ITEM 10599.32M BRIDGE ELECTRICAL TESTING

DESCRIPTION

Under this item, the Contractor shall furnish all labor, materials, plant, and equipment; and shall do all work necessary included in the field testing and final acceptance testing.

Field Testing

The Contractor shall arrange for and provide all the necessary field tests, as directed by the Engineer, to demonstrate that the entire electrical system is in proper working order and in accordance with the Plans and Specifications. The tests shall include, but not be limited to continuity and insulation resistance testing of multi conductor cables and operational testing of traffic signals, warning gates, bicycle/pedestrian gates, bascule leaves, navigation lights and signals, standby generator and automatic transfer switch. He shall arrange with the local power company to obtain, at his own expense, electric power during the testing period until the bridge has been accepted.

Should the tests show that any piece of equipment or cable or wiring connection, in the judgement of the Engineer, is defective or functions improperly, such adjustments and/or replacements shall be made by the Contractor as to make the installation satisfactory to the Engineer and at no extra cost.

The bridge field tests are intended to confirm each major sub-component acceptance factory tests, and that the subsystem is operational. Confirmation of correct operation of sub-components will be demonstrated through successful operation of the particular component. However, the Contractor is still responsible for the factory acceptance tests as required per contract specifications. Examples of subsystems are the span drive systems, control and power wiring, limit switches, starters, PLC system, etc.

Bridge Final Acceptance Testing

This acceptance test is intended to show and/or demonstrate that the normal and emergency control and power systems are operational, trouble free and in compliance with the requirements of the contract plans and specifications.

The bridge acceptance tests are not intended to substitute each sub-component acceptance factory and field tests. Confirmation of correct operation of sub-components will be demonstrated through successful operation of the total control system. However, the Contractor is still responsible for the factory and field tests acceptance tests as required per contract specifications. For example, it is not the intent to manually operate and test each limit switch. This will have been accomplished by the contractor prior to demonstration of the system under test. The contractor shall be able to prove that the results of the sub-component tests are in conformance with the contract plans and specifications. The recommended values of various device parameters can be found in the appropriate manufacturer's catalog cuts and instruction manuals. Correct operation of the sub-components and control circuit wiring connections will be verified through the successful completion of the entire bridge control and power systems tests.

This testing procedure will evaluate performance and confirm correct and proper operation of all major subsystems and devices including the control console meters, control switches and pushbuttons, traffic signals, warning gates, bicycle/pedestrian gates, span locks, brakes, the span drives and motors, bypass switches, auto transfer switch, etc.

Visual inspections and physical measurements of some equipment are required for the purpose of recording valid parameter values.

The NYSDOT must be in possession of the final new operating and maintenance (O & M) manuals at least 30 days before acceptance testing may begin.

MATERIALS

No materials are specified.

CONSTRUCTION DETAILS

Equipment Required For Final Acceptance Testing

The testing of the bridge electrical equipment would necessitate the use of the following recording and testing devices:

Recording Ammeter/Voltmeter
Power Factor Readout/Watt Recorder
Portable Tachometer
Portable Ohmmeter
Amp-probe
Infrared Scanner.
Measuring Tape
Stop Watch (Timer)

All other necessary instrumentation and tools to monitor, adjust or replace items during the bridge testing procedure.

Final Acceptance Test Data

All test results, parameters, data specified herein to be recorded shall reference the appropriate paragraph number and shall be presented in legible, tabular format, listing associated parameters and conditions. For example, motor current shall reference speed (rpm), span leaf angle (degrees), raise or lower mode, drive control selector position number, etc.

The results of the Normal, Back-Up and Emergency systems tests shall be presented in a matrix form on an Inspection Report Data Sheet. The proposed format of these sheets shall be submitted to the Engineer for acceptance prior to the actual testing. Any parameter value, which falls beyond the recommended range, would require the readjustment or replacement of the defective device.

The table of the test results shall have references to the specific sections of the testing procedure. The precision of the results will depend on the accuracy of recording equipment, the observer and weather conditions. For each stage of testing of the bridge control equipment, the name of the person who will perform the test, instruments used with calibration data if required, the exact date, time and weather conditions shall be recorded.

Some devices such as the transfer switch, PLC status, lamps, console indicator lights, brake function indicator lights, differential/emergency clutches, console controlled lighting, horn, can be easily tested without performing any bridge opening operation.

The bridge main parameters shall also be observed on the laptop screen, and visually compared to the control console indicating meters. Any discrepancy between results should be recorded. A discrepancy between critical measurements like span angle indication shall be resolved prior to continuing the tests.

The testing shall be accomplished sequentially, following the bridge operation instructions for normal operation and emergency operation. The major bridge systems shall be monitored while the bridge operates.The printout original shall be kept for future reference, and a printout copy shall be attached to the operation and maintenance (O & M) manual for reference. Another printout copy shall be provided to the Engineer.

