TECHNICAL SPECIAL PROVISION

FOR

T468 MECHANICAL CONSTRUCTION FOR MOVABLE BRIDGES

FINANCIAL PROJECT ID: 437966-1-52-01

The official record of this Technical Special Provision has been electronically signed and sealed using a Digital Signature as required by Rule 61G 15-23.004, F.A.C.

This item has been digitally signed and sealed by Joshua C. Jackson, P.E. on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

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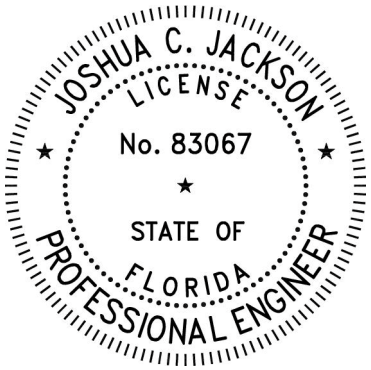
Pages:	1-25



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T468 MECHANICAL CONSTRUCTION FOR MOVABLE BRIDGES

T468-1. BASIC MECHANICAL REQUIREMENTS

T468-1.1. Description

This Technical Special Provision applies to Bridge Number 170158. Execute mechanical work in accordance with the Contract Documents.

T468-1.1.1. General

The intent and purpose of this Technical Special Provision is to cover apparatus, material and labor required to properly detail, manufacture, ship, install, adjust, test, paint and put into approved working order all Mechanical parts of the movable bridge.

Dimensions given on the plans are nominal and intended for guidance. Note any variations from nominal dimensions on the Contract Plans.

Definitions - The definitions below only apply to this Technical Special Provision.

A. Bascule Span: All structural, mechanical and electrical elements of the movable span, including the Bascule Leaf, and all associated trunnion bearings, machinery, power and control systems.

B. Bascule Leaf: The movable portion of the roadway and sidewalk deck and its supporting elements, including the Bascule Girders, floor beams, brackets, barriers, hand rails, roadway deck, sidewalk deck, counterweight, trunnions, and appurtenances which rotate about the trunnion axis during operation.

C. Bascule Girder or Main Girder: The main longitudinal load carrying members of the Bascule Leaf (steel girders).

D. Counterweight: The weight provided to balance the leaf including the steel box, counterweight concrete and associated reinforcing steel.

E. AASHTO Movable Specifications: AASHTO LRFD Movable Highway Bridge Design Specification, 2nd Edition, (2007) with all Interim Revisions.

F. Blend: A smooth transition between surfaces with a slope less than or equal to 1:3.

G. Tight Integration (Well Integrated): The methods, practices, techniques, standards, and procedures by which a seamless hardware, software, electrical, mechanical and structural interfacing of electrical sub-systems, hydraulic sub-systems, mechanical sub-systems and structural components is provided. Tight integration is determined (in part) by the Engineer through submittals, shop testing of complete systems and sub-systems, shop drawings, and incidental items as required by the Engineer. Provide a complete movable bridge system that is reliable, repeatable, and free of anomalies and intermittent operation as determined by the Engineer.

H. Balanced Leaf Condition: The condition where an individual leaf is within the acceptable limits required by the provisions of this Section for maintaining the balance state during construction or the final balance state, as applicable.

I. Unstable Leaf:

1. Condition No. 1 - Tail Heavy: The condition where a leaf is not balanced and the leaf due to the unbalanced condition will rotate to the open position (tail heavy).

2. Condition No. 2 - Tip Heavy: The condition where a leaf is not balanced and the leaf due to the unbalanced condition will rotate to the closed position (tip heavy).

R. Running Condition: Condition where the combination of span position (rotated position) and an unstable leaf condition would result in the span running (rotating) if;

1. The ability of the mechanical drive to sustain load is compromised by disconnected or inoperable fluid circuitry or disconnected or inoperable brakes; and

2. The span is not externally anchored to prevent rotation (tied down).

S. Tie-Down Device:

1. External applied anchoring device that prevents rotation of the span.

2. Applied to resist turning moments because of:

a. Imbalance in counterweighing;

b. Wind loads.

3. Structurally, a tension member, a compression member or combination as applicable to the position of the span and the type of turning moment.

T. Imbalance Moment: Imbalance moment is the moment caused by the eccentricity of the weight of the leaf about the center of rotation of the leaf, excluding trunnion friction.

T468-1.1.2. Integration

Coordinate electrical and mechanical equipment, systems, and sub-systems integration with structural components and disciplines. Variable Speed Drives (VSD), DC Drives, Uninterrupted Power Supplies (UPSs), inclinometers, brakes and gearboxes become the basic critical motion and control system for the leaf. Provide tight integration between all elements of the critical systems as well as with non-critical systems such as Closed-Circuit Television (CCTV) systems.

T468-1.2. Qualifications

Provide the qualifications demonstrating certification of Mechanical Systems Engineer, Supervisory Erector, Supervisory Fabricator, and the Supervisory Millwright as defined in FDOT Specifications Section 105-8.10 Supervisory Personnel-Post-Tensioned and Movable Bridge Structures.

T468-1.2.1. Supervisory Mechanical System Engineer:

Include a Mechanical Systems Engineer, in accordance with FDOT Specifications Section 105 as part of the field crew. Their responsibilities include but are not limited to; attending meetings related to mechanical issues, reviewing mechanical submittals, supervision of mechanical systems field installations, and coordination of mechanical aspects with the structural and electrical.

The Mechanical Systems Engineer must be a registered Professional Engineer licensed in the State of Florida, through examination taken in the mechanical engineering discipline.

T468-1.2.1. Supervisory Millwright

Utilize approved supervisory millwright for the supervision of field alignment and installation of the machinery and other designated work to be provided under the provisions of the Contract Documents: Individual who is a millwright by trade, who will supervise the alignment and installation of the machinery components to be field installed. Supervisory millwright is to have a minimum of ten years of the above stated General Millwright experience.

