

ITEM 10599.2221 M - BRIDGE ELECTRICAL EQUIPMENT REHABILITATION

DESCRIPTION. The work specified in this item includes the removal of the present electrical controls, circuit protection, and other items related to the electrical system, and the installation of new replacements of electrical equipment, all as indicated on the Plans and herein specified.

The work required under this Section includes the following items and incidental work related thereto:

1. Removal of all tail lock motors, motor brakes, motor overload relays, and limit switches, and replacement with new.
2. Installation of new tail lock motor and drive motor disconnect switches.
3. Rewinding and rehabilitation of existing leaf motors.
4. Installation of new emergency and motor thruster brakes.
5. Installation of new leaf limit switches, tail lock limit switches, and leaf fully closed limit switches.
6. Replace existing lights with new vapor-tight light fixtures in counterweight pits and other miscellaneous areas. Additional vapor-tight light fixtures will be installed in the counterweight pits.
7. Replace light switches, electrical receptacles, and associated wire and conduit in counterweight pits and other miscellaneous locations.
8. Recondition control console, correct indication light outages, repair/calibrate electric meters, replace drum controllers.
9. Installation of an additional 120/240 volt panelboard.
10. Installation of a three phase circuit with disconnect switch and receptacle in work shop in the operator's tower.
11. Install an Intercom System throughout the operator's house on bridge.
12. Install new wiring in new PVC coated conduit to newly installed equipment.
13. Installation of new engine generator fuel level alarm system.

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14. Remove steel cover plates from counterweight pit, submarine cable, and machinery level junction boxes. Manufacture and install new lightweight aluminum doors.
15. Installation of lighting, receptacles, and a panelboard in a new garage.
16. Install new service entrance equipment.

Quality Assurance

1. Codes and Standards. All installations shall conform to all Federal, State, and local codes, ordinances, and laws having jurisdiction over this project. In the event of a conflict between these Specifications and the above mentioned codes, the more stringent of the two shall govern.
2. Referenced Standards. Comply with the provisions of the following regulatory and directive documents:
 - a. New York State Department of Transportation (NYDOT) Standard Specifications for Construction and Materials, 1995, as amended.
 - b. American National Standards Institute (ANSI): C80.1, Rigid Steel Conduit, Zinc Coated.
 - c. American Society for Testing and Materials (ASTM):

A 525	Sheet Steel, Zinc Coated (Galvanized) by the Hot Dip Process, General Requirements.
B 3	Soft or Annealed Copper Wire
B 8	Stranded Copper Wire, Specter Conductors, Hard, Medium Hard, or Soft
B 33	Tinned Soft or Annealed Copper Wire for Electrical Purposes
 - d. American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Movable Highway Bridge.

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- e. National Electrical Code (NEC).
- f. National Electrical Safety Code (NESC).
- g. National Electrical Manufacturers Association (NEMA):
 - AB-1 Standards for Circuit Breakers
 - ST-20 Dry Type Transformers for General Applications
 - PB-1 Standards for Panelboards
- h. Title 33, Code of Federal Regulations 33 CFR, Part 118.80: Lights on Bascule Bridges.
- i. U.S. Department of Labor - OSHA.
- j. Lightning Protection Institute Installation Code LPI 175.
- k. National Fire Protection Code NFPA 780.
- l. LIPA Rules and Regulations, Construction Standards (CS 8016).

The New York Board of Fire Underwriters will arrange and pay for the inspection. Furnish certificates of inspection for the Department and LIPA.

Comply with local codes which are more stringent than the above.

- 3. Closing of Waterway. At no time during the repairs shall the waterway be completely closed to navigation without prior approval of the U.S. Coast Guard.
- 4. Obstruction of Navigation. During the progress of work should any material, machinery, or equipment be lost, dumped, thrown overboard, or sunk so as to obstruct, interfere with or hazard navigation, immediate notice shall be given to the Coast Guard and the object shall be removed immediately. Until removal can be effected, the obstruction shall be properly marked in order to protect navigation. Notice to the Coast Guard shall give a description and location of any such object and the action taken or being taken to protect navigation.

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5. Spillage of Oil and Hazardous Substance. Spillage of oil and hazardous substance is specifically prohibited by Section 311 of the Federal Water Pollution Control Act of 1972, as amended. Measures shall be taken including:
 - a. proper maintenance of construction equipment;
 - b. arrangement of fuel/hazardous substance handling areas so as to ensure that any spills are contained before trenching navigable waterways or their adjoining shorelines;
 - c. instructions to personnel not to dispose of oil/hazardous substances into drains or the navigable waterways directly or onto adjoining shorelines and any other procedure to prohibit spillage; and
 - d. if in spite of such planning, oil/hazardous substances are spilled into a navigable waterway or adjoining shoreline, the U.S. Coast Guard shall be notified immediately at 1-800-424-8802. A supply of an absorbent material shall be retained so that it may be rapidly deployed to soak up any possible spillage, pending Coast Guard arrival on scene. The use of chemical dispersing agents and emulsifiers is not authorized without prior, specified, Federal approval.

SUBMITTALS. Except as otherwise noted herein, eight copies of individual shop drawings shall be submitted.

Provide shop drawings, catalog cuts, or other descriptive certification. Provide working drawings, diagrams, and related data including but not limited to:

1. Electrical apparatus including control console equipment, motor control center equipment, drawings, and bills of materials.
2. Layout details of new electrical equipment (limit switches, disconnect switches, wire, light fixtures, receptacles, lightning protection equipment and their components, junction boxes, etc.), renovated equipment (MCC, control console, etc.), electrical and mechanical connection data.
3. Wiring diagrams schematics with wire and terminal numbers, field termination drawings, and bills for materials.

