

DESCRIPTION

This work shall consist of furnishing and installing all components required to replace the Span Lock assembly of the Southbound Bridge, with two independent Span Lock assemblies and rehabilitate the Span Lock assembly of the Northbound bridge as shown in the Plans or as directed by the Engineer. Portions of the Span Lock Assembly of the Southbound Bridge are to remain and be reconditioned. Painting of the associated components is incidental to this pay item. This work shall also include the removal and disposal of all components replaced.

MATERIALS

A. Shop Drawings. Dimensions given on the Plans are nominal and intended for guidance. The Contractor shall make note of any variations from nominal dimensions on the shop drawings or provide written notice to the Engineer. Prepare working, erection, and shop drawings and submit to the State for approval. Where additional information is required or changes must be made the Contractor shall clearly identify such information on the shop drawings.

B. General Shop Drawing Requirements. All shop drawings shall be prepared as directed by the New York State Steel Construction Manual (SCM). Shop drawings shall detail and accurately dimension all parts. Shop drawings shall define limits of accuracy and tolerances required for machining, surface finishes and allowances for fits. Designate tolerances in the shop drawings in accordance with ANSI Y14.5 Dimensioning and Tolerancing. Unless specified in the Plans or herein, the shop drawings shall tolerance dimensions between machined parallel surfaces to 0.25mm ($\pm 0.010''$) and tolerance flatness of machined surfaces to within 1.0mm (0.040'').

C. Manufacturer's Literature. The Contractor shall submit catalog cuts and detailed Manufacturer's literature for all components not detailed in the shop drawings. Clearly mark such items with the item number corresponding to the mark shown on the assembly drawing and the full and complete part number, extended to completely define the part including all optional or custom features. If the same cut sheet is used to define more than one item, submit multiple copies.

D. Material Certifications. The Contractor shall submit material certifications for all materials specified to require material testing within the Plans and Specifications or within a referenced material Specification (e.g. ASTM, ANSI, or others).

E. Procedures. In addition to required detailed shop drawings, the Contractor shall submit to the Engineer for review various procedures described herein. The procedures shall be thorough and be supplemented by sketches, calculations, details, catalog cuts, photographs, etc. as required to demonstrate that the specified requirements can be met.

F. Notification of Shop Work. The Contractor shall provide advance notification to the State for all shop work and shop testing for which the Specifications require, or indicate that it is the intent of the State, to provide a representative to observe or witness such activities. Provide a minimum of 30 days advance notice of such work.

G. Material Compatibility. The Contractor shall provide products which are compatible with other products of the mechanical work and with other work requiring interface with the mechanical work, including mechanical/electrical connections, control devices and supporting structure.

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H. Nameplates. The Contractor shall provide each piece of mechanical equipment and apparatus with a permanent, 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. Nameplates on all proprietary elements shall be readable, clean, and free of all paint before acceptance of the machinery.

I. Substitutions. Specification of a Manufacturer's part number, product, and/or name is for the purpose of defining quality, configuration, rating and arrangement of parts. Part numbers shown in the contract documents are not necessarily complete numbers nor are they intended to describe details of the component beyond those that are required. Be aware that Manufacturers may change product names and part numbers without advance notification. The Contractor shall select and provide manufactured products that meet the requirements and intent as shown in the contract documents. Provide complete, current part numbers for all proposed equipment and verify that the part as designated is appropriate for the intended function.

J. Linear Electric Actuator. Linear electric actuators shall meet the requirements in the Plans, particularly thrust and speed. They shall not exceed the specified maximum motor horsepower unless approved by the engineer. Linear actuators shall be provided as a complete package, from a single OEM / Manufacturer, to include all electrical motors, brakes, belts, pulleys, reducers, ball screws, rod ends, manual cranks with safety disconnect, trunnions, trunnion mounting brackets and accessories. The motor shall have class "F" insulation minimum and thermal protection. Actuators and all mounted equipment shall be painted with a factory finish intended for use in corrosive industrial applications. A storage compartment or clamp for the hand wheel shall be provided at each actuator location if the wheel is not permanently attached to the actuator. Detail storage mechanism in the shop drawings. Linear electric actuators shall be manufactured by the following or approved equal:

Raco International, Inc.	Duff-Norton	Nook Industries
3550 Industrial Boulevard	P.O. Box 7010	4950 East 49th Street
Bethel Park, PA 15102	Charlotte, NC 28241	Cleveland, Ohio 44125
412-835-5744	800-477-5002	216- 271-7900

Refer to the Plans for specific actuator requirements, including accessories. The Contractor shall coordinate details of the actuator hand wheel and motor disconnect with the structural details for the access hand hole to make the hand wheel easily accessible to maintenance personnel.