Final Acceptance Testing Requirements

Results and observations shall be carefully recorded throughout the various tests.

The bridge shall be balanced and strain gage conditions verified by the Contractor prior to any operational acceptance testing of the bascule span control system.

Prior to performance of these tests, all temporary bypasses, jumpers, switches, etc., installed during any previous testing must be removed. The control circuits shall be in the state presented in the originally As-Built control wiring diagrams (restored to normal).

All tests and verifications shall be for equipment at both the west and east span leaves. In addition to all above listed devices and all associated input devices should also be tested.

Tests To Be Performed

Control System

General

Prior to any other test, visually verify the wiring connection integrity of the major components including:

All encoder devices
All limit switches
MCC contactors, span drive input boards
Tach generators
Traffic signals, bicycle/pedestrian and warning gates, interlocked heating and ventilating devices, etc.
Control desk indicating lights
Control desk meters are zeroed and provide correct indications.

Control Desk

The control desk devices (switches, pilot lights, desk meters) will be used throughout the tests, and all irregularities observed shall be noted during and after the tests from the notes and printouts.

Provide one desk wattmeter and one desk ammeter verification as follows:

> For a determined bridge span opening, at an exactly start recording [Time stamp] time, an assigned test technician shall record every 5 seconds, on paper, the meter watt and ampere readings for a designated drive and motor.

The manually recorded values shall be filed. The results shall be compared and the meter accuracy estimated.

Span Brakes Function and Status Indication

The normal automatic set and released operation of the brakes shall be visually recorded during the span raise and lower operations.

The brakes shall be hand released, each brake one at a time, and the hand-released indication monitored through the PLC inputs.

With the span in non-permissive operation mode (span locks driven, drives not energized), the brake set and release switches can be activated manually and their set/released indication monitored on the control desk.

Closed Circuit TV (CCTV)

The test consists of:

> Turning on the monitors and cameras.
>
> Verification of the viewing angles of the CCTV cameras.
>
> The camera and monitor provide a clear, sharp image under high and low light conditions.

Air Horns

Test that the air horn produces a tone acceptable to the Engineer. If necessary, the air horn sound tone shall be re-tuned to an acceptable pitch and level.

Traffic Signals Control

Test that the traffic signals change state upon activation of the desk selector switch. The duration time of the amber light shall be of an acceptable time to

the Engineer. If necessary, the TSR timing relay shall be re-set to an acceptable time delay.

Warning Gates Control

Testing of the gates shall demonstrate the balance condition of the gate arms such that a stationery arm remains in the same position when the brake is released. Proper manual operation and proper normal operation upon activation of the desk selector switch shall be demonstrated.

Lower individually, group raise commands, lower/raise sequencing checks Follow the ”Sequence of Operation”.

Verify that the warning gates are lowered in the right sequence and the gongs de-activated at the appropriate time.

Group raise the barrier gates and verify that they are fully raised.

Interlock checks:

Set the ”Sequence of Operation” to first step.

Verify that manually moving any gate from its fully raised position shall turn on the red traffic signals, warning lights, and gongs.

Verify that the warning gates cannot be operated electrically unless "Stop" traffic signals has been turned on, the barrier gates are raised.

Verify that the span leaves cannot be operated electrically.

Bypass checks:

Verify that when the “Bypass Warning Gate Interlocks” keyswitch is enabled, the interlocks listed above are overridden.

Bicycle/Pedestrian Gates Control

Lower individually, group raise commands, lower/raise sequencing checks Follow the ”Sequence of Operation”.

Verify that the gates are lowered in the right sequence and the gongs de-activated at the appropriate time.

Group raise the gates and verify that they are fully raised.

Interlock checks:

Set the ”Sequence of Operation” to first step.

Verify that manually moving any gate from its fully open position shall turn on the red traffic signals, warning lights, and gongs.

Verify that the barrier gates cannot be operated electrically unless "Stop" traffic signals have been turned on, the warning gates are down.

Verify that the span leaves cannot be operated electrically.

Bypass checks:

Verify that when the “Bypass Bicycle/Pedestrian Gate Interlocks” keyswitch is enabled, the interlocks listed above are overridden.

Span Locks Control

Drive/pull commands:

I. Follow the ”Sequence of Operation” up to the span operation.
II. Pull all four locks using the control desk marked-up corresponding switches, and verify the locks are pulled.
III. Drive back all four locks using the control desk marked-up corresponding switches, and verify the locks are driven.
IV. Pull and drive the span locks using the control desk group switches, and verify that all span locks are operating accordingly.