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Final approval of shop drawings, details, and catalog cuts will not be given until the Contractor affixes a statement to each submittal indicating his review of the applicable Contract drawings and confirming compatibility.

It shall be the Contractor's responsibility to verify the field dimensions given on the drawings. Dimensions given on the drawings are nominal and intended for guidance. The Contractor shall indicate the actual field dimensions taken on the shop drawings.

Shop drawings shall show all parts completely detailed and dimensioned. Special machining and assembly instructions shall be shown on the shop drawings.

For submarine cables, the Contractor shall submit seven (7) copies of his/her schedule and sequence of operations to the Department for approval at least 45 days prior to any work over or in the waterway. In addition, a sketch of the project area shall be submitted showing the following:

1. the waterway;
2. the bridge;
3. the location of any restrictions that will be placed in the waterway such as barges, anchors, and anchor lines; and
4. the location, height above mean high water, and detailed description of any scaffolding or netting to be used.

MATERIALS.

General. Materials, Construction Details, and Methods of Measurement and Basis of Payment specified herein and/or required by the Plans shall be in compliance with the latest edition of the NYDOT Standard Specifications for Construction and Materials, as amended, except as specified or added to in these Technical Special Provisions.

Each piece of electrical equipment and apparatus shall have corrosion-resisting metal nameplate on which stamped the name of the manufacturer and the rating or capacity of the equipment or apparatus.

All metal parts of the electrical installation shall be of corrosion resisting material such as an aluminum, bronze, or stainless steel. Cast iron, malleable iron or steel with a hot-dip galvanized finish shall be used where specified herein or permitted by the Engineer.

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Notwithstanding any reference in the Specifications of any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number, such reference shall be interpreted as establishing a standard of quality and to inform the Contractor as to the type of material, quality, and fit required but shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixtures, form, or type of construction which in the judgement of the Engineer, expressed in writing, is equal to the specified quality.

Outlets, Junctions, and Pull Boxes. All exposed boxes shall be hot-dip galvanized cast iron, or stainless steel provided with screw fastened gasketed covers. All boxes shall have threaded hubs. Each of the boxes shall have sufficient volume to accommodate the number of conductors in the box, in accordance with the requirements of the National Electrical Code. Boxes shall not be less than 38.1 mm deep. Switch and receptacle boxes shall be approximately 102 mm by 51mm. Boxes located outdoors and in wet or damp locations shall be NEMA-4 and shall be furnished with screw-fastened gasketed covers. Enclosures shall be manufactured by O.Z. Gedney, Spring City, Crouse Hinds, or equal approved by the Engineer.

Weatherproof Receptacles. Weatherproof receptacles shall consist of a NEMA 5-20R Ground Fault Interrupting (GFI) type receptacle mounted in a FS conduit box with a gasketed, weatherproof, cover plate and cap over all receptacle openings. The cap shall be a spring-hinged flap.

Wire and Wiring. Single conductor cable shall be copper conductor cable with USG/RHW insulation.

Multiple Conductor Cable. Comply with the following requirements:

1. Number of Insulated Copper Conductors: As shown on the Plans.
2. Insulation: As specified for single conductor cable.
3. Overall Covering: PVC or neoprene jacket.

Fixture Wire. Comply with the following additional requirements:

1. Type: SF 2 Silicon rubber insulated.
2. Conductor: Stranded copper conductor 16 AWG or larger as shown.

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Extra Flexible Cable. Comply with specifications on the plans.

Bare Conductor. ASTM B 3, Class B stranded annealed copper conductor unless otherwise shown, size as shown for grounding for underground use.

Deliver conductors to the site of the project in original packaging or on factory reels, fully identified with tags or labels, indicating the manufacturer's name and date of manufacture. In addition, the name of the manufacturer, insulation type, voltage rating, and wire size shall be clearly and permanently imprinted throughout the length of each conductor.

Grounding Equipment.

1. All equipment used in this installation shall be factory inspected, approved, and properly labeled in accordance with LPI requirements. All equipment shall be new, the product of a single manufacturer as outlined above, and of a design and construction to suit the application where it is used in accordance with accepted industry standards and LPI and NFPA Code requirements.
2. Unless otherwise noted on the plans, all materials shall be copper or copper alloy.
3. All main conductors shall be copper of 32 strands 17 gauge minimum weighing 320 g/m unless noted otherwise on the plans.
4. Conductor that will be submerged in salt water shall be 152.4 mm x 482.6 mm, 11 mm diameter, 510.4 kg/m, preformed phosphor bronze conductors. Cadweld connections are not acceptable when using phosphor bronze conductors.
5. Solid stainless steel ground plates used under water shall be 457.2 mm x 457.2 mm x 20 gauge thick complete with two crimp type cable connectors.
6. Cable fasteners shall be substantial in construction and have ample strength to support conductors, non-corrosive, electrolytically compatible with the conductor and mounting surface, and shall be spaced according to LPI and NFPA Code requirements.
7. Bonding devices, cable splicers, and miscellaneous connectors shall be of cast bronze with bolt pressure connections to cable. Cast or stamp crimp fittings are not acceptable.