T468-1.2.3. Millwrights (General):

For field installation and alignment of machinery components and other designated components required under the provisions of the Contract Documents, utilize millwright(s), with a minimum of ten years of experience in the assembly and alignment of Bascule Spans comprised of trunnion bearings and installation of a variety of bearing and housing types and sizes for (1) movable bridges, or (2) machinery of similar size, type and character. Millwright(s) are to be present for the full duration of all field installations.

For alignment and installation procedures for machinery components, have Supervisory Millwright initial all submittals. Millwright: Individual who is a millwright by trade, who will conduct the alignment and installation of the machinery components installed in the field, under the provisions of this Technical Special Provision.

T468-1.2.4. Designated Machinery Manufacturer:

Have an authorized technical representative of the designated machinery manufacturer:

1. Verify and approve the acceptability of field assembly and installation procedures of machinery components.

2. Verify and approve the acceptability of field assembly and installation of machinery components.

3. Provide written report directly to Engineer listing observations, recommendations and acceptability of installations.

T468-1.3. Working Plans and Shop Drawings

Provide Shop Drawings in accordance with FDOT Specifications Section 105. Including but not limited to:

A. Detail and accurately dimension all parts as required by this Contract, indicate limits of accuracy and tolerances required for machining, surface finishes and allowances for fits. Unless otherwise called for, provide the fits and finishes in accordance with ANSI B46.1 and ANSI B4.1.

B. Provide detail and assembly drawings, together with an outline drawing, for all operating machinery and parts required by this Contract and the existing components which furnished components are to be attached to or combined with. Ensure the drawing contains all information necessary for computing the strength of the machinery parts. Provide sufficiently detailed drawings to permit the duplication of the machinery parts by others, including assembly and disassembly instructions. Show the estimated weights of individual parts and total weights of all parts in the details for machinery and castings.

C. Include in submittals for each manufactured item manufacturer's descriptive literature, drawings, diagrams, performance and characteristic curves, and catalog cuts, and include the manufacturer's name, trade name, catalog model or number, nameplate data, size, certified layout dimensions, capacity, specification reference, including ASTM, ANSI, and any other applicable references, and all other information necessary to establish Contract compliance.

D. Provide complete shop bills of materials for all machinery parts furnished by this Contract. If the bills are not shown on the shop drawings, furnish prints of the bills in the same manner as specified for the drawings.

E. State the material and material specifications for each part furnished as required by this Contract. Where ASTM Specifications or any of the Standard Specifications are used, give the designating numbers of such specification.

F. Give each shop drawing a suitable title to describe the parts detailed therein.

G. Where equipment or materials are specified to conform to requirements of the standards of an organization such as American Society of Mechanical Engineers (ASME), Underwriters Laboratories (UL), American Gas Association (AGA), and American Refrigeration Institute (ARI), which use a label or listing as method of indicating compliance, submit proof of such conformance for review. The label or listing of the specified organization will be acceptable evidence. In lieu of the label or listing, submit a certificate from an independent testing organization adequately equipped and competent to perform such services and approved by the Department, stating that the item was tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard or code.

H. As used herein, certified test reports refer to reports of tests conducted on previously manufactured materials, or equipment identical to that proposed for use.

I. As used herein, factory tests refer to tests performed on the actual materials or equipment proposed for use. Submit results of the test in accordance with provisions of the Contract Documents for laboratory test results.

T468-1.3.1. As Built Drawings

As a requirement of functional check-out, furnish complete assembly and as-built drawings as required by this Contract. Indicate identifying marks, match marks and essential dimensions for locating each part or assembled unit with respect to the bridge or equipment foundation. Cross reference every part to the drawing sheet on which it is detailed. Clearly show and detail marks or indentations of any type on the drawings. In general, avoid die stamping or scoring unless otherwise called for on the Contract Documents. Detail all components and assemblies separately to assure correct fabrication, assembly, and erection. Do not use mirror image or opposite hand drawings.

T468-1.4. Construction Requirements

T468-1.4.1. General

Construct in accordance with the Contract documents and the applicable provisions of the AASHTO Movable Bridge Specifications. Where a conflict exists between documents, the requirements of the Plans and this Technical Special Provision governs over those of the AASHTO Movable Bridge Specifications.

Ensure that, unless specified in the Plans or herein, dimensions between machined surfaces have a tolerance of 0.010-inch and machined surfaces have a flatness tolerance of 0.030-inch.

Design and construct temporary members in accordance with the provisions of FDOT Specifications Section 5 as necessary.

Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, furnish printed copies of these recommendations to the Engineer prior to installation. Do not install material until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

T468-1.4.1.1. Notification of Shop Work

Comply with FDOT Specifications Section 5 and 105.

T468-1.4.1.2. Removal and Disposal of Existing Components

Remove and properly dispose of the materials from the existing bridge as shown in the Plans to be removed. Remove at no additional cost, any other appurtenances or obstructions which may be required to remove the component of interest.

Submit a detailed schedule of information notice to the Engineer at least (15) working days prior to the commencement of any demolition of any structures.

Notify the U.S. Coast Guard prior to any demolition work of the existing span locks which may partially or fully block the navigable channel.

For bridges in navigable waters, when constructing the project under authority of a U.S. Coast Guard permit, the U.S. Coast Guard may inspect and approve the work to remove any portion of the existing bridge involved therein, prior to acceptance by the Department.

T468-1.4.2. General Inspection Requirements

T468-1.4.2.1. Final Inspection

Maintain all Work until the Engineer has given final acceptance in accordance with T465-4 Movable Bridge Functional Checkout.