K. Weldments. The intent of the design is to use a lock system that can be mounted to the existing structure as shown in the Plans. If an alternate mounting system is accepted, the Contractor shall provide a galvanized steel weldment bracket to adapt the alternate mounting to connect to the existing girder as part of the work at no additional cost to the State. Weldments shall be fabricated from ASTM A709M, Grade 345 structural steel.

Weldments shall be provided as required as replacement of machinery supports. The weldments shall be as detailed in the Plans, or shall mimic the item replaced.

Unless otherwise noted herein or in the Plans, all welding and weld inspection of machinery shall be performed in accordance with ANSI/AASHTO/AWS D1.5 and the SCM. Unless otherwise noted herein or in the Plans treat all welded machinery and weldments that support machinery or live load reactions as main members, all welds as subject to tension or stress reversal, and all welds as joining primary components.

Unless otherwise shown in the Plans, elements of weldments shall be connected by complete joint penetration welds. Do not use fillet welds where they would require machining to provide clearance for machinery, fasteners, or other attachments. Clip stiffeners to avoid overlapping stiffener welds with welds at the intersection of main plates.

Weldments shall be stress relieved after welding and prior to final machining. Unless otherwise shown in the Plans, machined surfaces of weldments shall be finished to the flatness required herein and parallel to each other and to the bottom of the base plate. The height of the weldment shall be per plan height $\pm 3\text{mm}$ ($1/8''$). All exposed edges of weldments shall be ground to a chamfer or radius to eliminate sharp edges and burrs.

Finished mounting surfaces shall be coated with an approved corrosion inhibitor and skidded or crated for protection during handling, shipment and storage.

L. Solid Bushings. Where required, provide solid bushings or shoes, as shown in the Plans of one piece bronze sleeve configuration. Round bushings shall be provided with spiral cut lubrication grooves, unless shown otherwise in the Plans. Shoe bushings shall be provided with linear lubrication grooves. Where materials are not called in the Plans, plain bearing bushings shall conform to ASTM B22 Grade 93700 and shoe bushings shall conform to ASTM B22 Type 86300.

M. High Strength Bolts. Unless otherwise specified, fasteners used for connecting machinery parts to each other and to supporting steelwork shall be turned bolts conforming to the minimum specified physical requirements of high strength, ASTM A325 or ASTM A449 cut thread, washer faced, hexagonal head bolts. Threads for turned bolts shall conform to the requirements of ASTM A325. Do not use ASTM A490 bolts. Nuts shall conform to ASTM A563 or A194, Grade DH or 2H, heavy hex series.

N. Washers. Hardened steel, plain washers shall conform to ASTM F436 and shall be used at the rotated end of high strength ASTM A325 or A449 bolts or studs and always under nuts. No more than one washer may be used at any end.

O. Shims. Shims required for leveling and alignment shall be stainless steel, full depth shims, trimmed to the dimensions of the assembled unit. Unless detailed otherwise to include keepers, shims shall be drilled with complete holes for all bolts that pass through. The nominal shim pack thickness shall be 12mm ($1/2''$) unless otherwise specified. Shim material shall be ASTM A666, type 304 or 316 stainless steel. Thin brass precision thickness shims may be used for final adjustment. Sufficient thicknesses shall be provided to permit 0.125mm (0.005'') variations of the nominal shim thickness plus one full allowance shim. All shims shall be corrosion-resistant. The Contractor shall provide the State with one full set of additional shims for each type of component.