Interlock checks:

I. Verify that the barrier gates and warning gates cannot be raised electrically unless the span locks are driven.
II. Verify that the traffic signals cannot be turned to green.
III. Verify that the span leaves cannot be operated electrically unless the span locks are pulled.

Bypass checks:

I. Verify that when the “Bypass Span Locks Interlocks” keyswitch is enabled, the interlocks listed above are overridden.

Span Brakes Control

I. The normal automatic set and released operation of to the brakes shall be visually recorded during to the span raise and lower operations.
II. The brakes shall be hand released, each brake one at a time, and to the hand-released indication monitored through to the PLC inputs.
III. With the span in non-permissive operation mode (span locks driven, drives not energized), to the brake set and release switches can be activated manually and their set/released indication monitored on to the control desk.

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Span Normal Operation

Several bridge openings may be required to demonstrate that all the operational parameters are acceptable and interlock functions safe. Subsequent runs will be required to simulate control failures, and to test interlocking and bypass functions. The normal sequence of operation as described in the "Sequence of Operation" section of the general specifications shall be followed up to the indicated operational step of the equipment to be tested.

Span Reduced Speed

I. Set the span drive speed to "Reduced" from the control console.
II. Follow the full "Sequence of Operation". During the span leaves "Raise" and "Lower" operation, the following parameters shall be monitored and manually recorded:
    i.) East and West span leaves angular position (degrees);
    ii.) East drive and west drive power (kilowatt)
    iii.) Maximum height during the "Raise" (degrees);
    iv.) Raise" time and "Lower" time;

I. These parameters shall be recorded at the fully seated, nearly closed, nearly open and fully open position as indicated at the control console by the span limit switches. Verify that the span operated normally within the permissible position limits, and without any automatic position control changeover to a back-up system.
IV. Verify that the recorded encoder angles, the control console indicated position and the limit switches indicated position are equal or within the set design tolerances.

Span Full Speed

I. Set the span drive speed to "Full" from the control console.
II. Follow the full "Sequence of Operation". During the bascule span "Raise" and "Lower" operation, the following parameters shall be monitored and manually recorded:

    i) East and West span leaves angular position [degrees];
    ii) East drive and west drive power [kilowatt]
    iii) Maximum height during the "Raise" [degrees];
    iv) Raise" time and "Lower" time;

III. These parameters shall be recorded at the fully seated, nearly closed, nearly open and fully open position as indicated at the control console by the span limit switches.

IV. Verify that the bascule span operated normally within the permissible position limits, and without any automatic position control changeover to a back-up system.
V. Verify that the recorded encoder angles, the control console indicated position and the limit switches indicated position are equal or within the set design tolerances.

Normal Stop

I. Set the span speed to "Normal" from the control console.
II. With the span running at full speed during a "Raise" operation, press the "Stop Span" pushbutton. The span should slow and stop smoothly within a minimum of 3 to 5 seconds deceleration.
III. Repeat the test during a "Lower" operation.

Overspeed Fault Detection Test

Simulate an overspeed condition from the tach generator assembly high overspeed switch (HOS) by manually changing the state during a normal span opening, at full speed. Verify that the span stops and the Dataliner displays the east or west overspeed failure message.

Deceleration Failure Test

Simulate an overspeed condition from the tach generator assembly low overspeed switch (LOS) by manually changing the state during a reduced speed span deceleration at the nearly seated position. Verify that the span stops and the Dataliner displays the east or west deceleration failure message.

Interlock Checks

I. Verify that the span cannot be operated electrically if more than one brake in each machinery room has been released by hand.
II. Verify that the span cannot be operated electrically if the hydraulic motor clutch in either machinery room has been engaged.
III. Verify that the bicycle/pedestrian gates, warning gates, traffic signals cannot be operated unless the span is seated and locked.
IV. Verify that the span locks cannot be operated unless the span is fully seated.

Bypass Checks

I. Verify that when the "Bypass Span Control Interlocks" switch is enabled, the interlocks listed above are overridden.

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Emergency Span Stops

I. This test should be conducted such as to minimize the mechanical stresses on the bridge systems. It is suggested to be conducted only once during a span raise, and once during a span lowering, under reduced speed condition.

II. Under a “Reduced Speed” normal opening procedure, push the emergency Stop” red mushroom head button.

IV. Verify that all motor and brake contactors drop out and the span brakes set immediately.

METHOD OF MEASUREMENT

Payment for the Items " Bridge Electrical Testing" shall be made on a lump sum basis.

BASIS OF PAYMENT

The lump sum bid for " Bridge Electrical Testing” shall include the cost of all labor, materials, and equipment necessary to complete the installation, ready for operation.

Progress payments for work satisfactorily completed will be made as follows:
35% is to be paid when the west span is tested and operational.
65% is to be paid when the entire electrical system is completed and accepted.