T468-1.4.3. Setting of Machinery on Concrete Structures

Utilize experienced millwrights, with qualifications described herein, to position, install, and make final adjustments to machinery and machinery pedestals installed on concrete structures. Use appropriate means and methods in setting machinery bases and pedestals, such as leveling screws or precision jacks such that the required positioning tolerances are obtained. Use stainless-steel shims between the concrete surface and the machinery or pedestal base for final adjustments. Unless otherwise indicated in the Plans, position all machinery pedestals that are installed prior to aligning the supported machinery to within the following tolerances:

A. Horizontal position: ± 0.031-inch.

B. Vertical Position: ± 0.031-inch.

C. Level (top of machined surface): ± 0.005 inch/foot.

D. Orientation (parallel to Plan centerline): ± 0.20 degrees.

T468-1.4.4. Erection and Testing

A. Erect and assemble machinery in accordance with part numbers and match marks. Adjust all parts for precise alignment by means of stainless-steel shims and pull parts tightly against supporting members by use of clamps, temporary bolts, or other approved means before drilling and reaming holes for connecting bolts. Install all machinery within the specified tolerances and such that satisfactory operation is achieved. In general, the order of assembly and alignment of bridge machinery is to start at the final driven component and work back to the prime mover.

B. Unless approved by the Engineer prior to construction, drill bolt holes in structural steel supports only after alignment of machinery. Fully grout and tension anchor bolts for pedestals prior to aligning machinery.

C. Prior to erection of the machinery components on their structural supports prepare and submit a layout of machinery shim thicknesses for review by the Engineer. Upon concurrence by the Engineer that the layout is acceptable, mark the necessary centerlines on the structural supports if different from those placed during fabrication, install the required thickness of stainless-steel shims, and only then proceed to set the machinery.

D. Drill bolt holes in structural steel for connecting machinery, in general, from the solid after final alignment of the machinery. The use of erection holes, sub drilled 1/4-inch undersize, for temporary bolts, can be used for erection and alignment of the machinery. When the machinery is aligned in its final position, sub drill and ream full-size holes for the remaining bolts, the full-size bolts installed, and the temporary bolts removed.

E. Do not install machinery unless mounting surfaces are clean of dirt, paint and other foreign materials.

F. Securely tighten connecting screws, bolts and nuts to specified torque values after approval of field alignment by the Engineer.

G. Arrange for and have the machinery supplier or manufacturer inspect and approve the complete machinery installation prior to checkout operations for the bridge (i.e., compliance criteria and acceptance tests per this Technical Special Provision or as specified in Shop Drawings). Also, have the machinery supplier observe the testing and trial runs of the equipment.

H. Match mark any components requiring selective assembly for future assembly.

T468-1.4.5. Lubrication of Machinery

Keep maintenance and lubrication manuals for each machinery component in the machinery room in a heavy bound binder. Immediately after erection and before operation, lubricate all rotating and sliding parts and fill all gear housings with the approved lubricants specified on lubrication charts.

Immediately after the completion of fabrication, plug all grease fittings until components are installed and regular lubrication is started.

Supply one grease gun for each type fitting. Do not use more than two sizes of fittings.

Provide standard grease fittings for a pressure system of lubrication for all bearings and surfaces requiring external lubrication. Use the large size wherever possible and use the smaller size for motor bearings and other small devices. Match existing size fitting where possible. Provide pressure fittings rated at a minimum 10,000 psi. Provide fittings with a steel check valve that will receive grease and close against backpressure.

T468-1.4.5.1. Span Locks - Remote Grease Station

Connect grease fittings with tubing and fittings so that grease is introduced directly into the grease grooves for distribution. Tubing is to extend from the guides to convenient lubrication stations located in the same location as existing or as shown on the plans. Tubing shall be 0.54-inch diameter schedule 80 minimum size extra strong, threaded steel pipe and forged threaded fittings installed with vibration dampening stainless steel pipe supports. Provide tubing supports at increments not to exceed 18 inches between supports.

Install on each end, vibration absorbent braided stainless steel hose, 8-inch minimum length, between the pipe and the component lubricated on span lock components or other components subject to vibration or impact. Install the remote grease fitting on a new structural mount identical to the existing or as detailed in the plans such that the fitting is easily accessed but is also recessed below any potential loads that may impact the fitting. After erection but prior to operation, purge the tubing and flexible lines of any air using the same type of grease outlined in the lubrication charts.

T468-1.4.5.2. Enclosed Gear Reducer

Meet the requirements of AGMA Standard 9005 "Lubrication of Industrial Gear Drives." Provide lubricants manufactured by a reputable and knowledgeable supplier of lubrication and as recommended by the reducer manufacturer. The lubricant should contain oxidation inhibitors, rust inhibitors, anti-foaming agents, and anti-wear additives. Follow recommendations of both the reducer manufacturer and the lubricant manufacturer with respect to maintenance of the lubricant, method of application, and re-lubrication intervals.

T468-1.4.5.3. Open Gearing

Provide open gear lubricant that bonds strongly to gear teeth to maintain a continuous film on bearing surfaces despite high loading and high load repetition, contains an Extreme Pressure (EP) additive, repels water, resists throw-off and dripping, maintains consistency over wide temperature variations, and allows for ease in application and removal. Provide lubricant that has an operating range of 0°F to 210°F and is considered a heavy bodied, adhesive type open gear lubricant by its reputable lubricant manufacturer. (Note: Some adhesive lubricants are available in a diluted form for ease of application. This type of lubricant is diluted with solvent that quickly evaporates after application leaving behind an adhesive tacky film. If such a lubricant is desired, the solvent must be non-flammable and the mixture must not pose any hazard to health). The detailed specifications for open gear lubricants that satisfy the above requirements vary.

Lubricant to Use: Unleaded, non-diluent type, non-chlorinated open gear grease, SUS 7,000 at 100°F viscosity, water resistant, anti-wear/extreme pressure.

T468-1.4.5.4. Lubricant Stock

Furnish the bridge with an appropriate amount of proper lubricant. Store the lubricant in steel containers at room temperature. Store, at the site, the following amounts of additional lubricant (turn over to the Department any unused lubricant):

a. Gear Reducer Oil - 10% of the total reducer fill volume
b. Open Gear Grease - 50 pounds
c. Bearing Grease - 50 pounds
d. Grid Coupling Lubricant - 25 pounds
e. Gear Coupling Lubricant - 25 pounds

Keep the lubricant for each type of machinery component separately in clearly marked containers. Take all measures necessary to prevent lubricant contamination.