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- 8. All miscellaneous bolts, nuts, and screws shall be bronze.
- 9. Connections to structural steel shall be made with bonding plates of cast bronze with bolt tension cable clamps unless otherwise noted on the plans.
- 10. Ground rods of 24.4 mm diameter shall be furnished in 3.05 m lengths. Ground rods shall be comprised of a high-strength steel core, a molten welded exterior of copper, and a cold formed point on driving end.

Connectors, Terminals, and Tape.

- 1. Connectors, Terminal Lugs, and Fittings: For 12 AWG to 4/0 AWG insulated cable compression type tin plated copper connectors and terminal lugs having conductor insulation grip. Terminal blocks shall be heavy duty, 600 volt, tubular screw type.
- 2. Bundling Straps: Self-locking steel barb on one end with tapered strap of self-extinguishing nylon of minus 54 degrees C to 121 degrees C temperature rating. For outdoor use: ultraviolet resistant nylon strap with the above characteristics.

3. Insulating Tape:

- a. Plastic Tape: Vinyl plastic tape with rubber-based pressure-sensitive adhesive, pliable at a low temperature of minus 17.8 degrees C and having the following minimum properties:

Thickness	0.22 mm
Breaking Strength	357 kg/m (width)
Elongation	200 percent
Dielectric Breakdown	10,000 volts
Insulation Resistance	1,000,000 megohms
(Indirect method of electrolytic corrosion)	

- b. Rubber Tape: Silicon rubber tape with silicon pressure-sensitive adhesive and having the following minimum properties:

Thickness	0.38 mm
Breaking Strength	232 kg/m (width)
Elongation	525 percent

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Dielectric Breakdown 13,000 volts
Insulation Resistance 1,000,000 megohms
(Indirect method of electrolytic corrosion)

Leaf Limit Switches. Furnish, install, and adjust leaf limit switches where shown on the Plans.

1. Leaf limit switches shall be a 10 circuit, rotating cam limit switch. Contacts shall be snap action with quick-make, quick break feature, double break, rated 15 amperes continuous at 120 volts AC. Cams shall be continuously adjustable from 4 through 356 degrees. The cam shaft shall be stainless steel. Contact arms with roller followers between plungers and cam surfaces shall be provided for reduced wear. Limit switch assembly shall include NEMA 4 cast aluminum enclosure. Assembly shall be B&B Electromatic Type AV or equal as supplied by General Electric Company or Gemco Electrical Division of McGraw Edison Company, or equal as approved by the Engineer. Provide suitable control device mounting supports as shown on the Plans. Clean, paint, and lubricate the existing leaf limit switch gear and install on new switch. Where such items are not detailed, the Contractor shall develop suitable details as required.
2. Leaf Fully Closed Limit Switch : Furnish and install new GO switch, 80 Series, top sensing, magnetically actuated, unpowered proximity type limit switches by General Equipment and Manufacturing Company, Inc., Louisville, Kentucky or approved equal, complete with supports and actuators as shown on the Plans.

Vapor Tight Lights. Vapor tight lights shall be furnished and installed in areas where shown on the drawings. The fixture shall be a Crouse-Hinds Vapergard Series vapor tight globe and guard, reflector, suitable for 120 volt operation, or equal as supplied by Appleton or Russellstoll, or equal as approved by the Engineer. Provide fixtures with 75 Watt lamps.

1. Where plans call for a pendant mounted vapor-tight light, provide a Crouse Hinds VDA-25 GPRD or approved equal.
2. Where plans call for a wall mounted vapor-tight light, provide a Crouse Hinds VXHBF25GP or approved equal.
3. Where plans call for a ceiling mounted vapor-tight light, provide a Crouse Hinds VXHF25GP.

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PVC Coated Conduit. Shall meet the following criteria:

1. Galvanized steel conduit and fittings, prior to plastic coating shall be new unused, material and conform to:
 - Federal Specifications WW-C-581E and W-C-586D
 - ANSI Standard C80.1
 - UL Standard No. 6 and No. 514B
 - NEMA Standard No. RN-1
 - CSA Standard C22.22#5
2. The conduit shall be galvanized inside and out and the conduit threads shall also be galvanized.
3. The interior of the conduit shall have a urethane coating of a nominal thickness of 0.05 mm.
4. The exterior of the conduit, and conduit fittings shall have PVC coating of a minimum thickness of 1.00 mm.
5. Conduit shall be bendable without damaging interior or exterior coating.
6. Conduit threads shall have a urethane coating of .05 mm.
7. A 0.05 mm nominal thickness coating of urethane shall be applied to the exterior, the interior and the threads of all fittings and couplings.
8. Stainless steel plastic encapsulated screws shall be supplied with all Form 7 and Form 8 conduit fittings.
9. All U bolts will be supplied with PVC encapsulated nuts that cover the exposed portions of the threads.

Supporting Devices. This section includes secure support from the bridge structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1. Submittals. Submit product data for each type of product specified. Also submit shop drawings indicating details of fabricated products and materials.

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2. Available Manufacturers. Submit to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following:
 - a. Preperforated Metal Angle and U-Channel Systems:
 - (1) American Electric
 - (2) B-Line Systems, Inc.
 - (3) Unistrut Diversified Products
 - b. Conduit Sealing Bushings:
 - (1) Cooper Industries, Inc.
 - (2) O-Z-Gedney
 - (3) Spring City Electrical Manufacturing Company
 - (4) Thomas & Betts Corporation
3. Coating. Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristics. Products for use outdoors shall be hot-dip galvanized.
4. Raceway Supports. Clevis hangers, riser clamps, conduit straps, threaded C-claps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
5. Fasteners. Types, materials, and construction features as follows:
 - a. Expansion Anchors: Carbon steel wedge or sleeve type.
 - b. Toggle Bolts: All steel springhead type.
 - c. Power-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.