P. Shafting and Pins. Rolled material may be used for shafting and pins up to 100mm (4'') diameter. Forged material shall be used for larger diameter shafts and those having integral flanges or pinions. Homogeneity of forgings is required; shafts shall be reduced to size from a single bloom or ingot at no less than red heat. The blooms or ingots shall have a cross sectional area at least three times that required after finishing. The finished product shall be free of injurious flaws such as seams, pipes or cracks. Forged shafts over 200mm (8'') in diameter shall have a hole bored lengthwise through the center. The diameter of the hole shall be about 1/5 the diameter of the shaft.

The Contractor shall test shafting materials for mechanical properties and furnish certificates to the State. Finished shafts shall be free of camber and run without vibration, noise or chatter at all speeds up to and including 120 percent of design speed.

The Contractor shall test all cold-finished shafting for its mechanical properties, and furnish a test certificate to the Engineer.

Dowel pins shall be American National Standard unhardened ground dowel pins with 440MPa (64ksi) minimum ultimate shear strength.

Q. *Lubricants.* Proprietary units shall use lubricants approved by the Manufacturer; other units shall be supplied with the lubricants specified herein or by the State. Immediately after erection and before operation, the Contractor shall lubricate all rotating and sliding parts and fill all gear housings with the lubricants specified on lubrication charts. Lubricants provided shall be formulated for use in extreme temperature applications with lower and upper operating temperature extremes of -28 and +93 C (-20 F / +200 F) respectively.

R. *Lubrication Tubing.* Flexible plastic tubing with stainless steel braided shield shall be used on all components of the spanlock system to prevent damage from vibration. Stainless steel or corrosion resistant hardware shall be used to secure lubrication tubing and fittings. The Contractor shall provide one grease gun for each type fitting. Tubing and tubing supports shall be provided as required to run lubrication lines to the lubrication station as shown in the Plans.

S. *Motor Couplings.* Flexible couplings shall be grid-type, self-aligning, fully flexible, torsionally flexible couplings intended to connect electric motors to machinery components. Grid-type couplings shall have steel hubs, alloy steel grids, and steel or aluminum covers. Bolts in the covers shall be shrouded. Flexible couplings shall meet the requirements of Subarticle 2.6.8 of the AASHTO Movable Specifications. Couplings shall be a standard product of an established Manufacturer. Provision shall be made for introducing lubricant to all contact surfaces.

T. *Seals.* Seal and gasket replacements for all items, such as speed reducers and couplings, shall be replaced by items provided by or recommended by the original Manufacturer of the equipment.

CONSTRUCTION DETAILS

A. *General.* Construction shall be in accordance with the requirements defined herein and in the Plans and the provisions of the AASHTO Movable Specifications and SCM. Where a conflict exists between documents, the requirements of the Plans and Specifications shall govern over those of the AASHTO Movable Specifications.

Unless specified in the Plans or herein, dimensions between machined surfaces shall have a parallel, perpendicular or circular tolerance of 0.25mm (0.010”) and machined surfaces shall have a flatness tolerance of 1.0mm (0.040”).

All machinery shall be set, aligned and verified by experienced millwrights. Millwrights shall have a minimum 10 years of experience in setting and aligning heavy machinery and shall have completed installation of machinery for a minimum of two bascule bridges. The qualifications of the proposed millwrights shall be submitted to the Engineer for review.

B. Basis of Acceptance. All fabrication of Structural Steel shall follow all of the requirements of the SCM. In addition, all shop drawings submitted shall follow all guidelines given in the SCM. No installation or rehabilitation work may take place until the shop drawings and procedures are approved by the Engineer.

C. Machinery General Positioning. Unless otherwise specified or shown in the Plans, all machinery connected to the structure, including linear actuator trunnion mounting brackets, lockbar guides and receivers and centering device guide and receiver assemblies shall be positioned within the following tolerances:

Horizontal position:	0.8mm (1/32 in.)
Vertical position:	0.8mm (1/32 in.)
Level (top of machined surface):	0.42mm/m (0.005 in./foot)
Orientation (parallel to Plan centerline):	0.5 degrees

D. Spanlock Adjustment. Rotate and shim the spanlock guides and receivers in all planes until the bar passes through all three with a clearance variation of less than 0.25mm (0.010”) along any side of the bar. The guides shall be shimmed and fastened with turned bolts such that this position is maintained. Shims shall be adjusted to provide vertical clearance between the lock bar and any guide or receiver between 0.1mm and 0.4mm (0.004 and 0.015”). The spanlock guide or receiver shoes shall be shimmed to achieve these tolerances. Preference should be given to maintaining equal clearance or bearing on the top or bottom of all three pieces, where practical, however the variation may be up to the maximum allowed herein. Horizontal clearances of the guides shall be established by the fabrication tolerance set in the Plans and installation tolerances on the guides and receivers.

