36 Inches in Diameter: 0.034 inch.
90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.

B.6.6 Ductwork General
Construct Ts, bends, and elbows with radius of not less than 1-½ times width of duct on centerline. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

Elbows and transformation pieces, etc., shall be one to two gauges heavier, depending on size. Ratio of width individual air passages to total width of elbow shall be one (1) to five (5).

Longitudinal joints in horizontal runs or in risers shall be made with grooved seams. In elbows and transformation pieces, they shall be made with Pittsburgh corner seams or double corner seams.

Bracing shall be galvanized steel or stainless steel angles as applicable and conform to SMACMA recommendations and standards.

All ductwork shall be constructed in accordance with SMACNA and ASHRAE Specifications Standards and in accordance with state and local code requirements. Ductwork to be sealed in accordance with SMACNA seal Class B.

Provide fire resistant neoprene or other approved flexible connections on the entering and leaving side of all air handling units, etc., and at the collection boxes of all roof fans, etc., or as shown on plans, equal to Ventfabric "Ventglas". Attach with metal collar frames to prevent air leakage.

Provide flexible connection for ducts of dissimilar metals to prevent galvanic action.

Use double nuts and lock washers on threaded rod supports.

B.7 Ductwork Accessories

B.7.1 Sheet Metal Materials

Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

B.7.2 Volume Dampers

Manufacturers:

Air Balance, Inc.
American Warming and Ventilating.
McGill AirFlow Corporation.
METALAIRE, Inc.
Penn Ventilation Company, Inc.
Ruskin Company.
Vent Products Company, Inc.

General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.

Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.

Aluminum Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.

Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.

Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.

Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

B.7.3 Turning Vanes

Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.

Manufacturers:

Ductmate Industries, Inc.
Duro Dyne Corp.
METALAIRE, Inc.

Ward Industries, Inc.

B.7.4 Duct Mounted Access Doors

General Description: Fabricate doors airtight and suitable for duct pressure class.

Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

Manufacturers:

American Warming and Ventilating.
CESCO Products.
Ductmate Industries, Inc.
Greenheck.
McGill AirFlow Corporation.
Ventfabrics, Inc.

Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

Provide number of hinges and locks as follows:

Less Than 12 Inches Square: Secure with two sash locks.
Up to 18 Inches Square: Two hinges and two sash locks.

B.7.5 Flexible Connectors

Manufacturers:

Ductmate Industries, Inc.
Duro Dyne Corp.
Ventfabrics, Inc.

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

Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.

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

Minimum Weight: 26 oz./sq. yd..
Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
Service Temperature: Minus 40 to plus 200 deg F.

B.7.6 Duct Accessory Hardware

Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

B.8 Ceiling Exhaust Fans
Centrifugal Fan Unit: Direct driven, with steel housing, resilient mounted motor, gravity backdraft damper in discharge.

Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

Grille: As required, molded aluminum with baked white enamel finish.

Accessories: Provide with Wall Cap and backdraft damper.

Provide cabinet and ceiling exhaust fans with capacities and accessories as indicated and scheduled on drawings.
Acceptable manufacturers to be: Greenheck, Cook or Penn.

B.9 Registers/ Grilles & Diffusers
B.9.1 Airfoil Blade Type Supply Grilles – Plan Designation "A"

Aluminum supply grilles shall be Titus AeroBlade Series as shown on the plan schedule, or Price or Metalaire equivalent.

The front deflection blades shall be available parallel to the long dimension of the grille or register. All supply grilles shall be constructed with a 1 1/4" wide heavy aluminum border having a minimum thickness of 0.040" 0.050". Outer borders shall be assembled and interlocked at the four corners and mechanically staked to form a rigid frame. Screw holes shall be countersunk for a neat appearance.

Blades shall be constructed of heavy duty aluminum and shall be contoured to a specifically designed airfoil cross section to meet published performance data. Hollow blades are not acceptable. Blades must be solid. Blades shall be spaced 3" apart. Blades shall extend completely through the side frame on each side to ensure stability throughout the complete cfm operating range of the grille. Blades shall be individually adjustable without loosening or rattling and shall be securely held in place with tension wire.

The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100 hour ASTM D117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250 hour ASTM 870 Water Immersion test. The paint must also pass the ASTM D 2794 Reverse Impact Cracking Test with a 50 inch pound force applied.

The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70 1991.

B.9.2 Heavy Duty Aluminum Bar Return Grilles – Plan Designation "B"
Aluminum return bar grilles – ½" spacing and 30° deflection. Blades parallel to the short

dimension.

1-1/4" frame with countersunk screw mounting. Border type as applicable for each installation situation.

Finish: White. Finish shall be an anodic acrylic paint, baked at 315° F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100 hour ASTM D117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250 hour ASTM 870 Water Immersion test. The paint must also pass the ASTM D 2794 Reverse Impact Cracking Test with a 50 inch pound force applied.

Acceptable Manufacturers: Titus 63FS or equivalent Price, Metalaire.

B.9.3 Contractor Fabricated – Plan Designation "C"
Stainless steel screen – 1" x 1" size fabricated with minimum 1-1/4" stainless steel borders.

Contractor option to utilize a manufactured equivalent.

B.10 Forced Air Furnaces and Evaporator Coils
B.10.1 Manufacturers
Provide units with capacities as scheduled on drawings.

Acceptable Manufacturers: Carrier, Trane, American Standard.

B.10.2 Manufactured Units
Configuration: Upflow, type as shown on drawings with gas burner and direct expansion refrigeration. Single or two-stage as scheduled on drawings.

Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner or heater, controls, air filter, refrigerant cooling coil and outdoor package containing compressor, condenser coil and condenser fan

Refrigerant: Puron (R-410A).

Construction and Ratings: In accordance with ARI 210/240. Testing: ASHRAE 14.

Performance Ratings: Energy Efficiency Rating (EER) not less than requirements of ANSI/ASHRAE 90A; seasonal efficiency to ANSI/ASHRAE 103. Provide units with meet or exceed the requirement of those scheduled on the drawings.

Heating Capacity & Staging: As scheduled on plans.

Air Handling: As scheduled on plans.

Cooling Capacity and Staging: As scheduled on plans.

B.10.3 Fabrication
Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.

Heat Exchanger:
Primary: 3-Pass 20 gauge corrosion resistant aluminized steel of fold and crimp sectional design which operates under negative pressure
Secondary: flow-through design having a interior laminate coating of polypropylene for corrosion resistance with fold and crip design which operates under negative pressure
Power vent fan, single or 2 speed as applicable.

Supply Fan: Centrifugal type rubber mounted with direct drive.

Motor: ANSI/NEMA MG 1; 1750 rpm rubber isolated hinge mounted, 4 speed.

Air Filters: Two-inch thick glass fiber, disposable type arranged for easy replacement.

B.10.4 Burner
Gas Burner: Sealed combustion type with power vent fan, slow-opening dual rate gas valve, electric switch gas shut-off; flame proving sensor, hot surface igniter, pressure switch assembly; flame rollout switch, drain tubing and condensate trap, blower and inducer assembly, 40va transformer for thermostat power. Suitable for use with LP gas.

B.10.4.1 Burner Operating Controls
High Limit Control: Fixed stop at maximum permissible setting, de energizes burner on excessive bonnet temperature and re-energizes when temperature drops to lower safe value.
Control Supply Fan: Bonnet temperatures and independent of burner controls, manual switch for continuous fan operation.
Single or two stage control as Scheduled

B.10.4.2 Evaporator Coil
Coil and Coil Casing: Copper tube aluminum fin assembly, galvanized drain pan, drain connection, refrigerant piping connections and factory installed thermostatic expansion valve, fully insulated cabinet.

B.10.4.3 Operating Controls
Adjustable Room Thermostat –heating/cooling: Low voltage, to control burner operation, compressor and condenser fan and supply fan to maintain temperature setting. Include system selector switch (heat-off-cool) and fan control switch (auto-on).

Electric solid-state microcomputer based room thermostat; locate as indicated.
Room thermostat to incorporate:
Automatic switching from heating to cooling.

Preferential rate control to minimize overshoot and deviation from set point.
Set-up for four separate temperatures per day.
Instant override of setpoint for continuous or timed period from one hour to 31 days.
Short cycle protection.
Programming based on weekdays, Saturday and Sunday.
Switch selection features including imperial or metric display, 12 or 24-hour clock, keyboard disable, fan on-auto.
5-degree deadband capability and night setback down to 55ºF capability.
Room thermostat display to include: (Note: Although setback capabilities will be available with thermostats, they will not be used since the building is unoccupied and heating setpoint for both units should be maintained at 55 deg F and cooling setpoint for Electrical room 105 shall be set at 78 deg F.
Time of day.
Actual room Temperature.
Programmed temperature.
Programmed time.
Duration of timed override.
Day of week.
System model indication: heating, cooling, auto, off, fan auto, fan on.
State (heating or cooling) operation.
Auxiliary Contacts for Ventilation control during Occupied/Unoccupied occupancy.

B.11 Air Cooled Condensing Units

B.11.1 Manufacturers

Provide condensing units of same manufacturer as the air handling/furnace equipment for which it is connected: Carrier, Trane or American Standard.

B.11.2 Unit Description

Provide and install as shown on the plans factory assembled, air cooled compressor condensing units in the quantity specified. Each unit shall consist of a hermetic compressor(s), air cooled condenser section, control system, suction and liquid connection valves, and all components necessary for safe and controlled unit operation when connected to the specified low side equipment.

B.11.3 Design Requirements

General: Provide a complete compressor-condensing unit as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in Section A and any local codes in effect.