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6. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.
7. U-Channel Systems: Steel channel sections shall be rolled from AISI 1008 Commercial Grade steel of 12 gauge, minimum. Channel attachment nuts shall be designed to prelocate in the channel and provide a bearing surface. All channels shall have minimum cross sectional dimensions of 38.1 mm x 38.1 mm, and shall be in lengths indicated through the use of section joiners which use two bolts per section and a framing channel form to rigidly secure channel sections. The finish on all steel channel components shall consist of .013 mm electrogalvanizing in accordance with ASTM B 33-78, Type LS coating and a gold zinc dichromate barrier formed on the zinc. Steel channel shall also have a 1.0 mm thickness coating of PVC.
8. Fabricated Supporting Devices:
 - a. General: Shop or field fabricated supports or manufactured supports assembled from U-channel components.
 - b. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.
 - c. Pipe Sleeves: Fabricate pipe sleeves with Schedule 40 galvanized steel pipe.

Tail Lock Motor. The Contractor shall provide new AC tail lock motors modified to conform to Westinghouse Specification 13N134A. A tail lock motor shall fit mechanically and perform electrically the same as the original motor except that a spring set disc brake (manufactured by Stearns or approved equal by Warner Electric/Dana or Eaton Corporation) be attached to the motor. The brake end shall include provisions for hand cranking.

For additional information regarding replacement of the existing tail lock motor, contact Mr. Brad Ruth of Homewood Products Corporation, 820 Washington Boulevard, Pittsburgh, Pennsylvania 15206, (412) 665-2720, reference Negotiation No. 0419BLR-225.

Contractor shall provide for a minimum of 16 weeks delivery for this product.

Navigation Lights. Navigation lights shall be wired for 100 watts, 120 volt AC incandescent lamps.

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Navigation lights shall be provided with 100 watt, 20,000 hour long life incandescent lamps or other arrangements such as automatically rotating multi-lamp assemblies which provide at least 20,000 hours of cumulative expected lamp life between complete outages.

Navigation lights shall be cast bronze with screened vents, glass fresnel lenses as listed below, stainless steel hardware and cast bronze junction boxes.

1. Type G: Fender navigation lights shall be pedestal mounted 200 mm O.D. red lenses providing 3.14 R (horizontal) light distribution. Fixtures shall be B&B Electromatic type MS 53 or approved equal by Automatic Power, Inc. or Roadway Manufacturing.
2. Type H: Bridge duplex navigation lights shall be swivel suspended with two 200 mm 3.14 R lenses, one red, one green, and transfer switch assembly. Fixtures shall be equipped with anti-swing brakes. Fixtures shall be B&B Electromatic Type MS66 or approved equal by Automatic Power or Federal Signal Corporation.
3. Type I: Bridge navigation lights shall be swivel suspended with one 200 mm 3.14 R red lenses. Fixtures shall be equipped with anti-swing brakes. Fixtures shall be B&B Electromatic Type MSC301 or approved equal by Automatic Power, Inc. or Roadway Manufacturing.

Navigation lights shall be U.S. Coast Guard approved fixtures

Roadway and Traffic Safety Gates. Roadway gates shall be capable of manual or electrical operation and installed at approximately where shown on the plans. They shall be furnished complete with 1/2 horsepower, 240 volt, 3 phase, 60 hertz reversible motors, solenoid brakes, and 7.5 m arms. Each gate shall be under full control of the operator's house.

They shall revolve 1.57 R in a vertical plane, opening to a fully vertical position and closing to a fully horizontal position. They shall open or close in not more than seven (7) seconds, smoothly and without jar at the end of their movement. They shall be controlled so that each gate can be operated independently.

Limit switch contact shall be provided for interlocks and indicating lights. When the gate is opened manually using hand cranking operations and/or when gate housing access doors are opened, normally closed contacts shall open preventing electrical operation of the gate.

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Each gate arm shall be aluminum/fiberglass combination, painted in "red" and "white" slanted stripes and equipped with four (4) gate arm red lamp fixtures with 12 volt lamp, and with approved marine type wiring between lamp fixtures on the gate arms and approved flexible leads between arms and gate housing. Solid state flashers for control of the gate lights shall be mounted in the gate housing. Lights shall be connected so that alternate lights will flash.

Mechanical and electrical equipment within the gate equipment housing shall be oriented such that all equipment can be accessed for maintenance or repair through the roadside housing door.

All mechanisms, attachments, connections, and everything necessary for the complete installation of the gates in good working order shall be furnished and installed by the Contractor.

Gate housings shall be cast aluminum.

A new concrete base shall be provided as required for new anchor bolts and mounting hardware.

Gate shall meet all requirements of the latest edition of the Manual of Uniform Traffic Control Devices.

Gates shall be B&B Electromatic Model VT-40, or approved equal supplied by Robert Industries or Roadway Manufacturing.

Intercom System. The intercom system shall consist of party stations located as shown on the drawings. Units shall be interior or exterior types as required and shall be provided with 25 feet handset cords. Equip units with page speakers. Selection buttons on the communications panel shall be provided for selection of desired location.