T468-1.4.6. Painting of Machinery

Clean and paint all unfinished surfaces of machinery and equipment in accordance with FDOT Specifications Section 560, Section 975, and as shown in the Plans.

T468-1.4.6.1. Surface Preparation

Ensure all surfaces to be coated are clean, dry, and free from oil, grease, dirt, dust, soluble salts, corrosion, peeling coating, caulking, weld spatter, mill scale and any other surface contaminants. Prepare all surfaces that will become inaccessible after fabrication, erection, or installation while accessible. Sequence the surface preparations and coating operations so that freshly applied coatings will not be contaminated by dust or foreign matter. Protect all equipment and adjacent surfaces not to be coated from surface preparation operations. Protect working mechanisms against intrusion of abrasive. In the event rusting or contamination occurs after the completion of the surface preparation, clean the surfaces again to the initial requirements.

All corners resulting from sawing, burning, or shearing operations must be broken. Clean all welds and prepare the area within 2 inches of welds by blast cleaning, power wire brushing, water scrubbing, or chemically scrubbing to remove all detrimental welding deposits and to create a surface profile meeting the coating manufacture requirements.

Degrease by solvent cleaning, detergent washing, or steam cleaning in accordance with SSPC-SP 1. Water wash existing components if levels of chloride or other undesirable contaminants are present on the surfaces. Water wash using standard industrial pressure cleaners with a pressure versus volume output balance that will ensure thorough cleaning.

Prepare non-contact finished surfaces, such as the sides of rack and pinion teeth, trunnion shafts between shoulder and hub, coupling housings, shafts other than journals, hub rings and hubs for painting with abrasive blasting to "Near-White" metal condition as defined in SSPC-SP 10. Determine "Near-White" condition according to NACE Visual Standard No. 2. Ensure all rust is completely removed from pits and depressions. Remove all abrasive residues from the surface, leaving it clean and dry prior to the application of coatings. After blast cleaning, ensure the surface profile meets the coating manufacturer's requirements. Perform all abrasive blasting within a containment system to ensure confinement of all particulates. Design the containment system to comply with all applicable Federal, State, and Local regulations. Ensure the blasting operations does not produce holes, cause distortion, remove metal, or cause thinning of the substrate.

Any damage to equipment, seals, bearings, or other components which would adversely be affected by sand intrusion, caused by the failure of contractor to properly protect during sand blasting, shall be replaced at no additional cost to the department. Reducer oil shall be tested for silicone to assure no sand intrusion occurred during blasting.

Install span lock bronze wear plates and grease after blast and paint operations. Any grease present during sand blast operations shall be replaced at no additional cost to the department. Photograph exterior of reducer input and output shaft seals before and after sand blasting, but before painting. Submit for review prior to functional checkout.

T468-1.4.6.2. Weather and Temperature Limitations for Coating Application

Provide with paint coating shop submittal, the manufacturer's weather and temperature data contained within the application instructions which clearly outlines the limits of the ambient air temperature, relative humidity, dew point, and the surface temperature of the steel to be coated. Do not spray coating except while within these limits and when the measured wind speed is less than 15 miles per hour.

T468-1.4.6.3. Application of Coatings

Mix in accordance with the manufacturer recommendations. Perform all mixing operations over an impervious surface with provisions to prevent runoff to grade of any spilled material. Ensure the material is agitated as required by the manufacturer's technical data requirements during application to maintain uniform suspension of solids.

Train all coating personnel on the proper mixing and application of the coatings, Specification requirements, material application characteristics, and inspection criteria. Only personnel receiving this training may mix or apply coatings. Use thinners and cleaners according to coating Manufacturer's technical data requirements. Coating that lifts or curls after application must be removed and the area cleaned and recoated, at no additional cost to the Department.

Paint with a three-coat system consisting of two coats of aluminum epoxy mastic primer and a finish coat of aliphatic polyurethane. Apply the finish coat to weldments, bearing housings, enclosed gear boxes and other machinery as much as possible in the shop after fabrication.

After erection is complete, thoroughly clean with benzene and give intermediate coats of paint to all machinery surfaces remaining exposed, except rubbing surfaces and mating surfaces of gear teeth.

After completing the operating tests and acceptance of the machinery, wash with benzene or other approved solvent all accumulated oil, grease, dirt, and other foreign matter from exposed machinery surfaces, except rubbing surfaces and mating surfaces of gear teeth. Give the exposed surfaces a final field coat. Provide paint for the final field coat high-gloss enamel compatible with the intermediate coats and the following colors:

A. Federal Safety Blue - for all fixed parts of the machinery, such as reducers, weldments, housings, and motors.

B. Federal Safety Red - except rubbing surfaces, for all moving parts of the machinery, such as shafting, couplings, brakes, machinery guards, hydraulic cylinders, live load shoes, and load shoe masonry plates.

C. Federal Safety Yellow - non-corrosion resistant hydraulic power unit manifolds and support components, machinery guarding, and handrails.

Paint the other supporting steel with final field coat to match the structural steel. Do not paint stainless steel elements of hydraulic power unit assemblies, including support structure, reservoir, and drip pan unless approved by the Engineer. Do not paint the Lexan glass trunnion shield.

T468-1.4.6.4. Protection of adjacent surfaces

Protect all surfaces and working mechanisms not intended to be coated, during the application of coatings. Clean surfaces that have been contaminated with coatings until all traces of the coating has been removed. Do not allow material from cleaning and coating operations to be dispersed outside the work site.

Ensure all nameplates on machinery elements are readable, clean, and free of all paint before acceptance of the machinery.

T468-1.4.7. Protection for Shipment

A. Clean machinery parts of dirt, chips, grit, and all other injurious materials prior to shipping and coat with corrosion-inhibiting preservative.