Performance: Refer to the schedule of performance on the drawings. The unit shall be capable of stable operation to a minimum of 35°F outdoor temperature. Provide Low Ambient accessory option.

Refrigerant: R-410A

B.11.4 Condensing Unit Features

B.11.4.1 Compressors

The compressors shall be a sealed hermetic type with a forced feed lubrication system and oil charge. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two pole, with inherent thermal protection on all phases and shall be mounted on RIS vibration isolators. All Models shall be furnished with a crankcase heater.

B.11.4.2 Condenser

The condenser coil(s) shall consist of seamless copper tubes mechanically bonded into plate type fins. The fins shall have full drawn collars to completely cover the tubes. A subcooling section shall be an integral part of the main condenser coil. Condenser fan(s) shall be propeller type arranged for vertical air discharge and individually driven by direct drive fan motor(s). The fan discharge area shall be equipped with a heavy gauge fan guard. Fan motor(s) shall be weather protected, single phase, direct drive, 1100 rpm, open drip proof type. The condenser coil(s) shall be mechanically protected from physical damage by a wire guard covering the full face area of the coil.

B.11.4.3 Refrigerant Circuit

The condensing unit shall be furnished with a liquid line filter drier and service valves for liquid and suction connections. The finished field installed refrigerant circuit furnished by the contractor shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line (insulated hot gas bypass line) and insulated suction line.

B.11.4.4 Control System

A centrally located weatherproof control panel shall contain the field power connection points, control terminal block and control system. Power and starting components shall include fan motor contactors, time delay relay(s) for the compressor(s), inherent fan motor overload protection and unit power terminal blocks for connection to remote disconnect switch. Safety and operating controls shall include a manually reset high pressure switch and an automatic reset low pressure switch. Barrier panels shall be furnished to protect against accidental contact with line voltage when accessing the control system.

B.11.4.5 Service Accessibility

Entrance to the separate compressor(s) and control compartment shall be through an access panel.

B.11.4.6 Wiring Diagrams

Wiring diagrams shall be in color and marked to match the color and markings of the wires and shall be both "point to point" and "ladder" diagrams.
Diagrams shall be laminated in plastic and permanently fixed to the control compartment door.

Installation and maintenance manuals shall be supplied with each unit within the control compartment.

B.11.5 Options and Accessories
Unit shall be supplied with the following options:
Cycling condenser fan control for low ambient operation to 35° F
Refrigerant reservoir.
Low ambient kit
Crankcase heater
Liquid line solenoid valve

C Construction
C.1 Piping Systems – Common Requirements
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.

Install piping free of sags and bends.

Install piping to allow application of insulation.

Select system components with pressure rating equal to or greater than system operating pressure.

Sleeves are required for core-drilled holes.

Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
Cut sleeves to length for mounting flush with both surfaces.
Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
Install sleeves in new walls and slabs as new walls and slabs are constructed.
Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
Steel Pipe Sleeves: For pipes smaller than NPS 6.

Verify final equipment locations for roughing-in.

C.1.1 Piping Joint Construction
Join pipe and fittings according to the following requirements.

Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

C.1.2 Equipment Installation – Common Requirements.
Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

Install equipment to allow right of way for piping installed at required slope.

C.1.3 Painting
Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C.1.4 Concrete Bases
Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions. Coordinate size and placement of concrete bases. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
Install anchor bolts to elevations required for proper attachment to supported equipment.
Install anchor bolts according to anchor-bolt manufacturer's written instructions.
C.2 Identification & Paining - General
Where more than one type of mechanical identification is specified for listed application, selection is installer's option, but provide single selection for each product category.

Degrease and clean surfaces to receive adhesive for identification materials.

C.2.1 HVAC Systems - Labeling and Identifying

Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
Plastic markers: Install on pipe insulation segment where required for hot non insulated pipes.
Locate pipe markers wherever piping is exposed in finished spaces, equipment rooms, accessible maintenance spaces (shafts, tunnels, plenums), and exposed exterior locations as follows:
Near each valve and control device.
Near each branch, excluding short take offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
Near locations where pipes pass through walls, floors, ceilings, or enter inaccessible enclosures.
At access doors, manholes, and similar access points that permit view of concealed piping.
Near major equipment items and other points of origination and termination.
Spaced at a maximum of 50 foot (15 m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.
On piping above removable acoustical ceilings, except omit intermediately spaced markers.

Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.
Lettering Size: Minimum ¼ inch (6 mm) high lettering for name of unit where viewing distance is less than 2 feet (0.6 m), ½ inch (13 mm) high for distances up to 6 feet (1.8 m), and proportionately larger lettering for greater distances. Provide secondary lettering 1/2 to ¾ of size of principal lettering.
Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.

Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows, showing duct system service and direction of flow.
Location: In each space where ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 50 feet (15 m).

Adjusting: Relocate identifying devices, which become visually blocked by work of this Division or other Divisions.

C.2.2 Painting
Color Coding and Labeling of Piping and Equipment - The following color code shall be applied for all new piping installed as part of this project exposed to view:
Natural gas piping (interior) – yellow; (exterior) - grey
Exposed HVAC mechanical equipment hangers and supports: grey.

Protection of Finished Work and Equipment
Protect with tarpaulin or drop cloth all floors, walls, glass, finished painted work, and equipment from paint spatter or other damage that might result from this Work.
Promptly remove all oil, paint, and solvent waste rags from the site and legally dispose of them. Do not burn waste materials.
Paint, varnish, and mixing cans shall not be placed on bare floors.
Dirty, oily, and dusty cover shall not be used.
No stains or spots shall remain after completion of painting. Remove hardware accessories, light fixtures, and similar items before painting.
Replace above items after finish coat is applied.
Masking may be utilized in lieu of removal of items.

Application:
Application may be by brushing or rolling. Method used shall be one as approved by material manufacturer for any one particular product.
Brushing: Brush in one direction then smooth at right angles to original brushing to produce a uniform thickness of coating.
Thickness of Coating: Where number of coats is indicated, it is intended to show the normal practice to obtain the proper dry mil thickness.
The dry mil film thickness must be provided in all cases even though it may require additional coatings to that specified. Contractor must provide adequate ventilation at all times.

Ventilation shall be adequate to remove fumes, preventing injury to workmen, or possibility of accumulating volatile gases.

C.3 HVAC Ductwork Insulation
C.3.1 Preparation
Surface Preparation
Clean, dry, and remove foreign materials such as rust, scale, and dirt.

Mix insulating cements with clean potable water. Mix insulating cements contacting stainless steel surfaces with demineralized water.

C.3.2 Installation
Refer to schedules at the end of this section for materials, forms, jackets, and thicknesses required for each ductwork system.

Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or

dry state.

Install vapor barriers on insulated ducts having surface operating temperatures below 60°F.

Install insulation, accessories and finishes in accordance with the latest edition of MCIA National Commercial and Industrial Insulation Standards and manufacturer's installation instructions. Exceptions to these standards will be accepted where specifically modified in these specifications or where prior written approval has been obtained from the Engineer.

Install insulation with smooth, straight, and even surfaces.

Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.

Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

Seal Ends
Except for flexible elastomeric insulation, taper ends at 45 deg angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.

Apply adhesives and coatings at manufacturer's recommended coverage per gallon rate.

Keep insulation materials dry during application and finishing.

Items Not Insulated: Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment:
Factory insulated flexible ducts.
Flexible connectors.
Testing laboratory labels and stamps.
Access panels and doors in air distribution systems.

Install block and board insulation as follows:
Speed Washers Attachment: Secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18 inches apart each way and 3 inches from insulation joints. Apply vapor barrier tape to seal insulation in contact, open joints, breaks, punctures, and voids in insulation.

Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:
Smaller than 24 Inches: Bonding adhesive applied in 6 inch wide transverse strips on 12 inch centers.
24 Inches and Larger: Anchor pins spaced 12 inches apart each way. Apply bonding adhesive to prevent sagging of the insulation.

Overlap joints 3 inches.
Seal joints, breaks, and punctures with vapor barrier tape.

At test plugs, provide removable insulation plugs.

Insulate around damper operators so as to maintain full operating range of operator.

C.3.3 Ductwork Insulation Schedule
Interior exposed Supply, Return and outside air ducts and plenums – All
Material Glass Fiber Board, round or rectangular as required.
Thickness 1-1/2" with vapor barrier
Jacket: Provide with factory FSK jacket.

First 6' of exhaust duct from building envelop Penetration.
Material: Glass fiber board round or rectangular as required.
Thickness 1/1/2"
Jacket: Provide with factory FSK jacket.

C.4 Installation of Natural Gas Piping
Use sealants on metal gas piping threads that are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.

Remove cutting and threading burrs before assembling piping.

Do not install defective piping or fittings. Do not use pipe with threads that are chipped, stripped or damaged.

Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed.

Install drip legs in gas piping where indicated, and where required by code or regulation.

Install "tee" fittings with bottom outlet plugged or capped, at bottom of pipe risers.

Install piping with 1/64 inch per foot downward slope in direction of flow.

Install piping parallel to other piping, but maintain minimum of 12 inch clearance between gas piping and steam or hydronic piping above 200 deg F.

Install gas pressure regulator at equipment. Size for pressure leaving meter, required pressure at equipment and required flow. Vent per code to atmosphere. NOTE: Coordinate gas pressures provided and placement of step down regulators where they may be required.

All pipe supports to be spaced a maximum of 5 feet.

C.4.1 Installation of Piping Specialties
Do not conceal any gas piping or specialties.