1. Description: Private voice communication between master station and locations indicated on drawings.
2. Configuration: Direct-connected, push button single conversation path, central control intercom system.
3. System Capacity: One master station in Operator's Room , 15 speaker/microphone stations as follows: tail locks (8), pits (4), electrical room, workshop and office.

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4. Conversation Paths: One.
5. Sequence of Operation: Master selects any remote station by entering push button associated with that station. Only the selected station can communicate.
6. Intercom Master Control Unit:
 - a. Description: Surface wall-mounted master intercom unit.
 - b. Intercom Amplifier: 12 watts rated output with less than 5 percent total harmonic distortion, frequency response of 100 to 10,000 Hz \pm 3 Db, and minimum 60 Db signal-to-noise ratio at rated output.
 - c. Speaker Sensitivity: 92 Db.
 - d. Input Sensitivity: Provide adequate input sensitivity to deliver rated amplifier output when no more than 10 dynes per square centimeter impinge on speaker/microphone.
 - e. Handset: Standard molded plastic telephone handset with 5 feet long permanently coiled cord.
 - f. Sequence of Operation:
 - (1) Intercom Control Unit connects calling station to remote stations.
 - (2) Manual momentary switch with sustained TALK position sets TALK/LISTEN mode.
 - (3) Incoming calls actuate annunciator lamp and momentary buzzer and are amplified at called station.
 - g. Minimum Controls and Indicators:
 - (1) Power On-Off selector switch and indicator lamp.
 - (2) Selector switch for each remote station.
 - (3) Lighted annunciator lamp for each speaker/microphone station.

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- (4) Audible signal for incoming calls.
- (5) Called Station Busy indicator lamp.
- (6) Speaker disconnect by lifting handset.
- (7) Volume control for listen volume level only.
- (8) Talk/listen switch.
- (9) Mark each control and indicator with legible and permanent nameplates.

h. Sequence of Operation:

- (1) Remote selector switches connect master directly to remote stations.
- (2) Manual momentary switch with sustained talk position sets talk/listen mode.
- (3) Incoming calls actuate annunciator lamp and momentary buzzer and are amplified without master selection of calling station.

7. Speaker/Microphone Intercom Units

- a. Description: Surface wall-mounted unit.
- b. Construction: NEMA 4 (metallic).
- c. Finish: Fiberglass.
- d. Sensitivity: 92 dB at 1 Watt input, 4 feet on axis of speaker.
- e. Handset: Standard molded plastic telephone handset with 25 feet permanently coiled cord.
- f. Controls and Indicators:
 - (1) Power On-Off selector switch and indicator lamp.

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- (2) Recurring audible signal for incoming call.
 - (3) Speaker disconnect by lifting handset.
 - (4) Volume control for listen volume level only.
 - (5) Talk/listen switch.
- g. Sequence of Operation:
- (1) Master selector switches connect unit directly to master stations.
 - (2) Manual momentary switch with sustained talk position master station sets talk/listen mode.
 - (3) Incoming calls actuate annunciator lamp and momentary buzzer and are amplified.

CONSTRUCTION. Prior to commencing installation, it is pointed out that:

1. During construction, it will be mandatory to keep the bridge in operation. It will be the Contractor's responsibility to maintain service in accordance with the Special Provisions and provide necessary labor and materials for splicing, rerouting, and temporarily supporting the necessary cables.

All electrical work requiring bridge closure shall be carefully planned and coordinated with other work such as machinery and structural work and shall meet the complete bridge closure schedule proposed in the Contractor's schedule of rehabilitation.
2. There will be outages during critical changeovers. These service outages shall be scheduled in advance and shall be at the convenience of the Nassau County Department of Public Works, even if this work requires to be done at premium time.
3. The Contractor shall be responsible for coordinating and complying with power company standards. The Contractor shall install any items furnished by the power company and required to provide the service.

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4. Verify that all surfaces upon or in which enclosures are to be mounted are properly prepared and that all pre-mounting wire pulling has been completed and properly tagged. Take corrective action if necessary.
5. Verify that enclosure mounting provisions are suitable for intended mounting. Make corrective adjustments, if necessary.

Installation.

1. Enclosures: Install at indicated or approved locations in accordance with manufacturer's instructions, and at convenient operating height such that unless shown otherwise, no manually operable device will be within 0.75 m of the floor or more than 2.00 m above the floor.

Adjust straight and plumb, then fasten securely in place. Align securely and independently fasten each section of multi-section enclosures.

Install wall mounted enclosures and cabinets on structural channel erector systems, such as Kindorf or equivalent.

Perform circuit wiring as specified elsewhere herein.

Neatly route, harness, and support conductors in gutters, slotted wire duct, wiring spaces, and compartments. Bending radii not less than recommended by conductor manufacturer.

2. Conduit and Fittings: Conduit to motors and other electrical vibrating equipment shall terminate in conduit fittings on the motors and equipment, the final connection being made with liquid tight flexible conduit and suitable liquid tight connectors.

Install liquid tight unions where standard threaded couplings cannot be used.

Equip conduit terminations 30 mm and larger with insulated bushing.

Conduits shall be concealed or exposed as shown on the Plans. Install conduits in accordance with the requirements of the National Electrical Code.

Support all conduits not more than 3.0 m apart if on a fixed structure and 1.5 m on movable parts with at least one support between couplings, and install parallel or

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perpendicular to walls, structural members, or intersections of vertical planes and ceilings with right angle turns consisting of cast metal fittings or symmetrical bends.