B. Coat all finished metal surfaces, not to be painted, as soon as practical after machining with a temporary protective coating that prevents oxidation. Coat non-stainless component parts or surfaces with a temporary protective coating that prevents oxidation prior to shipment, wipe clean before installation. Completely protect machinery parts from weather, dirt and foreign materials during manufacture and store indoors while awaiting erection. Grease exposed shaft journals or coat with the oxidation preventative coating, wrap in oil-soaked burlap and securely timber lag for shipment. Any solvent used to clean a journal prior to assembly must be completely removed from the shaft and bearing prior to assembly. Assembled units - including bearings, lock bar operators and other devices having finished mounting surfaces will have those surfaces thoroughly coated with a temporary protective coating that prevents oxidation and skid or crate for protection during handling, shipment and storage.

C. Reapply any coating removed for the installation or erection of equipment as soon as practical until it is removed for the application of paint or installation into a lubricated assembly.

D. Coat, as soon as practical after finishing, all finished metal surfaces and unpainted metal surfaces that would be damaged by corrosion with a rust-inhibiting preservative. Except for unfinished metal surfaces inside of gear reducers, remove this coating from operation and from all surfaces prior to painting and after erection.

E. Coat any interface between stainless steel or aluminum and structural steel with zinc-chromate primer prior to assembly.

F. Completely protect machinery parts from weather, dirt, and all other injurious conditions during manufacture, shipment, and while awaiting erection.

G. Protect shaft journals that are shipped disassembled from their bearings during shipment and before erection by a packing of oil-soaked waste secured in place by burlap and covered with heavy metal thimbles or heavy timber lagging securely attached. Take every precaution to ensure that the bearing surfaces are not damaged and that all parts arrive at their destination in satisfactory condition.

H. Mount assembled units on skids or otherwise crate for protection during handling and shipment.

I. Bag and crate mounting hardware and other small parts for shipment. Provide wire tags, indicating the part number, and attach to each part prior to shipment.

T468-1.5. Fasteners

T468-1.5.1. General

A. Clean all contact surfaces of structural steel to be bolted together in accordance with this Technical Special Provision before bolting.

B. Spot face bolt holes through unfinished surfaces for both the head and the nut, square with the axis of the hole.

C. Unless otherwise indicated in the Plans, drill bolt holes in machinery parts for connection to supporting steelwork in the shop a minimum of 1/4-inch diameter smaller than the finished bolt diameter or drill from solid at assembly. Drill and ream for the required fit at final assembly.

D. Drill or ream-assemble all elements connected by bolts to assure accurate alignment of the hole and accurate clearance over the entire length of the bolt within the specified limits.

E. Ream or drill holes in stainless-steel shims and fills for machinery parts to the same tolerances as that of the connected parts at final assembly.

F. Furnish and install positive locks, of an approved type, for all nuts except those on High Strength Bolts. High-strength bolts and nuts if fully torqued per AASHTO Standards are self-locking and need no additional locking devices. If double nuts are used, use for all connections requiring occasional opening or adjustment. Provide lock washers made of tempered steel if used for securing.

G. Do not use different size bolts when connecting components (i.e., gearbox to pedestal, bearing to pedestal). If a hole is over drilled requiring a bigger bolt, then furnish all bolts of the bigger size.

H. Provide bolt heads, nuts, castle nuts, and hexagonal head cap screws dimensioned in accordance with ANSI B18.2.1, Hexagon Bolts and ANSI B18.2.2 Nuts.

I. Use nuts that conform to ASTM A563 or A194, Grade DH or 2H, heavy hex series.

J. Ensure the dimensions of socket-head cap screws, socket flathead cap screws, and socket-set screws conform to ANSI B18.3. Provide screws made of heat-treated alloy steel, cadmium-plated, and furnished with a self-locking nylon pellet embedded in the threaded section. Unless otherwise called for on the Plans or specified herein, provide setscrews of the headless safety type with threads of coarse thread series and cup points. Do not use setscrews to transmit torsion nor as the fastening or stop for any equipment that contributes to the stability or operation of the bridge.

K. Unless otherwise noted on the Contract Drawings, all threads for bolts, nuts, and cap screws must conform to the coarse thread series and have a Class 2 tolerance for bolts and nuts or Class 2A tolerance for bolts and Class 2B tolerance for nuts in accordance with the ANSI B1.1, “Unified Screw Threads.”

L. Coat the threads of all mounting bolts with anti-seize compound before assembly of the nuts to prevent corrosion or galling and to facilitate future removal if necessary.

M. Provide, on site, a set of micrometers and bore micrometers capable of measuring bolt and bore diameters. Check that bolt clearances meet the requirements of AASHTO before assembly.

T468-1.5.2. Material - Machinery Parts to Each Other and to Steel Supports

Provide all bolts for connecting machinery parts to each other and to supporting members as shown in the Contract Documents and conform to one of the following types:

1. High-strength bolts.
2. High-strength turned bolts, turned cap screws, and turned studs.

T468-1.5.2.1. High Strength Bolts

All high strength bolts shown on the mechanical drawings are machinery fit unless otherwise noted. Ensure all high strength bolts meet the requirements of ASTM A449. Use only high strength bolts with hexagonal heads. Ream holes for machinery fasteners to 1/32-inches larger than for nominal bolt diameters less than 1-inch, and 1/16-inch for fasteners 1-inch diameter or larger.

Ensure that all Structural Fit high strength bolts have a maximum clearance of 1/16-inch between the bolt shank and hole. Connect both Machinery Fit and Structural Fit high strength bolts using nuts meeting the requirements of ASTM A563 Grade DH or DH3 and installed with a hardened plain washer meeting ASTM F436 at each end.

Install, wherever possible, high-strength bolts connecting machinery components to structural elements or to other machinery components comprised of different thicknesses so that the bolt head is adjacent to the connected element with the least thickness.

T468-1.5.2.2. High Strength Turned Bolts, Turned Cap Screws, and Turned Studs.