C.4.2 Installation of Valves
Gas Cocks: Provide at connection to gas train for each gas fired equipment item and on risers and branches where indicated.

Locate gas cocks where easily accessible, and where they will be protected from possible injury.

C.4.3 Equipment Connections
General: Connect gas piping to each gas fired equipment item with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions. Install any required Step-down pressure regulators that may be required based on gas pressures supplied from gas meter to gas pressure requirements of equipment. Pipe any regulator vents to outside of building away from any O.A. intakes.

C.4.4 Field Quality Control
Piping Tests: Inspect, test, and purge natural gas systems in accordance with NFPA 54.

C.4.5 Adjusting and Cleaning
Cleaning and Inspecting: Clean and inspect natural gas systems. Paint gas piping per C.2.2.

C.5 Refrigeration Piping & Specialties Installation
C.5.1 Preparation
Ream pipe and tube ends. Remove burrs.

Remove scale and dirt on inside and outside before assembly.

Prepare piping connections to equipment with flanges or unions.

C.5.2 Installation
Install refrigeration specialties in accordance with manufacturer's instructions.

Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

Install piping to conserve building space and not interfere with use of space.

Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

Provide non conducting dielectric connections when joining dissimilar metals.

Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

Provide clearance for installation of insulation and access fittings.

Provide access to concealed fittings.

Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.

Insulate piping per insulation manufacturers recommendations. All insulation exposed to sunlight or installed outdoors shall be protected with two coats of WB Armaflex Finish or weather resistant coating.

Fully charge completed system with refrigerant after testing.

Provide refrigerant charging valve connections in liquid line between receiver shut off valve and expansion valve.

C.5.3 Field Quality Control
Test refrigeration system in accordance with ANSI/ASME B31.5.

Pressure test system with dry nitrogen to 200 psig. Perform final tests at 27 inches vacuum and 200 psig using halide torch electronic leak detector. Test to no leakage.

C.6 Ductwork Installation
Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

Suspended horizontal ductwork shall be securely and rigidly anchored and supported from the building structure by means of rod-angle iron or strap iron hangers. Rod hangers shall be threaded at both ends and equipped with nuts and washers. Angle and strap hangers shall be attached to ducts by means of welds or sheet metal screws or by rivets. They shall be attached to suitable roof or ceiling structures through formed angles, by anchor screws and heavy, wide washers. If attached to floor slab, the bearing quality of slab material shall be checked and found capable of supporting weight of duct.

Vertical dust risers shall be rigidly supported as they pass through floors, ceilings or roofs by angle iron spanning the opening and firmly and securely attached to the building walls

or columns. All ductwork shall be so installed as to be free from vibration under all normal operating conditions. Where required, suitable sound attenuators shall be incorporated with the anchors and/or supports. Finish openings in floors, walls and ceilings with 22 gauge sheet metal closures to give a neat appearance.

Where ducts pass through walls or floors, provide a suitable sheet metal angle around the periphery of the duct. Where ducts pass through exterior building construction, provide a suitable flashing and counterflashing to make a weathertight installation.

Where external insulated ducts pass through walls, floors or ceilings, suitable size openings shall be made to allow for the insulation through the opening. The insulation shall not be stopped on each side of the opening.

Connect diffusers to low pressure ducts with 5 feet maximum length of flexible duct. Hold in place with strap or clamp.

C.6.1 Field Quality Control

Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual". Provide evidence of compliance upon request.
Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg.
Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

C.6.2 Adjusting and Cleaning

Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment, which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

C.7 Application and Installation of Ductwork Accessories

Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts

Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

Provide balancing dampers for all diffuser and equipment connections unless noted otherwise.

Provide additional balancing dampers that are required to achieve a balanced system but not shown on the drawings. Install balancing dampers a minimum of two duct widths from branch takeoff.

Provide test holes at fan inlets and outlets and elsewhere as indicated.

Install fire dampers, with fusible links, according to manufacturer's UL-approved written instructions.

Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:
On both sides of duct coils.
Downstream from volume dampers, turning vanes, and equipment.
Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
On sides of ducts where adequate clearance is available.

Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

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

C.7.1 Adjusting
Adjust duct accessories for proper settings.

Final positioning of manual-volume dampers is specified in “Testing, Adjusting, and Balancing” work description.

C.8 Ceiling Exhaust Fan Installation
Install in accordance with manufacturer's instructions.

Coordinate all wall openings required with General contractor.

Support fan and fan housings utilizing neoprene isolators at all hanging points. Coordinate supports and support anchoring placement with general contractor.

Coordinate electrical requirements. Final electrical connections shall conform to Project Electrical requirements. Properly ground equipment. Coordinate the mounting and

power wiring of fans with manufacturer’s recommendations.

C.9 Installation of Registers / Grilles & Diffusers
Install items in accordance with manufacturers' instructions.

Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

Install grilles to ductwork with airtight connection.

Install balancing dampers on duct take-off to grilles and registers, regardless of whether dampers are specified as part of the diffuser, or grille and register assembly.

C.10 Installation of Furnace and Evaporator Coil

Coordinate furnace, cased cooling coil with air cooled condensing unit being furnished All equipment shall be matched to work together.

Verify pressure of natural gas to furnace. Install stepdown regulator if required.

C.10.1 Examination
Verify that floors are ready for installation of units and openings are as indicated on shop drawings.

Verify that proper power supply is available for furnace package.

Verify that proper fuel supply is available for connection.

C.10.2 Installation

Install in accordance with manufacturer's instructions.

Install refrigerant lines from indoor equipment to outdoor condensing units. Insulate as required and recommended by manufacturer. Refrigerant lines are to be insulated.

Install interconnecting control wiring between thermostat, furnace and air cooled condensing unit.

Install to NFPA 90A and ANSI/NFPA 90B.

Install gas fired furnaces to ANSI Z223.1 (NFPA 54).

Provide vent connections to ANSI/NFPA 211.

C.11 Condensing Unit Installation
Install in strict accordance with manufacturer's requirements, shop drawings, and contract

documents.

Set unit on concrete equipment (housekeeping) pad if located on grade. Adjust and level unit on supports. For units located on roof. Set unit on roof rails appropriately flashed into roof structure.

Install refrigerant piping in accordance with drawings and manufacturers recommendations. Seal exterior envelop penetrations weather tight. For Roof penetrations utilize pitch pocket.

Evacuate the system and charge with refrigerant in accordance with standard practice.

Coordinate electrical installation with electrical contractor.

Coordinate controls with control contractor.

Provide all appurtenances required to insure a fully operational and functional system.

C.11.1 Startup
Check and assure proper system charge of refrigerant and oil.

Provide testing, and starting of system, and instruct the Owner in its proper operation and maintenance.

C.12 HVAC Testing & Balancing
This Section includes TAB to produce design objectives for the following:

- Gas Fired Furnace Units
- DX Cooling systems associated with Furnaces
- Exhaust fans
- Damper & Other equipment interlocks
- Ductwork distribution – Grilles and diffuser airflow volumes
- HVAC equipment quantitative-performance settings.
- Test & Verify that automatic control devices function properly and that interlocks work.

Reporting results of activities and procedures specified in this Section.

C.12.1 Submittals
Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

D Measurement
The City will measure Heating, Ventilating and Air Conditioning (HVAC) Systems**,** completed in accordance to the contract and accepted, as a single completed unit of work.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.400	Heating, Ventilating and Air Conditioning (HVAC) Systems	LS

60. Plumbing Systems, Item SPV.0105.410

A Description
A.1 Work Summary
This special provision describes the demolition of select components of the existing plumbing systems and the installation of new water heater, interconnecting piping and new toilet fixture. Work required for the project is indicated on the plans.

A.2 Regulatory Requirements
A.2.1 State & Local Codes
Conform to all state and local code requirements.

A.2.2 Standards, Codes and Permits
All work shall be installed in accordance with National, State and Local plumbing codes, laws, ordinances and regulations. Comply with all applicable OSHA regulations.

All materials shall have a U.L. label where a U.L. standard and/or test exists.

Prepare and submit to all authorities having jurisdiction, for their approval, all applications and working drawings required by them. Secure and pay for all permits and licenses required.

A.3 Delivery, Storage & Handling
Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

A.4 Demolition, Renovation and Disposition of Existing Equipment.
Plumbing equipment in conflict with construction shall be removed and/or relocated as indicated on the drawings, as directed or required. This Contractor shall remove all plumbing equipment released from service as a result of construction, and no equipment removed shall be reused, except as specifically directed on the drawings or elsewhere herein. Except for piping and miscellaneous hardware, all plumbing equipment that the owner desires to retain shall remain the property of the Owner and shall be stored on the site for removal by the Owner. All other piping and equipment removed and not retained

by the Owner shall become the property of this Contractor and shall be removed from the site.

This Contractor shall be responsible for the work of other trades as may be necessary to facilitate the installation of plumbing work in the existing building. Such work necessary that is normally done by other trades and is not covered as a part of other Divisions of the work shall be done under the direction and at the expense of the Plumbing Contractor. This work shall include but is not limited to, cutting, patching, and refinishing and all necessary and required to leave existing building in condition acceptable to the engineer.
Any existing fixtures or equipment not shown on the drawings and which are logically expected to be continued in service and which may be interrupted or disturbed during construction shall be reconnected in an approved manner. In addition, any existing fixture or equipment which may require relocation or rerouting, as a result of construction, shall be considered a part of the work of this branch and shall be done by this Contractor with no additional compensation.

All coring that is required for plumbing work shall be by this Contractor.
All equipment containing hazardous materials removed during the project become the Contractor's property and he shall dispose of them in accordance with applicable DNR and EPA regulations.