Make all bends with an approved hickey or conduit bending machine.

Fasten conduits securely to all outlet, junction, and pull boxes and cable trays with galvanized locknuts and bushings with full number of threads projecting through to permit the bushing to be drawing tight against the box to insure good electrical contact. Use gasketed or O-ring waterproof conduit hubs on outside boxes as required.

Furnish sleeves and insert and install as required for the electrical work.

Conduits crossing expansion joints shall be provided with expansion fittings or other means to compensate for expansion and contraction. Expansion fittings shall allow for movement as required for each specific location.

The Contractor shall exercise the necessary precautions to prevent the lodgment of dirt, plaster, or trash in conduit, fittings, and boxes during the course of installation. A run of conduit which has become clogged shall be entirely freed of these accumulations or shall be replaced.

Carefully open conduit ends closed during the construction to prevent foreign materials entering the conduit. Do not install conduits which have been crushed, dented, or deformed in any way.

Conduits and conduit sleeves for use by others shall be capped until used.

Make up all conduit connections tight to provide good electrical conductivity throughout the entire length of the conduit run including flexible conduits.

Provide all empty conduits with a suitable 6.4 mm pull wire or a 6.4 mm nylon rope, or other approved type. Not less than 0.8 m of slack shall be left at each end of the pull wire. Tag empty conduit at each accessible end with a plastic tag identifying the purpose of the conduit and the location of the other end.

3. Conductors and Wiring: Install wiring and conductors only when the raceway has been completed. Thoroughly clean the inside of all conduits of any dirt, moisture, or other foreign materials before pulling wire and cable. Pull wires and cables in

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conduits after an application of suitable lubricant that will have no injurious effect on the insulation of the conductor. No oil or grease shall be used.

Make no splices or joints in either feeders or branch circuits except at outlets, accessible junction boxes, or accessible raceway fittings.

Secure joints in circuit wiring mechanically and electrically. Conductors shall be joined by compression type splicing sleeves, by means of bolted type pressure connectors having cast metal bodies, or on terminal blocks. Split-bolt type connectors are not acceptable. Unless properly insulated by the connector, all joints shall be insulated at least equal to the insulation of the conductors.

Identify all service entrance power conductors insulation by color coding as follows:

<u>Conductor</u>	<u>240 System Voltage</u>
Phase A	Blue
Phase B	White or Gray
Phase C	Red or Blue
Ground	Green

Note: Conductors No. 6 AWG or larger, permanent plastic colored tape may be used to mark conductor end instead of coded insulation. Tape shall cover not less than 50.8 mm of conductor insulation within enclosure.

Identify control wiring by color-coded, plastic-coated, self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means. The identification of each control wire shall consist of a number and a letter based on the existing control schematic. Provide conductor identification within each enclosure where a tap, splice, or termination is made. Identify control circuit terminals of equipment also. Terminal and conductor identification must be shown on approved shop drawings. Hand lettering or marking is not acceptable.

Verify that circuits are wired as indicated and are continuous and free of shorts. Energize and test each circuit, including lights and outlets. Check voltage at outlets. Test other electrical equipment as recommended by manufacturer. Measure grounded conductor resistance to true ground and resistance between insulation and ground. Resistance must be within limits specified in Paragraph (1) below. Troubleshoot and correct as necessary.

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Repeat the test specified above in the presence of and to the satisfaction of the Engineer.

- a. Test operation of each circuit and circuit control a minimum of 10 times and operation of each circuit continuously for a minimum of 1/2 hour.
- b. Acceptable Resistances;

Grounded Conductor to True Ground: 10 ohms, maximum.

Between Insulation and Ground: 100 megohms, minimum.

4. Wiring Devices: Fasten surface mounted boxes and supports with machine screws and nuts or welded studs on steel work. In open overhead spaces, cast metal boxes threaded to raceways need not be separately supported except where used for fixture support. The location of all boxes shall be easily accessible. Report any interference with mechanical or structural features to the Engineer prior to installation. Where several feeders pass through a common pull box, tag the feeders to indicate clearly the electrical characteristics, circuit numbers, and panel designation.

Install pull boxes or pull bodies in all conduit runs as required and locate as approved. Not less than one pull box shall be installed every 45 m.

5. Control System: Wire leaf motors and controls to provide proper operation of the connected equipment. Provide operating tests of the leaves in accordance with requirements as described under Bridge Machinery.
6. Lighting Fixtures:
 - a. Install lighting fixtures of types and at the locations as shown.
 - b. Fixtures shall be supported from structural ceilings, walls, or structural supports.
 - c. All splices shall be carefully placed in outlet boxes or wiring gutters with no crowding.
 - d. No circuit other than the one feeding the fixture shall be pulled through a fluorescent fixture.

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- e. Ground lighting fixture body.
 - f. Test fixture body for continuity to the grounding system.
7. Permanent Removal and Reinstallation Items: The Contractor shall disconnect and remove permanently or temporarily as indicated on the Plans, any and all items of electrical equipment, conduits, and wiring existing on the bridge or mounted in the Operator's House, as required to permit the installation of new electrical or structural work shown on the Electrical Plans. The Electrical Plans do not necessarily show every electrical item which may exist in these areas, but the Contractors shall temporarily remove any such item when directed by the Engineer.