Furnish turned bolts, turned cap screws, and turned studs with turned shanks and cut threads manufactured from ASTM F3125 Grade A325. Furnish turned bolts with semi-finished, washer-faced, hexagonal heads and nuts. Ensure all finished shanks of turned fasteners are 0.060-inch larger in diameter than the diameter of the thread, which determines the head and nut dimensions. Ensure the shanks of all turned fasteners have a LC6 fit in the finished holes in accordance with ANSI B4.1.

Provide heavy hex series heads and nuts for turned bolts, screws, and studs.

Unless otherwise indicated in the Plans, drill bolt holes in steelwork for turned bolts from solid at assembly or erection after proper alignment. Do not pre-drill holes full size prior to final assembly.

T468-1.5.3. Miscellaneous Fasteners and Hardware

Unless otherwise specified or shown in the Plans, provide all miscellaneous fasteners and hardware, including cotter pins and lock wire of stainless steel, Type 316.

A. Dowel Pins: Unless otherwise specified or shown in the Plans, provide dowel pins in accordance with ANSI B 18.8.2. Provide unhardened dowel pins with minimum shear strength of 64 ksi.

B. Where Grade 8 bolts are called out in the Plans, use matching nuts and washers for the assembly.

C. Eye Bolts: Provide eye bolts per ASTM A489, Type 2 - shoulder pattern, Style B, and dimensioned in accordance with ANSI/ASME B18.15. Eye bolts are specified by the bolt shank diameter.

D. Provide cotters that conform to SAE standard dimensions and are made of half-round stainless-steel wire, ASTM A276, Type 316.

T468-1.5.4. Construction Requirements

A. Except as noted herein or in the Plans, tension ASTM F3125 GRADE A325 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 1-1/2-inch in accordance with the Bolted Connection requirements of the ASTM Specifications.

B. Tension turned bolts smaller than 1-1/2-inch (nominal thread diameter) by turning the nut 1/4 turn past snug tight and adding a backing nut (double nuts) turned snug tight unless otherwise noted in the Plans. If the Plans require tensioning a turned bolt larger than 1-1/2-inch, hydraulically tension the bolt as indicated herein.

C. Preload for High Strength SAE Bolts and Studs: Tension bolts, cap screws and other threaded fasteners as follows:

For permanent connections: $F_t = 0.75 \times A_t \times S_p$

Where: F_t = fastener preload
A_t = tensile area of the fastener
S_p = fastener proof strength

Preload may be applied by direct hydraulic tensioning or torque. Where using torque calculate it as follows:

$T = K \times F_t \times d$

Where: T = required wrench torque applied to fastener
K = constant dependent upon bolt size, material and lubrication
d = nominal fastener diameter

For mild-steel fasteners use an average value of K = 0.2 for dry assembly. For lubricated assembly use K = 0.18.

D. Hydraulic Tensioning: Hydraulically tension pre-tensioned Anchor Bolts, including Undercut Anchors, anchored into concrete and high strength bolts whose length exceeds 12 bolt diameters. Provide additional bolt length as required to perform hydraulic tensioning. The following requirements apply to hydraulically tensioned bolts:

1. Bolts must have a grip exceeding 12-inch or 12 bolt-diameters, whichever is greater.

2. Tension pre-tensioned anchor bolts embedded into concrete by use of the following procedures:

a. Tension all bolts anchoring any one component during the same day unless otherwise permitted in the Contract Documents.

b. Tension all bolts sufficiently to set them. Use the minimum setting load specified by the bolt manufacturer.

c. Snug the nut down prior to releasing the hydraulic pressure to the ram. Perform final tensioning after all bolts are set and the machinery base aligned. Tension all bolts using a center hole calibrated hydraulic ram. Mount the ram on a chair that permits access to the anchor bolt nut. If the Plans require a turned bolt larger than 1-1/2-inch to be tensioned but do not specify a preload value, tension the bolt to 70% of the minimum tensile strength of the bolt, using the nominal area of the threaded section. Tension bolts to 70% of the specified minimum tensile strength of the bolt or the anchor bolt manufacturer's recommendation, whichever is greater, unless otherwise indicated in the Contract documents.

d. Check the preload just after installation and again 60 days later. Apply hydraulic tension. Ensure the bolts have a tension equal to 60% of the minimum specified tensile load applied. Ensure there is no movement of the nut under this load.

e. If the preload test fails, re-tension the bolts to original tensioning values and retighten the nut.

E. Install primary nuts of epoxy anchors to 1/4 turn past snug tight condition and double nut, unless otherwise noted in the Plans.

T468-1.5.4.1. Field Installation of Fasteners

A. Torque ASTM A449 bolts to the same tension required for ASTM F3125 Grade A325 bolts in structural steel as required by ASTM. Tighten all bolts by the turn-of-the nut method. Torque all fasteners to 75% of their yield strength to provide adequate preload and to extend their fatigue life. Use the torque table below. The table is based on their yield strength of the various bolts specified in the mechanical items.

Table 1
Torque Table for Various Bolts
(values in ft-lbs)

Bolt Size	F3125 Machine Oil	F3125 Copper anti-seize	A449 Machine Oil	A449 Copper anti-seize
1/2 - 13 UNC	85	55	85	55
3/4 - 10 UNC	295	185	295	185
7/8 - 9 UNC	475	300	475	300
1 - 8 UNC	630	395	630	395
1 1/4 - 7 UNC	1260	795	1260	795
2 - 4 UNC	NA	NA	2130*	1340*

NOTE: Torque values in this table generate stresses in the bolts equal to 75% of their minimum rated yield strength, and were rounded to the nearest 5 ft-lbs. The average nut factor coefficient for machine oil as a thread lubricant was taken as 0.21; for copper anti-seize thread lubricants, 0.123.

NA = bolts not available in this size

*For bolts or shafts of 2-inches or more in diameter, only 40% of yield strength is recommended, due to the difficulty of applying such a large torque and because of the depth of the threads.