Piping which is to remain in service, but which is presently routed through areas being demolished shall be rerouted around demolition area.

A.5 Equipment Accessibility
Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

A.6 Submittals
A.6.1 Equipment and Material Shop Drawings
Submit shop drawings which include equipment information and product data for equipment listed below for review:

Utility Sink Faucet and accessories
Water Heater

B Materials
B.1 Common Work Results for Plumbing
B.1.1 Pipe Threads and Fittings
Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B.1.2 Joining Materials
Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

Solvent Cements for Joining Plastic Piping:

ABS Piping: ASTM D 2235.
CPVC Piping: ASTM F 493.
PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
PVC to ABS Piping Transition: ASTM D 3138.

B.1.3 Dielectric Fittings

Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

Insulating Material: Suitable for system fluid, pressure, and temperature.
Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

Manufacturers:
Eclipse, Inc.
Epco Sales, Inc.
Hart Industries, International, Inc.
Watts Industries, Inc.; Water Products Div.
Zurn Industries, Inc.; Wilkins Div.

B.1.4 Escutcheons

Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
Finish: Polished chrome-plated and rough brass.

B.2 Domestic Water Piping – Interior and Exterior Systems

B.2.1 Copper Tube and Fittings

Hard Copper Tube: ASTM B 88, Types L (ASTM B 88M, Types B and C), water tube, drawn temper.

Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.

Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

For exterior Domestic Piping Systems, reuse existing piping material wherever possible.

B.3 Valves for Plumbing Systems

B.3.1 Copper-Alloy Ball Valves

Manufacturers:

Copper-Alloy Ball Valves:

Grinnell Corporation.
Milwaukee Valve Company
NIBCO INC.
Watts Industries, Inc.; Water Products Div.

Copper-Alloy Ball Valves, General: MSS SP-110.

Two- or Three-Piece, Copper-Alloy Ball Valves: Bronze body with full -port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4137-kPa) minimum CWP rating and blowout-proof stem.

B.4 Sanitary Waste Piping – Exterior

B.4.1 Copper Tube & Fittings

Reuse existing copper soil piping. Where additional piping is to be provided where needed, the new piping shall be as follows:

Copper Tube: ASME B 88 Type L
Copper fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper, solder-joint fittings.

B.5 Hangers & Supports for Plumbing Piping & Equipment

B.5.1 Manufacturers

Subject to compliance with requirements, provide products by one of the following:

B-Line Systems, Inc.
Carpenter & Patterson, Inc.
Grinnell Corp.
Michigan Hanger Co., Inc.
National Pipe Hanger Corp.
Unistrut Corp.

B.5.2 Manufactured Units

Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.

Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.

Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.

Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.

For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.

For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

B.5.3. Miscellaneous Materials
Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

B.6 Plumbing Pipe Insulation & Jackets
B.6.1 Manufacturers
Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Mineral-Fiber Insulation:
CertainTeed Manson.
Knauf FiberGlass GmbH.
Owens-Corning Fiberglas Corp.

B.6.2 Insulation Materials
Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.

Mineral-Fiber Insulating Cements: Comply with ASTM C 195.

Hydraulic-setting, mineral-fiber cement is suitable for temperatures from 100 to 1200 deg F (38 to 649 deg C) and for a smooth surface.

Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

B.6.3 Jackets – Exterior Insulation Systems
Aluminum Jacket: ASTM B209, 3003 Alloy, H-14 temper, roll stock ready for shop or field cutting and forming into required sizes.

B.7 Piping Identification Devices
Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

Colors: Comply with ASME A13.1, unless otherwise indicated.

Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.

Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

Plastic Tape: Continuously printed, vinyl tape at least 3 mils (0.08 mm) thick with pressure-sensitive, permanent-type, self-adhesive back.

Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.

B.8 Electric Tank Type Water Heaters
Manufacturers: AO Smith, Rheem, Bradford White., State Industries, American.
Description: Comply with UL 1453.

Construction: Steel with 150-psig working pressure rating

Tapping: Factory fabricated of materials compatible with tank for piping connections, relief valve, pressure gage, thermometers, grain, anode rods and controls as required. Attach tappings to tank shell before testing and labeling.

NPS 2 and Smaller: Threaded ends according to ASME B1.20.1, pipe threads.

Interior Finish: Materials and thicknesses complying with NSF 61, barrio materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

Jacket: Steel with enameled finsh

Heating Elements: Electric screw-in or bolt-on, immersion type.
Temperature Control: Adjustable thermostat.
Safety Control: Automatic, high-temperature-limit cutoff device or system.
Drain Valve: ASSE 1005, corrosion-resistant metal, factory installed.
Anode Rods: Factory installed magnesium
Dip Tube: Factory installed. Not required if cold water inlet is near bottom of storage tank.

B.8.1 Water Heater Accessories
Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than heat-exchanger working-pressure rating.

Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated, steel bracket for wall mounting and capable of supporting water heater and water.

B.9 Plumbing Faucets
See plumbing schedule on plans for specific fixture faucet requirements and specifications.

B.9.1 Manufacturers
Faucet descriptions listed on plan schedule establish fixture type, quality, materials, features and size. Products of the following manufacturers determined to be equal by the Engineer will be accepted:
Faucets & Accessories: Chicago Faucets, Kohler, Elkay, or Zurn.

C Construction
C.1 Plumbing Demolition
Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

Equipment to Be Removed: Disconnect and cap services and remove equipment.

Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner. Verify with owner all equipment and fixtures prior to removal.

Remove demolished material from Project site.

Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

C.1.2 PIPING SYSTEMS - COMMON REQUIREMENTS

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.
Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

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.

Install piping to permit valve servicing.

Install piping free of sags and bends.

Install fittings for changes in direction and branch connections.

Install piping to allow application of insulation.

Select system components with pressure rating equal to or greater than system operating pressure.

Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

New Piping:

Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
Insulated Piping: One-piece, stamped-steel type with spring clips.
Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

C.1.3 Piping Joint Construction

Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

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:

Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

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.

C.1.4 Piping Connections

Make connections according to the following, unless otherwise indicated:

Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

C.1.5 Equipment Installation – Common Requirements

Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
Install equipment to allow right of way for piping installed at required slope.

C.2 Domestic Water Piping
C.2.1 Pipe and Fitting Applications.
Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:

NPS 3-1/2 and Smaller (DN 65 to DN 90): Hard copper tube, Type L (Type B) (Type C) with: Threaded, soldered or brazed connections.

C.3 Sanitary Waste Piping
C.3.1 Pipe and Fitting Applications.
Reuse existing exterior above ground piping where ever possible. Maintain existing cleanout locations.
Install waste piping with a minimum of 2% downward slope in direction of flow.

C.4 Valves for Plumbing – Examination
Examine piping system of compliance with requirements for installation tolerances and other conditions affecting performance.
Proceed with installation only after unsatisfactory conditions have been corrected.

Examine valve interior for cleanliness, freedom from foreign matter, and corrosion.

Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

Examine threads on valve and mating pipe for form and cleanliness.

Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

Do not attempt to repair defective valves; replace with new valves.

C.4.1 Valve Applications
Domestic water Piping: Balve Valves NPS 2” and Smaller: Two-piece, 600-psig CWP rating, copper alloy.

For Copper Tubing, NPS 2” and smaller: Solder-joint or threaded ends.

C.4.2 Valve Installation
Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

Locate valves for easy access and provide separate support where necessary.

Install valves in horizontal piping with stem at or above center of pipe.

Install valves in position to allow full stem or handle movement.

C.4.2 Joint Construction
Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C.4.3 Adjusting
Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs

C.5.Hanger and Support Applications
C.5.1 Horizontal-Piping Hangers and Supports:
Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN15 to DN50).

Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).

Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).

Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).

Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.

Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

C.5.2 Hanger & Support Installation

Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. All exterior hangers and Hanger Accessories shall be fabricated with 316 stainless steel.

Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

Field assemble and install according to manufacturer's written instructions.

Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

Note: For exterior pipe hanger locations, all hangers & hanger accessories shall be fabricated from 316 Stainless Steel.

Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

Insulated Piping: Comply with the following:.

Attach clamps and spacers to piping.

Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

Do not exceed pipe stress limits according to ASME B31.9.

Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

Option: Thermal-hanger shield inserts may be used

Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.

Option: Thermal-hanger shield inserts may be used

Shield Dimensions for Pipe: Not less than the following:

NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.

Insert Material: Length at least as long as protective shield.

Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

Install hangers for exterior piping systems per the following maximum horizontal spacings and minimum rod diameters (NOTE: if Structural drawings & details indicate rod diameter for hangers, defer to diameters so indicated):

NPS 1-1/4: 72” with 3/8-inch rod

NPS 1-1/2 – NPS 2: 96” with 3/8-inch rod

NPS 2-1/2: 108” with ½-inch rod

NPS 3 –NPS 5: 10 feet with ½-inch rod

NPS 6: 10 feet with 5/8-inch rod

C.5.3 Equipment Supports
Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

C.5.4 Metal Fabrication
Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

C.5.5 Adjusting
Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

C.5.6 Hanger Painting
Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

C.6 Insulation Execution
C.6.1 General Application Requirements
Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

Apply multiple layers of insulation with longitudinal and end seams staggered.

Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

Keep insulation materials dry during application and finishing.

Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

Apply insulation with the least number of joints practical.

Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

Apply insulation continuously through hangers and around anchor attachments.

For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.

Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

Apply adhesives and mastics at the manufacturer's recommended coverage rate.

Apply insulation with integral jackets as follows:

Pull jacket tight and smooth.

Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.

Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.