Prior to final alignment and installation of the spanlock components, the Contractor shall verify that the span alignment is proper at both the center break and rear break of the bascule leaves. The live load shoes shall be adjusted such that the vertical misalignment between each side of a bascule joint does not exceed 3.2mm (0.125”) measured at a straight edge held flat to the higher of the two surfaces. This measurement shall be taken only after verifying that both leaves are fully bearing on both live load shoes without the locks driven. Live load shoes shall be adjusted with ambient temperature between 18 and 24 degrees Celsius (65 and 75 degrees Fahrenheit).

After spanlock guide and receiver installation, driving and pulling of the locks shall not affect the full bearing of any live load shoe or the horizontal alignment between the leaves at the center break. Driving clearances shall be checked in the morning, at mid day, and in the late afternoon. If either bascule span moves during the driving or pulling of the locks, evidenced by a change in the bearing of a live load shoe or leaf tip alignment, the live load shoes and spanlock shoes shall be adjusted until the proper condition is achieved.

E. Actuator Adjustment. The actuator connection point shall be adjusted, via positioning on the trunnion mounting bracket, to provide the required reserve stroke in the actuator with the spanlock bar in the fully driven position. No less than 6mm (1/4”) reserve stroke shall be provided in the actuator with the spanlock assembly in the fully engaged position.

Prior to installing turned bolts, the actuator shall be aligned such that no binding exists at the pivot point at any position of travel. The angle of approach between the actuator and the spanlock bar shall be within 1 degree at any position of travel. Actuator trunnion columns shall rest unsecured in the same position on the top plate of the support weldment, while connected to the installed lock bar, in the spanlock pulled and driven positions.

Initial installation of the actuator on the girder shall be performed with a minimum of 6mm (1/4") reserve stroke extended from the actuator, or with other means of ensuring that the required final reserve stroke will be present after final shimming of the assembly. The Contractor shall install the components of the assembly in accordance with the approved procedure. The sequence of installation and the tolerance for actuator alignment shall be included with the installation procedure submittal.

F. Actuators. Coordinate actuator details with other spanlock components. Submit justification with shop drawings for any changes in the actuator dimensions, actuator lengths or other features from those shown in the Plans. The minimum clearance between the actuator and the support shown in the Plans with the actuator rotated to the limit of rotation during spanlock operation shall be provided.

Erection and assembly shall be in accordance with part number and match marks. Final bolt holes shall be drilled in girder, shims and mounting plate after alignment of actuator. Two subdrilled holes, one per bracket, may be drilled initially to assist in clamping for alignment. Shims, between the actuator mounts and supporting steel, shall be adjusted for final alignment.

G. Turned Bolts. Where holes in pre-manufactured components are to be bolted through with turned bolts, the turned bolts shall be detailed to meet the required fit with the hole as manufactured or to be reamed. Certified prints, from the component Manufacturer, shall be submitted with shop drawings of the adjoining weldments.

H. Bolting. Unless otherwise specified or shown in the Plans, bolt holes in machinery parts for connection to supporting steelwork shall be drilled in the shop a minimum of 1.6mm (1/16") diameter smaller than the finished bolt diameter or drilled from solid at assembly. Drill and ream at final assembly.

Unless otherwise specified or shown in the Plans, bolt holes in steelwork for turned bolts shall be drilled from solid at assembly or erection after proper alignment. Do not pre-drill holes full size prior to final assembly. Note that several of the bolts may be installed in the place of existing structural rivets. Where this is the case, the mating steel shall be provided without holes, transfer punched and drilled to meet the required hole arrangement. Final reaming of the holes shall be performed in both the existing steel and the new steel simultaneously. Use of temporary bolts or clamps for the purpose of holding the pieces for reaming shall be required.