B. Assemble and erect all parts of the machinery in accordance with erection marks and match marks. Before final drilling or reaming, precisely adjust all parts for correct alignment by means of stainless-steel shims or collars furnished for each part and securely clamped. Ensure that after final alignment and bolting, all parts operate smoothly, quietly, and without vibration.

C. Drill bolt holes in supporting structural steel for connecting machinery bases from solid metal after final alignment of the machinery unless otherwise indicated on the Contract Drawings. Erection holes, sub drilled 1/4 inches undersize for undersize temporary bolts, may be used for erection and alignment of the machinery. When the machinery is aligned in its final position, drill and ream full size the undersize holes used for temporary bolts and install full-size bolts to complete the installation.

D. Ensure all surfaces in contact with bolt heads and nuts are clean and free of grease and paint.

E. After erection is complete and prior to the Contractor's inspection, lubricate all machinery components with the lubricants listed on the lubrication charts.

F. Perform the initial application of lubricant at machinery installation and all subsequent lubrication applications required prior to turning over the bridge to the Department.

T468-1.6. Welding and Weldments

T468-1.6.1. General

A. Unless otherwise noted herein or in the plans, perform all welding in accordance with AASHTO, AWS D1.5 Bridge Welding Code, and FDOT Specifications Sections 460 & 965. Unless otherwise noted, herein or in the plans, treat all welded machinery and weldments that support machinery as main members, all welds as subject to tension or stress reversal, and all welds as joining primary components. Do not perform field welding on these elements unless specifically required in the Contract Documents or unless the Engineer has approved a shop drawing detailing the weld and the corresponding weld procedure to be used.

B. Inspect all weldments utilizing non-destructive tests (i.e., via dye penetrant checks supported by Ultrasonic Testing or Radiographical Testing as required by ASHTO, AWS D1.5 Bridge Welding Code, and the Contract Documents.

C. Unless otherwise specifically stated, stress relieving is required for welded machinery parts prior to final machining. Do not machine components until after welding and stress relieving.

T468-1.6.2. Materials

A. Include a certified copy of a test report showing the chemical composition of the specific steel piece(s) to be welded in any welding procedure involving attachment to existing steelwork. Consider this chemical composition in the welding procedure.

B. Ensure all welding required or designated by the Contract Documents and the shop drawings conforms to the appropriate AASHTO and American Welding Society (AWS) Specifications for the material being welded.

C. Ensure the fitting up and welding procedure is such that distortion of the work will be minimum. If necessary to obtain this result, use suitable fixed welding fixtures, evenly distribute welds in a balanced fashion around the perimeter or alternate sides, use pre-heat, or assure that the magnitude of any distortion may be remedied with the subsequent stress relief and machining.

T468-1.6.3. Construction Requirements

A. Provide a pair of lifting eye bolts either drilled and tapped into the weldment or through bolted in a weldment plate for lifting and handling. Provide lugs with a minimum working capacity of 2 times the weight of the weldment.

B. Provide leveling screws drilled and tapped through the weldment base plate for field leveling. Use leveling screws with adequate capacity to support the weldment and any other construction loads anticipated to be applied prior to grouting under the base plate. After installation of grout and prior to tensioning anchor bolts, remove leveling screws. Grease the leveling screws and reinstall them in the taped holes to a snug tight condition.

C. Perform coupon testing and provide a certified copy of test reports prior to any welding procedure involving attachment to existing steelwork. Provide report showing the chemical composition of the specific steel piece(s) to be welded. Design a weld procedure specific to this chemical composition.

D. Groove welds to be complete joint penetration groove welds (CJP).

E. Do not paint welded components until welds are inspected and approved.

F. Unless otherwise shown in the Plans, connect elements of weldments 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.

G. Stress relieve weldments after welding and prior to final machining. Unless otherwise shown in the Plans, finish machined surfaces of weldments to flatness as required herein and finish machinery bearing surfaces parallel to each other and to the bottom of the base plate. Machine finish the height of the weldments supporting machinery, on stainless-steel shims, as measured from the bottom of the base plate to the top of the bearing surface, to Plan height plus or minus 1/8 inch. Grind all exposed edges of weldments to a chamfer or radius to eliminate sharp edges and burrs. Ensure that weldment base plates, placed against concrete or grout, have 3/4-inch minimum radii on the corners.

H. Thoroughly coat finished mounting surfaces with an approved temporary protective coating that prevents oxidation and are skidded or crated for protection during handling, shipment and storage. Unless the weldment is galvanized and after weldment is accepted by the Engineer, prime base surfaces which will have concrete or grout cast against them, but do not finish coat them.

I. Where galvanizing of weldments is required, hot dip galvanize in accordance with ASTM A123. Provide lifting lugs and vent holes as needed for the galvanizing process. Mask surfaces to be machined as required.

T468-2. MISCELLANEOUS MATERIALS AND EQUIPMENT

T468-2.1. Material

Material Compatibility: Provide products that are compatible with other products of the mechanical work, and with other work that requires interface with the mechanical work, including mechanical, electrical, or structural connections and control devices.

Nameplates: Provide each piece of mechanical equipment and apparatus produced under this Contract with a permanent, corrosion-resisting metal nameplate stamped with the name of the manufacturer, the catalog or model number, and the rating or capacity of the equipment or apparatus.

Shop Inspection and Testing: Comply with the requirements of FDOT Specifications Section 5, 6, and 105.

Use materials that conform to the current ASTM specifications. An alternative material may be requested in writing; the request must provide complete data justifying suitability of the alternate materials and must be approved by the Engineer prior to initiating fabrication or construction.

Furnish, for each major component of equipment required by this Contract, the manufacturer’s name and address and the model and serial number on a nameplate securely affixed in a conspicuous place.

T468-2.1.1. Shaft Journals

Turn journal bearing areas on shafts and pins and polish with no trace of tool marks or scratches on the journal surface, and no step between the journal surface and fillet. Provide running fits between journals and bearings, in accordance with ANSI Class RC6.