ALUMINUM DOORS FOR EXISTING ENCLOSURES. Remove steel covers from existing designated steel enclosures. Fabricate new lightweight galvanized aluminum doors to replace steel doors. Wall mounted enclosure vertical doors shall be designed to withstand a live load of 415 kg/m². Horizontal aluminum doors and frame supports will be designed to withstand a live load of 488 kg/m².

Contractor is responsible for field measurements to determine exact size, hinge locations, etc. Contractor is responsible for providing a latching mechanism for all proposed doors.

INSTALLATION OF SUPPORTING DEVICES. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements. Coordinate with the building structural system and with other electrical installation.

- 1. Raceway Supports: Comply with the NEC and the following requirements:
 - a. Conform to manufacturer's recommendations for selection and installation of supports.
 - b. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 900 N, provide additional strength until there is a minimum of 900 N, provide additional strength until there is a minimum of 900 N safety allowance in the strength of each support.
 - c. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other

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hardware necessary for hanger assembly and for securing hanger rods and conduits.

- d. Support parallel runs of horizontal raceways together on trapeze-type hangers.
- e. Support individual horizontal raceways by separate pipe hangers.
- f. Space supports for raceways in accordance with Table 1 of this section. Space supports for raceway types not covered by the above in accordance with NEC.

**TABLE 1
SPACING FOR RACEWAY SUPPORTS**

Raceway Size (mm)	No. of Conductors	Location	Rigid Metal Conduit (m)
Horizontal Runs 19.1 and Larger	2 or More	Any Location	3.05
Vertical Runs 19.1	---	Exposed	2.13
25.4, 31.8	---	Exposed	2.44
38.1 and Larger	---	Exposed	3.05
Any	---	Concealed	3.05

- g. Support exposed and concealed raceway within 305 mm of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminations are not made with chase nipples or threadless box connectors.
- h. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminations.

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2. Vertical Conductor Supports: Install simultaneously with installation of conductors.
3. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting disconnects, light fixtures, and other devices.
4. In open overhead spaces, support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 610 mm from the box.
5. Sleeves. Install in concrete slabs and walls and all other fire-rated walls for raceways and cable installations. For sleeves through fire-rated wall construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduit and cables.
6. Conduit Seals. Install watertight seals for conduit penetrations of slabs on grade on exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.
7. Fastening. Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the bridge structure, including but not limited to conduits, raceways, boxes, disconnect switches, and control components in accordance with the following:
 - a. Fasten by means of toggle bolts on hollow masonry units, concrete inserts of expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine screws. Do not weld conduit, pipe, straps, or items other than threaded studs to steel structures.
 - b. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachment to concrete slabs.
8. Tests: Test pull-out resistance of one of each type, size, and anchorage material for the following fastener types:

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- a. Expansion anchors.
 - b. Toggle bolts.
 - c. Powder-driven threaded studs.
9. Provide all jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain the Engineer's approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener. If fastening fails test, revise all similar fastener installations and retest until satisfactory results are achieved.

Motor Control Center. The Contractor shall furnish services to rehabilitate the existing motor control center components in existing equipment enclosure as shown on the Plans and as specified herein.

1. **Cleaning:** Clean the motor control center and control desk interior and exterior by vacuuming while brushing loose dust, dirt, and debris from surfaces. Do not allow dirt to settle on electrical components. Clean all corrosion from surfaces of the motor control center and the control desk. Primer and paint the motor control center cabinet in accordance with the latest edition of NYDOT Standard Specifications for Construction and Materials, as amended, except as specified or added to in these Technical Specifications.
2. **Wiring:** Wiring for electrical equipment shall be installed new and in accordance with details shown on the Plans.

Control Transformer. A 25 KVA control transformer shall be provided to operate all devices shown on the wiring diagram plus an additional 10 percent spare capacity. One (1) circuit breaker shall be provided on the transformer primary. One (1) fused disconnect switch shall be provided on the transformer secondary. Transformer shall be rated 240/120 volts.

Relays. Relays shall be provided as shown on the wiring diagram, in order to provide the control functions indicated on the Drawings and required by the Specifications, and still maintain the number of spare contacts as specified. Additional low burden auxiliary control relays shall also be provided when required by excessively long runs of control wiring. Each relay shall be equipped with two spare contacts for future use.

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Branch Circuit Breakers. Branch circuit breakers of the frame size, number of poles and calibration, shown on the schedules and diagrams, shall be provided in the control center. Circuit breakers shall be manually operated, thermal magnetic trip, molded case air circuit breakers. Breakers shall be "F" frame, 15,000 AIC minimum. Breakers shall be mounted in the vertical position with handles arranged up for "ON" and down for "OFF."

Panelboards. Panelboards shall be provided for power and lighting branch circuits as shown on the schedule. The panelboard shall be complete with a standard panelboard door and latch. The main buses shall be rated equal to the maximum trip setting of the main or feeder breaker protecting the panelboard, regardless of the trip ratings indicated. In no case shall panelboard be provided with busing accessible from the front of the panelboard by operating personnel. Phase busing shall not be extended over the face of the individual branch circuit breakers. Circuit breakers shall be of the molded case, quick-made, quick-break type with both thermal and magnetic trip elements. Main breakers shall be centered at top as indicated on the schedule, so arranged to have the operating handle up for "ON" and down for "OFF." Circuit breakers shall be of the types shown on the Drawings and shall be provided in the panelboard in accordance with the frame and interrupting ratings indicated on the schedules. Circuit breakers shall be both ac and dc rated. A directory holder with transparent cover and metal frame shall be mounted on the inside cover, with a type directory identifying each circuit. Contractor will also provide newly revised directory for existing panelboard.