At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

C.6.2 Mineral-Fiber Insulation Application

Apply insulation to straight pipes and tubes as follows:

Where pipe expansion is anticipated, detail expansion compensation for insulation on Drawings and indicate intervals for its occurrence. See MICA's "National Commercial & Industrial Insulation Standards," Plate No. 41A.

Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.

Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.

For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.

For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

Apply insulation to fittings and elbows as follows:

Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

Cover fittings with standard PVC fitting covers.

Apply insulation to valves and specialties as follows:

Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.

Apply insulation to flanges as specified for flange insulation application.

Use preformed standard PVC fitting covers for valve sizes where available.

Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

C.6.3 Metal Jackets

Install metal jacket with 2 inch minimum overlap at longitudinal and butt joints. Overlap longitudinal joints to shed water. Seal but joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel draw bands 12 inches on center and at butt joints.

C.6.4 Insulation Application Schedule, General

Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

C.6.5 Interior Insulation Application Schedule

Service: Interior - Domestic hot water.

Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
Insulation Material: Mineral fiber with ASJ Jacket
Insulation Thickness for piping up to and including 2": 1 (one) inch minimum.
Insulation Thickness for piping over 2": 1-1/2 (one and one-half) inch minimum.
Field-Applied Fitting covers: PVC
Vapor Retarder Required: No.
Finish: Painted.

Service: Interior - Domestic cold water.

Operating Temperature: 35 to 60 deg F (2 to 15 deg C).
Insulation Material: Mineral fiber with ASJ Jacket
Insulation Thickness: 1 (one) inch minimum.
Field-Applied Fitting covers: PVC.
Vapor Retarder Required: Yes.
Finish: Painted.

Service: Exterior Domestic Water and Sanitary Waste Piping

Insulation Material: Mineral fiber with ASJ Jacket
Insulation Thickness: 3 (three) inch minimum.
Field Applied Jacket & Fitting Covers: Aluminum
Vapor Retarder Required: Yes
Finish: Aluminum.
Note: Coordinate with installation of electrical heat tracing.

C.7 Piping Identification

Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Pretensioned pipe markers. Use size to ensure a tight fit.

Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations as follows:

Near each valve.

Near each branch connection, excluding short takeoffs for fixtures. Where flow pattern is not obvious, mark each pipe at branch.

Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
At access doors, manholes, and similar access points that permit view of concealed piping.

Near major equipment items and other points of origination and termination.

Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.

C.8 Water Heater Installation
Install water heaters, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

Anchor water heaters to substrate.

Install temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.

Fill water heaters with water.

C.8.1 Connections
Install piping adjacent to equipment to allow service and maintenance.

Connect hot- and cold-water piping with shutoff valves and unions.

Make connections with dielectric fittings where piping is made of dissimilar metal.

Electrical Connections: Power wiring and disconnect switches are specified in Electrical work Sections. Arrange wiring to allow unit service.

Ground equipment

Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

D Measurement

The City will measure **Plumbing Systems,** completed in accordance to the contract and accepted, as a single completed unit of work**.**

E Payment

The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.410	Plumbing Systems	LS

61. Bridge House Electrical Systems, Item SPV.0105.420

A Description

A.1 Work Summary

This special provision describes the demolition of existing Bridge House and pier service platform electrical systems and the furnishing and installation of new lighting fixtures, light switches, wiring devices, HVAC and plumbing equipment electrical connections, and all associated branch circuit wiring, conduit and boxes in the Bridge House and on the pier service platforms. Work required for the project is indicated on the plans.

Contractor shall examine the drawings relating to the Bridge House electrical work (BE1 through BE7) and shall become fully informed as to the extent and character of the work required and its relation to other bridge electrical work, and the work of other trades.

The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation for the Bridge House and pier service platforms.

Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the Authority Having Jurisdiction inspections and Engineer's reviews, tests and approval from the commencement until the acceptance of the completed work.

Refer to Item 56, “Bridge Electrical Work, Item SPV.0105.300” for additional electrical requirements that are common to the electrical work for the Bridge House.

A.2 Demolition, Renovation and Disposition of Existing Equipment.

The Contractor shall disconnect and remove all existing lighting, light switches, receptacles, and all branch circuit wiring (conduit, boxes, and conductors) from the Bridge House and the service platform of the near and far bridge piers. Existing conduit concealed in the walls and ceilings shall be cut off flush with the wall or ceiling surface,

the concealed portion of the conduits to be abandoned in place and the openings in the walls and ceilings to be patched to match the surrounding wall or ceiling finish.

Remove all electrical equipment released from service as a result of construction. No equipment removed shall be reused, except as specifically directed on the drawings or elsewhere herein. The Owner shall have the privilege to retain ownership of any electrical equipment that has been removed, and all such equipment shall be relocated to a designated temporary location for storage until removed by the Owner. All other equipment, conduit, conductors, and miscellaneous hardware removed shall become the property of this Contractor and shall be removed from the site.

All ballasts, lamps, transformers, or other equipment containing hazardous materials removed during the project become the Contractor's property and he shall dispose of them in accordance with applicable DNR and EPA regulations.

A.3 Submittals

A.3.1 Equipment and Material Shop Drawings

Submit manufacturer's shop drawings and equipment brochures which include equipment information and product data for equipment listed below for review:

- Lighting Fixtures
- Wiring Devices
- PVC Coated Galvanized Rigid Steel Conduit, Boxes, and Fittings
- Enclosed Disconnect Switches

B Materials

B.1 Electrical Lighting Fixtures

Furnish and install all fixtures, lighting equipment, and components shown on the plans and as listed on the "Fixture Schedule" and provide all labor and materials to install the lighting equipment in the manner indicated or recommended by the manufacturer. All fixtures and lighting equipment shall be delivered with accessories, lamps, hangers, canopies, hickeys, casings, end plates, sockets, fixture wires, holders, reflectors, globes, glass, guards, ballasts, diffusing louvers, recessing boxes, etc., all wired and assembled as indicated.

Furnish and install all lamps and accessory wiring. Entire fixtures and all component electrical parts shall be listed by UL. The engineer reserves the right to require colors and finish to meet special requirement on the building. The lighting fixtures shall be furnished and installed as required by the fixture schedule on the drawings.

Lighting fixtures on movable spans or where vibration may be a hazard to lamp life shall be installed with shock-absorbing lamp receptacles.

Fluorescent fixtures shall be internally wired with No. 16, Type AF, insulated fixture wire in accordance with the latest requirements in the current edition of the NEC.

B.1.1. Lighting Fixture Types

All light fixtures installed within the Bridge House and on the west and east bridge pier service platforms shall be enclosed and gasketed, 4 foot, 2-lamp fluorescent type with T-8 lamps and electronic ballasts.

Light fixture installed in the Control Room to be a recessed 1x4 lensed flange troffer. Fixture housing to be steel with polyester powder coat finish, IC rated for direct contact with insulation. Standard door frame to be flat white steel with acrylic lens. Ballasts shall be electronic dimming type.

Light fixtures installed in the lower level equipment and entry/street level rooms and out at the service platforms of the bridge piers to have impact-resistant, UV-stabilized, reinforced polyester fiberglass housing with high-impact acrylic lens. Light fixtures at the piers shall be UL Listed for wet locations, and have low-temperature rated ballasts for -20° F starting.

B.1.2 Manufacturers

Fixture descriptions listed on plan schedule establish fixture type, quality, materials, features and size.

Catalog cuts of fixtures with complete photometric data, where different from those indicated, shall be submitted to the Engineer for approval

Products of the following manufacturers determined to be equal by the Engineer will be accepted:

- Fixture Types F2, F3 – Lithonia, Day-Brite.
-
- Fixture Type F4 – Gardco, Lithonia.
- Fixture Type F5 – Lithonia, Kenall.
- Fixture Type F6 – Crouse-Hinds, Appleton Electric.
- Fixture Type F7 – Philips Color Kinetics, GE Lighting, Nora.
- Fixture Type F8 – Hazlux, Crouse-Hinds, GE Lighting.
- Fixture Type EBU-1– Lithonia, Dual-Lite.

B.1.3 Ballasts

Ballasts shall be furnished and installed as required for all lighting fixtures. Ballasts shall meet the requirements specified herein and shall be designed to meet applicable Certified Ballast Manufacturer's and/or American Standard Association and Underwriter's Laboratories specification. Ballasts furnished must provide lamp watts within 90 percent minimum of lamp manufacturer's published ratings. All ballasts shall be sound rated "A". Replace any ballasts which do not operate quietly. Ballasts shall be applied such that the ballast case temperature will remain below 90 degrees C, for full ballast life. The

ballast shall supply an open circuit voltage which, at the minimum supply voltage limit, will meet requirements of the lamp manufacturer, and shall be guaranteed to start at least 90 percent of seasoned HID lamps at the minimum supply voltage limit in -20 degree F. ambient. All ballasts shall be equipped with either internal, non-resetting thermal protection devices adjacent to the coils and in the power capacitor or each ballast shall be provided with dual-element, inline, slow blowing external fuse

All ballasts shall be of the high power factor type, with 120 V primaries.

Provide radio-frequency interference suppressor.

Ballasts for dimmer-controlled fluorescent fixtures shall comply with general and fixture-related requirements above for electronic ballasts and the following features:

- Ballast shall be Program Start, Electronic Dimming type.
- Dimming Range: Minimum 100 to 5 percent of rated lamp lumens.
- Ballast Input Watts: Can be reduced to 20 percent of normal.
- Compatibility: Certified by manufacturer for use with specific dimming system indicated.
- Lamp Connection: Series.
- Ballast shall have a Power Factor greater than 0.98 at full light output and greater than 0.90 throughout the dimming range for primary lamp.
- Ballast shall be high frequency electronic type and operate lamps at frequency above 40 kHz to avoid interference with infrared devices.
-
- Ballast shall be universal voltage type which operate from 50/60 Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.