All contact surfaces of structural steel to which machinery is to be bolted shall be cleaned in accordance with the Specifications for structural steel, to be bolted together, before bolting.

Bolt holes through unfinished, rough cast surfaces shall be spot faced for the bolt head and nut.

Except as noted herein or in the Plans, ASTM A325M and ASTM A449 bolts used for connecting steel machinery parts together or to structural steel, and whose nominal threaded diameter is less than or equal to 38mm (1-1/2"), shall be bolted in accordance with the bolted connection requirements of AASHTO and the standard Specifications.

I. Welding and Weldments. Do not perform field welding on weldments or other connections unless specifically required in the contract documents.

J. Testing. Spanlock actuators shall be operated a minimum of four times each with the leaf in the lowered position. Between tests, raise and lower the leaves through an opening cycle. During the test the spanlock actuator cannot bind and motor shall not draw over 50% FLRT in order to be acceptable. All alignment criteria provided herein and in the Plans shall be measured and verified in the presence of the Engineer. All measurements shall be confirmed after the installation of all final turned bolts, high strength bolts, and any accompanying Live Load Shoe adjustments.

K. Lubrication of Machinery. Grease fittings shall be connected with tubing or fittings so that grease is introduced directly into the grease grooves for distribution. Tubing shall be extended from the bearings to convenient lubrication stations. Vibration absorbent braided stainless steel hose, 200mm (8”) minimum length, shall be installed between the pipe and the component lubricated. Tubing supports shall be provided at increments not to exceed 915mm (3 feet) between supports. Lubrication stations shall be mounted to the railings at the sidewalk level in an inconspicuous location, easily accessible to maintenance.

Immediately after erection and before operation, all rotating and sliding parts shall be lubricated and all gear housings shall be filled with the approved lubricants specified on lubrication charts.

L. Startup Requirements. Implement startup procedures that protect the equipment from damage and ensure safe working conditions during bridge operations throughout construction. The spanlock assemblies shall not be left in the engaged position unless appropriate interlocking, preventing the operation of the bascule leaf, is in place, tested and working.

M. Protection of Equipment. During construction, all equipment shall be protected from damage as a result of construction operations and contamination from dust and debris. Should any equipment become contaminated, immediately clean the equipment, relubricate, and protect from further contamination. The bridge shall not be operated and no enclosed equipment opened during any period in which construction operations can contaminate the equipment.

N. Painting. Ferrous metal surfaces of spanlock machinery and associated hardware and supports shall be painted. Ferrous surfaces of new machinery shall be painted in accordance with the “Structural Steel Painting: Shop Applied” Section of the Specifications. Field installed bolts, existing machinery to remain or structural steel surfaces exposed during the installation of machinery shall be painted in accordance with the “Structural Steel Painting: Overcoating and Localized” Section of the Specifications. Do not paint machined surfaces in sliding contact or those specified to be lubricated. Costs for all painting shall be incidental to this payment item.

O. Demolition. Where removal or replacement is called for in the Plans or the Specifications, these components shall be removed in their entirety. Removal and disposal of such equipment shall include all shims, fasteners or other miscellaneous items that are also replaced through the work of this Contract. All removed components shall be disposed of properly, by the Contractor, in accordance with all local, State and Federal regulations. All associated fees shall be borne by the Contractor and shall be incidental to this payment item.

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METHOD OF MEASUREMENT

This work will be measured for payment on a lump sum basis for each bridge.

BASIS OF PAYMENT

The lump sum price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work. Associated electrical work, including motor starters, conduit, wiring, and limit switches required for operation of the span locks are to be provided under a separate pay item(s). Progress payments will be based on the percentage of Spanlock work completed. No more than 10% of the quantity will be paid for all demolition and disposal required. No more than 10% of the quantity will be paid for purchased, stored, shop fabricated and shop tested materials. Total payment on this item will not exceed 90% of the quantity prior to all field testing of the installed spanlock equipment.