Solid State Multi-Function Protective Relay. All existing motor control center overload relays shall be replaced with solid state relays. The solid state multi-function protective relay shall be installed to monitor the condition of the various phases after the main breaker. The relay shall trip all control functions if there is a ground fault, overload, a phase reversal, a phase unbalance, an open phase, or an open wound rotor secondary phase.

The overload relay shall be a heaterless, current sensing, solid state motor protective relay, and have the following features:

1. Overload class adjustable for 5, 10, 20, or 30 seconds, maximum trip times at six times rated current.
2. NO/NC contact on output relay.
3. Isolated alarm relay output contact.
4. Selectable manual or automatic reset.

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5. LED alarm indication for device status including overload, phase unbalance, or ground-fault trip.
6. Protection for underload.
7. Automatic reset option.
8. Internal current transformers.

The relay shall be manufactured by Cutler-Hammer, Square D, ABB, or other approved equal.

Nameplates. All compartment doors and visual components shall be identified with nameplates. Nameplates shall be white laminated phenolic plates engraved with black letters. Lettering shall be vertical. Letter size and stroke shall be consistent and coordinated with the panel layout. Where nameplates are not suitable due to location or nature of the information, stamped metal tags shall be used.

Safety Switches. Furnish and install safety switches as indicated on the drawings and as specified. Single throw safety switches shall be stainless steel, Underwriters Laboratories listed, File E2875 and 154828, and meet or exceed the NEMA Standards KS1 unless noted otherwise on the plans.

All switches shall have switch blades which are fully visible in the OFF position when the door is open. Lugs shall be UL listed for aluminum or copper cables and front removal. All current carrying parts shall be planted.

Switches shall have a quick-make and quick-break operating handle and mechanism which shall be an integral part of the box, not the cover. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door in the ON position or closing of the switch mechanism with the door open. Single throw switch handle position shall indicate if switch is ON or OFF. Padlocking provisions shall be provided for locking in the OFF position.

All switches shall be furnished in NEMA 4 stainless steel hinged door enclosures unless specified on the drawings. Covers on NEMA 1 enclosures shall be attached with pin type hinges. NEMA 1 enclosures shall be of code gauge (UL 98) sheet steel treated with a rust-inhibiting phosphate primer finished in gray baked enamel.

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Bridge Control Console. Clean and check console components, wire connections, and other miscellaneous. The Contractor must provide two spare keys for each key switch.

Calibrate all console mounted meters. Verify all meter line (current) and line to line (voltage) settings work properly and repair as required.

Set all limit switches such that:

1. Leaf position indicator lights illuminate in the proper sequence and at leaf positions approved by the Engineer.
2. Equipment positions indicator light illuminate when equipment is in the appropriate position.

Correct equipment malfunctions and/or incorrect limit switch settings in accordance with these plans and specification so that the use of bypass switches is not necessary for operation of the spans.

Main Leaf Motors (2 Each Leaf). Rehabilitate main leaf wound rotor motors which operate main leaf gearing. The motors have the following characteristics:

1. Rating: Type CIP, Frame 404, Enclosure TENV, H.P. 20, RPM 875, Phase 3, Cycles 60, Volts 220, Amps 66.
2. Characteristics:
 - a. Duty: 1/2 hour intermittent.
 - b. Ambient Temperature: 40 degrees C.
 - c. Rotation: Either direction.
 - d. Service Factor: 1.
 - e. Class of Insulation: A - Plus Special Number 1.
 - f. Drive: Coupled.
 - g. Bearings: Ball.

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- h. Lubrication: Prelubricated with grease.
- i. Mounting: Horizontal.
- j. Outline Drawing - 21-C-2960.

The motor shall be removed, rewound, and tested to meet requirements of the National Electrical Testing Administration (NETA). The insulation resistance of each motor shall be greater than the NETA recommended minimum of 2 Megohms. Motor ball bearings shall be replaced and the motor housing shall be cleaned and painted. Also, clean and paint steel support for motors. Motors shall be fitted and realigned on the supports so that there will be a true meshing with the main leaf gearing.

Span Brakes. Eight "thruster" operated electric powered motor brakes, two for each leaf shall be removed. New thruster brakes shall be installed on the existing machinery platforms, operative upon the shaft extensions of the drive motors. Contractor is responsible for providing a new mounting arrangement.

Equip each brake with a new hand release limit switch.

Equip each brake with new limit switches for the control of indicating lights and interlocks. The indicating light shall show when the brake is released or set.

Brakes shall be tested to verify that the thruster push rod stroke is 38.1 mm (± 12.7 mm) when operated. When the brake is in the set position, brake shoes must clamp brake wheel so that the motor shaft is unable to move.

METHOD OF MEASUREMENT. Payment for the foregoing work will be made at the lump sum price bid. Progress payments will be made in accordance with the following: The Contractor shall submit a schedule of work outlining each work phase, with a percentage figure assigned to each phase. the percentages assigned to each phase are subject to the approval of the Engineer. The Engineer will use this schedule to set progress payments. The Engineer may request a revised work schedule at any time. Failure by the Contractor to supply a revised work schedule upon request will cause the progress payment process to be immediately terminated.

BASIS OF PAYMENT. The lump sum price bid and payment for Electrical Equipment Rehabilitation shall be the cost for furnishing and installing all equipment and materials described and specified in this Section.

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