B.1.4 Lamps

Lamps shall be T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI of 75 (minimum), color temperature of 3500 K, and average rated life of 20,000 hours, unless otherwise indicated.

Compact Fluorescent Lamps: CRI 80 (minimum), color temperature 3500, average rated life of 10,000 hours at 3 hours operation per start, unless otherwise indicated.

- T4, Twin Tube: Rated 13 W, 825 initial lumens (minimum).

- T4, Double-Twin Tube: Rated 18 W, 1200 initial lumens (minimum)

B.2 Branch Circuit Wiring
Furnish all 120V and 208V branch circuit wiring for the light fixtures, switches, receptacles, smoke detectors, HVAC, and plumbing equipment located in the Bridge House and pier service platforms. All branch circuit wiring shall be installed in conduit.

Refer to Item 56, "Bridge Electrical Work, Item SPV.0105.300" for 1-Pole, 2-Pole, and 3-Pole branch circuit breaker information to be included in panelboards.

B.2.1 Wires
All wires shall be copper.

Type THHN-THWN conductors installed inside the building, and Type XHHW for conductors installed outside and at the pier service platforms.

Refer to Item 55 "Bridge Electrical Work, Item SPV.0105.300" for additional conductor requirements.

B.2.2 Conduit and Boxes
All conduit and boxes to be surface mounted, except conduit and boxes installed in drywall construction on the Control Room. Minimum conduit size shall be ¾ inch.

Conduit installed inside the Bridge House shall be Electrical Metallic Tubing (EMT). EMT shall comply with ANSI C80.3 and UL 797. Fittings for EMT shall be steel compression type.

Conduit installed on the roof and outside of the Bridge House and at the service platform of the bridge piers shall be PVC coated galvanized rigid steel.

All junction and pull boxes shall be NEMA 4X stainless steel with gasketed covers.
Connections to equipment subject to movement or vibration shall be made using Liquidtight Flexible Metal Conduit (LFMC) with PVC jacket.

Refer to Item 56, "Bridge Electrical Work, Item SPV.0105.300" for additional conduit and box requirements.

B.3 Wiring Devices
Furnish all light switches, dimming switches, duplex grounded receptacles, and associated cover plates. All wiring devices shall be UL Listed. All wiring devices shall be brown with stainless steel wall plates, except for weatherproof device cover plates installed in the Bridge House Equipment Room, Bridge House Roof, and on the pier service platforms.

Light Switches shall be quiet toggle type, Extra Heavy-Duty Industrial Grade, UL and Fed. Spec. Listed, 20A, 120-277V AC.

Dimmer Switch for LED uplight fixtures to be slide-lever type, 600W single pole, 120 V, leading/trailing edge phase-cut dimmer compatible with LED light fixture. On-off switch positions shall bypass dimmer module.

Dimmer Switch for fluorescent lamps to be slide-lever type, modular, compatible with dimming ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

Occupancy sensors to be ceiling mounted, dual-technology type designed to detect occupancy by using a combination of PIR and ultrasonic detection methods in the area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit. Sensor operation shall turn lights on when covered area is occupied and off when unoccupied, with a time delay for turning lights off adjustable over a minimum range of 1 to 15 minutes.

Daylight sensor to be a ceiling mounted solid-state photoelectric switch, designed to detect changes in ambient lighting levels and provide dimming range of 20 to 100 percent in response to change. Sensor to have a time delay, adjustable from 5 to 300 seconds to prevent cycling.

Duplex receptacles shall be Extra Heavy-Duty Specification Grade, UL and Fed. Spec. Listed, 20A, 125V, NEMA 5-20R configuration. Receptacles installed outside shall also be GFCI type, and provided with weatherproof covers that are listed for wet locations while in use.

B.4 Enclosed Switches

Furnish all fusible and non-fusible enclosed switches for equipment disconnecting means for all HVAC and plumbing equipment installed in the Bridge House. Enclosed switches shall conform to NEMA Standards Publication KS1, and shall be Heavy Duty Type. Operating mechanism shall be quick-make, quick-break, and interlocked with the cover in the closed position. Operating handle shall be lockable in both the OFF and ON positions. Fusible enclosed switches shall be provided with clips to accept Class R fuses. Enclosed switches shall be equipped with an equipment ground kit and a neutral kit where applicable. Enclosed switches located inside the building to have NEMA 1 enclosures, and enclosed switches located outside to have NEMA 4X stainless steel enclosures.

B.5 Smoke Detectors

Smoke detectors shall be dual sensor with both photoelectric and ionization sensing chambers capable of detecting visible and invisible products of combustion. Power requirements shall be 120VAC with 9VDC battery backup. Internal alarms shall be provided. Auxiliary contacts shall be provided for remote annunciation. Units shall be installed where shown on the Plans, and they shall be interconnected to sound all units in

the control tower if any one unit is activated. Units shall be Kidde model PI2010 with Kidde SM120X relay module, Simplex, Honeywell, or approved equal.

B.6 Hangers and Supports

Damp Locations and Outdoors: Stainless steel U-channel system components and hardware.

Selection of Supports: Comply with manufacturer's written instructions.

Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

B.7 Pipe Heat Tracing

The incoming water supply line and the sanitary sewer line for the Bridge House shall be heat traced for the exposed pipe runs along the south face of the west fixed bridge span, approximate distance of 100 feet. Insulation of pipes will be provided by others under this contract. Continue heat tracing inside the equipment room (1^{st}) level of the Bridge House for approximately 10 feet.

The heat trace cable shall be constructed of 16 AWG stranded copper bus wire embedded in parallel self-regulating polymer conductive core that varies its power output to respond to temperature along its length and shall be rated at 5 watts per foot. The heat trace cable shall be covered by a radiation cross-linked modified polyolefin dielectric inner jacket, tinned copper braid sheath, and a modified polyolefin outer jacket. The heat trace cable shall be capable of maintaining 40 degree F pipe surface temperature with an outside ambient temperature of -20 degree F. Provide a power connection and end seal kit, and thermostatic control for heat trace to maintain the temperature. Furnish and install a spare heat tracing cable the length of each pipe and coil the end of each spare cable for connection near the respective thermostat.

The electrical branch circuits serving the heat trace cables shall be provided with ground-fault protection of equipment.

C Construction

C.1 Electrical Systems

C.1.1 Electrical Demolition

Disconnect, demolish, and remove electrical systems, equipment, and components indicated to be removed from the Bridge House and pier service platforms.

Remove exposed portion of all electrical conduit and cut off concealed conduit flush with wall, floor or ceiling surface and plug.

Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner. Verify with Owner all equipment and fixtures prior to removal.

Remove demolished material from Project site.

Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

C.1.2 Electrical Systems - Common Requirements
Keep raceways at least 6 inches away from parallel runs of flues and hot-water pipes. Install horizontal raceway runs above water piping.

Complete raceway installation before starting conductor installation. Install temporary closures to prevent foreign matter from entering raceways.

C.2 Conductor Installation
Refer to Item 56, "Bridge Electrical Work, Item SPV.0105.300" for conductor installation and testing requirements.

C.3 Electrical Identification
Refer to Item 56, "Bridge Electrical Work, Item SPV.0105.300" for electrical identification requirements.

C.4 Electrical Fixture Installation
C.4.1 Fixture Installation
Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

Install fixtures level, plumb, and square with ceilings and walls according to manufacturers' written instructions and roughing-in drawings.

C.4.2 Heat Trace Cable Installation
Heat trace cable to be installed according to manufacturer's installation and maintenance manual. Attach heat trace cables to pipe using manufacturer approved fiberglass tape.

Branch circuit serving heat trace cable to have ground-fault protection. Circuit breaker shall provide Class B ground-fault protection of equipment at a 30 milliampere level.

Installed heat trace cables to be visually inspected for physical damage and proper installation and connections. Perform insulation resistance tests, power tests, and ground-fault tests according to manufacturer's installation instructions.

Insulation of pipe by Mechanical Contractor.

C.4.3 Field Quality Control
Verify that installed fixtures are categories and types specified for locations where installed.

Inspect installed fixtures for damage. Replace damaged fixtures and components.

Test installed fixtures for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.

D Measurement
The City will measure Bridge House Electrical Systems, completed in accordance to the contract and accepted, as a single completed unit of work**.**

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0105.420	Bridge House Electrical Systems	LS

Payment is full compensation for Bridge House Electrical Systems, and for furnishing all labor, tools, equipment, materials and incidentals necessary to complete the work.

62. Exodermic Deck, Item SPV.0165.156.

A Description
The work consists of furnishing and installing the steel Exodermic™ grid panels, any miscellaneous metal forms (or other related forming materials), reinforcing steel, and structural light weight concrete as shown in the contract drawings and in accordance with the manufacturers' recommendations. All concrete required for this item shall be placed in the field.

Within 10 days after the contract is awarded, the contractor shall notify the Engineer of the name, address, telephone number, and contact person of the Exodermic™ deck grid fabricator of all deck panels to be manufactured, supplied, and installed. The product under this item is patented. All royalty payments are paid by the authorized manufacturers.

The Exodermic™ grid deck system may be purchased from the following AISC Simple Steel Bridge (SBR) certified (minimum) and participating BGFMA members:

Bailey Bridges, Inc.	(256) 845-7575
LB Foster	(412) 875-3492

Clearspan Construction Products (412) 445-2765

Further information may be obtained from:

BGFMA
Attn: Mark Kaczinski
300 East Cherry Street
North Baltimore, OH 45872
Tel: 1-877-257-5499
Fax: 419-257-0332
mkaczinski@dsbrown.com

Design the grid deck for HS20 loading per AASHTO Standard Specifications for Highway Bridges, 17th edition.

B Materials

Steel shall conform to sections 506 of the Standard Specifications for Construction, except as modified herein or noted on the plans.

The main bearing bars of the steel grid deck shall be fabricated from WT structural shapes using ASTM A992 steel, and distribution bars and miscellaneous plates shall meet the requirements of A572/A709 Grade 50. Welding shall be in conformance with established grid industry practice, including the permitted use of Gas Metal Arc Welding (MIG). Weld qualification and weld procedures are in accordance with AWS D1.5

The panel layout shown on the Contract plans is suggested. The fabricator shall develop the layout and detail it on the shop drawings.

Hot-dip galvanize the grid deck after fabrication in accordance with ASTM A123.

Concrete shall be in conformance with section 501 of the standard specifications, except that maximum coarse aggregate shall not exceed 3/8" in size. Provide lightweight concrete that has a unit weight of not more than 115 pounds per cubic foot.

Reinforcing steel shall be in conformance with section 505 of the standard specifications and ASTM A615 Grade 60. All reinforcing bars shall be epoxy coated.

Galvanized coatings shall conform to ASTM A123. Any defects in galvanizing shall be repaired as specified in ASTM A780. Repair materials containing aluminum shall not be used to restore defective areas.

Unless specified otherwise, leveling bolts, nuts, and washers shall conform to the specifications of ASTM A307, ASTM A563 and ASTM F844 respectively. All leveling bolts, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A153.

The vertical steel sheet metal form pans installed in the grid prior to galvanizing shall conform to the latest specification for ASTM A366 or A1011. Galvanized steel sheet metal forms installed following grid panel galvanizing shall conform to the latest specification for ASTM A653, furnished in the gauge specified on the shop drawings. All metal forms shall be protected during shipment and site storage to retain their shape until deck panel installation.

The steel grid deck shall be fabricated to the dimensions and properties as shown on the plans, and shop drawings. The use of tertiary or supplemental bars to develop composite action between the concrete deck and steel grid shall not be allowed. Weld sizes shall be in conformance with established grid industry practice unless otherwise indicated on the contract plans. It shall be the contractor's responsibility to field verify all dimensions in order to make necessary changes prior to fabrication. Due consideration shall be given to the placement of leveling devices to provide adequate clearance for their field adjustment from above using a socket wrench and for adequate clearance for field placement of headed shear studs. After the attachment of edge bars, leveling devices, vertical form pans, and other components as described in the plans and specifications, the grid deck shall be galvanized in accordance with ASTM A123. The forming material used to contain the concrete during the pour shall meet the requirements of ASTM A653, Designation SS Grade 50 Class 1, 2, or 3, Coating Designation G210.

Lifting locations and lifting procedures shall be included on the shop drawing submission. Care shall be taken to avoid twisting of the panels or bending of the panels in the weak (perpendicular to main bar) direction. Use of multiple pick points is recommended. Steel grid panels must be properly blocked with wood (with due regard to built-in panel camber) during transportation and storage in order to avoid distortion or other damage.

Concrete fill will be a Portland cement concrete mixture conforming to section 501 of the Standard Specifications and as specified herein. The concrete fill will be Grade C except that it will be a lightweight concrete mixture.

Design and submit to the Engineer for approval a lightweight high-performance concrete mixture, proportioned according to the American Concrete Institute Manual of Concrete Practice, ACI 211.2, Standard Practice for Selecting Proportions for Structural Lightweight Concrete. Produce a homogeneous mixture of cement, fly ash, microsilica, fine aggregate, lightweight coarse aggregate, air entraining agent, normal range set retarding water-reducing admixture, and water. Add additional additives to prevent map cracking, The contractor may also incorporate an approved accelerator, depending on his schedule and on navigational requirements.

The concrete mix provided shall produce concrete which shall attain a 28-day compressive strength of 4000 psi.

Coarse aggregate shall conform to section 501 of the Standard Specifications for Construction, with a maximum aggregate size of 3/8 inches. Provide lightweight coarse

aggregate so that the density of the concrete is as close as possible to the density specified on the plans.

Construct lightweight aggregate stockpile(s) so as to maintain uniform moisture throughout the pile. Continuously and uniformly sprinkle the stockpile(s) with water for a minimum of 24 hours using a sprinkler system approved by the Engineer. If a steady rain of comparable intensity occurs, turn off the sprinkler system, at the direction of the Engineer, until the rain ceases. At the end of the wetting period, allow stockpile(s) to drain for 12 to 15 hours immediately prior to use, unless otherwise directed by the Engineer.

After the materials have been accepted for this work, determine the proportions for concrete and equivalent batch masses based on trials made with materials to be used in the work. Determine the cement content for each trial batch by means of a yield test according to ASTM C138.

Determine the density of the proposed lightweight concrete mix prior to submitting balance calculations. Determine the density of the proposed mix as specified in the standard specifications and in AASHTO Standard Specifications for Highway Bridges, 17th Edition, Division II, Section 8. Cast and cure three test blocks of lightweight concrete. The test blocks should be the same mix and from the same plant as the proposed concrete. The test blocks shall be measured after curing for 28 days. Use the actual average unit weight determined from these test blocks in the balance calculations. Make two additional test blocks, identical in dimension to the three prior test blocks, during each deck pour to serve as a check on the unit weight of the actual concrete placed.

The concrete mix provided shall produce concrete which shall attain a 28-day compressive strength of 4000 psi.

At least 2 weeks prior to concrete placement provide the Engineer with a copy of the trial mix design with the following data:

Fine and coarse aggregate (saturated surface dry condition) content in lb/cy.
Cement content in pounds per cubic yard
Water content in pounds per cubic yard
Dry unit mass in accordance with ASTM C567
28-day compressive strengths
Batch masses
28-day density

The Engineer will approve the batch weights prior to use. Use these values to manufacture all lightweight concrete for this project.

Quality control and testing requirements shall be per section 701 of the standard specifications.

C Construction

C.1 General

Welding shall be according to section 506 of the Standard Specifications. The Fabricator shall notify the Engineer at least 2 weeks prior to the start of fabrication to qualify welders and procedures.

C.2 Steel Grid Fabrication

Verify all dimensions, including any modifications made to the structure during construction, to determine relative elevations of the stringers, and make all necessary adjustments for the fabrication of the grid.

Prepare working drawings for the Engineer's review and approval in accordance with the special Provision for Shop Drawings and Submittals. The working drawings shall provide complete details and procedures to complete the assembly and installation of the deck.

Fabricate the grid on a level solid surface. Monitor the flatness of the grid panel during the fabrication process. Welding of the grid deck must be sequenced and controlled to prevent distortions during and after fabrication.

The contractor shall verify all dimensions, including any modifications to the structure during construction, to determine the relative elevations of the deck beams, and shall make all necessary adjustments for the fabrication of the grid deck.

The steel grid deck panels shall be fabricated within the following tolerances:

Panel Length (L)	±0.25"[6.4mm] (in the direction of main bar)
Panel Width (W)	+0, -0.125"[-3.2mm] (in the direction of distribution bar)
Squareness (Diagonals 'D1' and 'D2')	$\lvert D1-D2 \rvert \leq 0.5$"[12.7mm]
Longitudinal Camber	0.003*L
Transverse Camber	0.004*W
Sweep (side bow) ('L' in feet, tolerance in inches)	0.025*L (for $L \leq 40'-0"$) $0.00065*L^2$ (for $L > 40'-0"$)
Main Bar Verticality	0.04*H ('H' = full bar height) (See Note 1)
Distribution Bar Verticality	0.04*H ('H' = full bar height) (See Note 1)
Bar Spacing (Main Bar & Dist. Bar)	±0.125"[3.2mm] center to center (See Note 1)

Note 1: No more than 1% of all locations can violate specified tolerance.

Sheet metal forms shall be installed in such a manner as to minimize leakage.

C.3 Grid Erection

Perform all work for this Item in accordance with all applicable requirements of the standard specifications in general and section 506 in particular, except as modified herein or as shown on the plans.

Panels shall be delivered to the job site free from any defects and bearing the proper identifying marks. Check the panels for defects and identification. Repair or replace the grid panels or metal forms damaged during shipment and storage, to the satisfaction of the Engineer.

Position panels on the beams and align with adjacent panels. Measure from fixed points to avoid cumulative error. Adjustment to proper elevation shall be made through the use of the built-in leveling bolts if specified, or shims or other means. Square up panels as necessary.

After all haunch and miscellaneous forms have been installed, the contractor shall install the welded headed shear studs to the steel stringers, girders, and/or floor beams as detailed on the plans through the openings provided in the deck panels. A separate welding generator shall be used to furnish power to each stud gun in order to assure acceptable welds.

After all studs have been installed, clean the top surface of all flanges before any concrete is placed, including breaking the ceramic ferrules around the welded studs.

Field seal gaps between the main bars and the horizontal form pans with silicone caulk as required to prevent excessive concrete and grout leakage.

At haunches and areas of full-depth concrete, including the edge of the deck, the contractor shall seal the openings in the main bars using duct tape or other similar material prior to concrete placement. Seal the openings from the haunch or full-depth side.

Level the fabricated floor grid in accordance with the manufacturer's specifications to assure proper alignment.

Installation shall be in accordance with this specification and the most recent version of BGFMA TS-03, "Installation Tolerances and Guidelines for Grid Reinforced Concrete Bridge Decks," published by the Bridge Grid Flooring Manufacturers Association. The steel grid deck panels shall be installed within the following tolerances:

1.) Alignment: Main bearing bar misalignment between adjacent grid deck panels shall be no more than 1/2" [12.7mm].
2.) Gap: Distance between main bearing bars between adjacent grid deck panels shall be as specified, ±1/2" [±12.7mm] but shall not exceed 8" [203.2mm].

Obtain the Engineer's approval prior to any field trimming.

Support the grid deck in a manner to prevent distortion during transport and storage. Provide adequate support beneath the grid deck panel at the ends of the panel and at intermediate points. Provide intermediate spacing of no more than half the maximum stringer spacing. Fully secure the grid deck during transport. After transport or storage, conform to the allowable tolerance for flatness as noted above.

Place and install the grid panels such that no initial stress is induced into the grid deck panel. Do not apply external force to the new grid panel, new structure or existing structure to fit the component, except to close a gap of less than 1/16 inch between the new deck panel and the new stringer. Do not impose undue stresses or distortions of the grid deck during installation. If a gap greater than 1/16 inch exists between the deck panel and the stringer, provide shims to close the gap. Remove and replace, at no additional cost to the City, any deck panel that is installed with an undue stress or distortion.

Installed deck panels that do not conform to these specifications shall be removed and replaced with new panels at contractor's expense.

Prior to placement of any construction equipment on the bridge structure, submit calculations that determine the capacity of the deck and span. Clearly define the location of the equipment on the work plans. Engage a Professional Engineer licensed in the State of Wisconsin to prepare the calculations. Submit to the Engineer for acceptance.

C.4 Concrete Placement

The provisions of section 502 of the standard specifications apply except as modified herein.

No concrete shall be placed until all grid panels are in place on the bridge, and secured in proper position and all welded headed shear studs and reinforcing steel is installed in accordance with the shop drawings. Main (top) rebar, which runs in the same direction as the main bearing bars of the steel grid, shall be placed a minimum of 1" from the web of the main bearing bars.

Concrete shall be placed, finished, and cured in accordance with Section 502 of the Standard Specifications. A pencil vibrator shall be used in the haunch and full depth areas between grid panels to assure good consolidation.

The vertical surfaces of any construction joints shall be thoroughly coated with a Portland cement mortar bonding grout.

Where feasible, a worker with a high-pressure water hose shall be stationed under the deck during all concrete pouring and finishing to wash any drips off of the structural steel. Care must be taken not to disturb the form pans in the grid deck with the high-pressure stream.

Damaged or defective concrete shall be repaired or replaced in accordance with the standard specifications.

Forms and steel grid shall be clean and dry at the time of placing the concrete. Form the block outs for future streetcar rails in the deck as shown on the plans. Form the vertical edges of deck over the exterior girders. Vibrate the concrete by hand or by mechanical internal vibrators, as approved by the Engineer, to consolidate the mix within the voids of the grid. Remove wet concrete spilled on structural steel before it hardens.

Concrete is placed in cold weather shall be in accordance with Section 502.3.9 of the standard specification.

D Measurement
The City will measure Exodermic Deck by the square foot, acceptably completed.

E Payment
The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0165.156	Exodermic Deck	SF

Payment is full compensation for fabricating, galvanizing, and erecting the steel grid; furnishing and placing epoxy coated reinforcement; furnishing and placing the lightweight concrete, forming and curing; for performing all required testing; and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.

63. Fiberglass Sidewalk Floor Plates, Item SPV.0165.157.

A Description
The minimum requirements for fiberglass sidewalk plates, splice bars, and stainless steel hardware shall be as follow:

All items, details of construction, services or features not specifically mentioned which are regularly furnished in order to provide fiberglass sidewalk plates and stainless steel hardware shall conform in strength, quality and workmanship to that usually provided by the practice indicated in this specifications.

B Materials
The fiberglass sidewalk floor plates shall be manufactured by the pultrusion process and made from isophthalic polyester resin with fire retardant additives to meet a flame spread rating of less than 25 per ASTM E-84 and meet the self-extinguishing requirements of ASTM D-635. All structural shapes shall contain a UV inhibitor.

B.1 General

Floor Plate composition shall consist of a glass fiber reinforced polyester resin matrix, approximately 50% glass by weight. A synthetic surface veil shall be the outermost layer covering the exterior surfaces. Glass strand rovings shall be used internally for longitudinal strength. Continuous strand glass mats or stitched reinforcements shall be used internally for transverse strength.

B.2 Properties

Color	Haze Gray
Resin	Isophthalic Polyester
Fire Retardant Properties	Meets Class I Frame Rating of 25 or less per ASTM E-84
Anti-Skid Surface	Permanently bonded grit baked epoxy surface

Fiberglass sheets shall have gray-ultra-violet resistant polyurethane top coat.

B.3 Minimum Ultimate Coupon Properties

Following are the required test results for the ultimate coupon properties per the referenced ASTM procedures.

Property	Test	Value	Thickness
Mechanical			3/8"-1"
Flexural stress, Flatwise LW	D790	24,000 psi	
Flexural stress, Flatwise CW	D790	17,000 psi	
Flexural Modulus, Flatwise LW	D790	1,000,000 psi	2”
Flexural Modulus, Flatwise CW	D790	1,000,000 psi	1.4”
Tensile Stress, LW	D638	20,000 psi	
Tensile Stress, CW	D638	10,000 psi	
Tensile Modulus, LW	D638	1,000,000 psi	1.1”-1.4”
Tensile Modulus, CW	D638	1,000,000 psi	08”-1.3”
Comprehensive Stress, Edgewise, LW	D695	24,000 psi	
Comprehensive Stress, Edgewise, CW	D695	20,000 psi	
Comprehensive Modulus, Edgewise LW	D695	1,000,000 psi	1.8”
Comprehensive Modulus, Edgewise CW	D695	1,000,000 psi	1.0”
Notched Izod Impact, LW	D256	20 ft-lbs/in	
Notched Izod Impact, CW	D256	5 ft-lbs/in	
Bearing Stress, LW	D953	32,000 psi	
Bearing Stress, CW	D953	32,000 psi	
Perpendicular Shear Stress, LW(1)	D3946	6,000 psi	
Perpendicular Shear Stress, CW	D3946	6,000 psi	
Poisson's Ratio, LW		0.31 in/in	
Poisson's Ratio, CW		0.29in/in	
Physical			
Barcol Hardness		40	
24 Hr. Water Absorption (2)	D570	0.6% Max.	

Density	D792	060-068 lbs/in^3
Coefficient of Thermal Expansion	D696	1,000,000 8.0in/in/°F

Electrical

Arc Resistance	D495	120 seconds
Dielectric Strength, PF	D149	N.T.
Dielectric Strength, LW1	D149	35 KV/in
Dielectric Constant, PF	D150	5 @ 60 Hz.

Abbreviations
LW = lengthwise
CW = crosswise
PF = perpendicular to the laminate face
N.T. = not tested

Submit a sample of the sidewalk plate for approval by the engineer with the shop drawing submittal.

C Construction
Drill all the holes connecting the plates to the 5-inch fiberglass splice plate in the shop and all other holes in the field.

Furnish sufficient fiberglass patch kits to patch all holes and cuts made in the field .

Supply stainless steel bolts, washers and nuts, and fiberglass support bars 5 inches wide. These support bars should have the longitudinal fibers in the 5 inches wide direction. The main bars should be placed in the longitudinal direction of the span for the sidewalk plates.

Stainless steel ½" diameter countersunk head screws, ½" nylon plug type key lock nuts, ½" washers and beveled washers shall be Ryerson and AISI Stainless Steel 304, or an approved equal.

Fiberglass plate shall be anti-skid abrasive grit with a surface buildup equal to 3550 mesh silica, as manufactured by Joseph T. Ryerson and Son, Inc., IKG Industries, or an approved equal. The 5" fiberglass splice plate does not require an anti-skid surface

Fiberglass plates that do not meet the requirements set forth by these specifications and the plan drawings shall be returned for a product that will receive the ultimate inspection and approval by the City.

Drilled holes in fiberglass are to have a minimum edge distance equal to 1 ½" measured from the center of the hole to the free edge of the material.

Fasteners for the non-metallic sidewalk plates shall comply Standard Specifications Subsection 513.2.2.5.

Bolts shall be socket type flat countersunk head cap screws, with washer and prevailing torque locking hex nuts.

The lock nuts shall be anco lock nuts with a locking pin as manufactured by Lok-Mor Inc., IKG Industries, or an approved equal.

Predrill at the shop before delivery all holes where the plates are attached to adjacent plates and 5" splice plates. The splice plates shall be drilled in order that the smooth surface is up against the bottom of the walk plates.

Provide a qualified person to instruct the crews in the type of tools to use and proper methods to install and fabricate the fiberglass plates. A minimum of 24 hours of on-the-job instruction shall be provided..

D Measurement

The City will measure Fiberglass Sidewalk Floor Plates in area by the square foot, acceptably completed.

E Payment

The City will pay for measured quantities at the contract unit price under the following bid item:

ITEM NUMBER	DESCRIPTION	UNIT
SPV.0165.157	Fiberglass Sidewalk Floor Plates	SF

Payment is full compensation for fabricating and erecting fiberglass sidewalk floor plates in accordance with the plans and special provisions; and for furnishing all labor, material, equipment, tools, and incidentals necessary to complete the work.