T468-2.1.2. Hubs and Bores

Finish and polish both face of the hubs of all gears, wheels, and couplings where the hub face performs the function of a collar to prevent shaft movement. Bore the hubs concentric with the rims of gears and wheels or with the outside of the couplings. Fit all hubs on shafts to provide an ANSI B4.1 Class FN2 medium drive fit, unless otherwise specified.

T468-2.1.3 Keys and Keyways

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

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

T468-2.1.4. Flexible Couplings

A. Connect electric motors to machinery components using grid-type, self-aligning, fully flexible, torsional flexible couplings unless otherwise indicated in the Contract Documents.

B. Other than for connecting electric motors to machinery components, provide all metal, flexible, positive engagement gear type couplings, unless otherwise indicated in the Contract Documents, capable of accommodating misalignment between the shafts without introducing bending into the shafts, and with provisions for introducing lubricant to all contact surfaces.

C. Provide manufacturer-machined couplings that are finish-bored and with keyways cut to limits specified on the shop drawings. Install coupling halves on reducer shafts and other shafts as per the coupling manufacturer's installation instructions. Provide coupling-shaft fits that conform to ANSI B4.1, preferred FN2 medium drive fit.

D. Use gear-type, self-aligning, full-flexible couplings or semi-flexible couplings with floating shafts to connect all machinery components, except where other types of couplings are called for on the drawings. Provide couplings with shrouded bolts.

E. Use gear-type couplings made of forged steel, with curved face teeth, and provision for at least a ± ¾° misalignment per gear mesh.

F. Use grid-type couplings, self-aligning, flexible (in bending and torsion) to connect electric motors to machinery components.

G. Provide grid-type couplings with steel hubs, alloy steel grids, and steel or aluminum covers. Provide shrouded cover bolts and design with a horizontal split housing.

H. Provide couplings that are standard products of an established manufacturer.

I. Provide machined coupling hub boring, including key ways, to the required size and tolerances.

J. Ship each hub to the proper location for installation on its shaft by the manufacturer of the connected component.

K. Provide special couplings as shown on the Plans.

T468-2.1.5. Non-Shrink Epoxy Leveling Grout

Use a Non-Shrink Epoxy Leveling Grout where required for chocking, leveling and supporting equipment. Use a Non-Shrink Epoxy Leveling Grout that is a two component, pourable, epoxy-based grouting compound manufactured for use in severe applications. Use Non-Shrink Epoxy Leveling Grout manufactured for use in a thickness range shown in the Plans or detailed in approved shop drawings for each application.

Use Non-Shrink Epoxy Leveling Grout having the following minimum properties:

Minimum Compressive Strength: 19,000 PSI
Maximum Linear Shrinkage: 0.0002 in/in
Minimum Tensile Strength: 4,970 PSI
Fire Resistance: Self Extinguishing

Store, mix, place, and finish Epoxy Leveling Grout in strict accordance with the Manufacturer's recommendations.

T468-2.1.6. Shims

Provide type 316 stainless steel, full depth shim packs, drilled for all bolts that pass through, trim to the dimensions of the assembled unit. Shim material shall be ASTM A36 for ½" and over and Type 316 stainless steel for shims under ½" thickness. Thin brass precision thickness shims may be used for final adjustment. Unless otherwise indicated in the Plans, provide shim pack containing shims of decreasing thickness from full depth down to 0.010-inch, plus 2-0.005-inch shims. For example, a 0.5-inch shim pack would consist of the following shim thickness 0.500, 0.250, 0.125, 0.060 (or 16 Ga.), 0.040 (or 20 Ga.), 0.020 (or 26 Ga.), 0.010 (or 30 Ga.), 2-0.005-inch for a total of 9 shims.

Show and fully dimension shims as details on the shop drawings. Do not use shims with open sided or U-shaped holes for bolts unless otherwise noted. Ensure no shims have less than two holes for bolts.

Provide full tapered shims, if required to obtain the specified alignment tolerances, at no additional cost.

Neatly assemble shims not installed after final alignment, tag with the part number from the approved shop drawing and turn over to the Department for future use.

Do not use resins in lieu of shims.

T468-2.2. Construction Requirements

Structural Steel: Unless otherwise noted, construct structural steel fabrications in accordance with the provisions of FDOT Specification Section 460.

Concrete: Unless otherwise noted, construct concrete works in accordance with the provisions of FDOT Specification Section 400.

Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, furnish printed copies of these recommendations to the Engineer prior to installation. Do not install material until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

T468-2.2.1. Shop Assembly Operations

Shop assemble machinery components to verify their correct fit prior to shipment. Disassemble components not mounted in a common base for shipment. Match mark any components requiring selective assembly for future assembly.

T468-2.2.2. Erection and Testing

See Basic Mechanical Requirements in this Technical Special Provision T468-1.4.4 Erection and Testing.

T468-2.2.3. Machinery Guards

Provide machinery guards for all moving parts readily accessible to personnel including but not restricted to the following:

A. Couplings (Drive Machinery)
B. Unused shaft extensions
C. Shafts at platform and roadway level
D. Brakes

Machinery guards are not required for the rack segments. Construct machinery guards to comply with the applicable requirements of ANSI B 15.1, Safety Standard for Mechanical Power Transmission Apparatus.

Unless otherwise indicated or specified, construct all machinery guards of Type 316 stainless steel having minimum thickness of No. 12 gage and with provision for removal without requiring disassembly of any machinery component.

Provide machinery guards with removable hinged or bolted covers for access to lubrication fittings enclosed by the guard. Provide phenolic nameplates on these covers with lubrication instructions.

T468-2.2.4. Spare Parts and Tools

Provide the following spare parts and tools to the Department, along with all spare parts required in this Technical Special Provision.

A. Two drop forged steel wrenches for each size fastener installed during this contract.

B. One spare pressure gage for the reducer lubrication system packaged in moisture-proof packaging inside a wooden box clearly labeled in 2-inch tall lettering the contents.

C. One spare pressure switch for the reducer lubrication system packaged in moisture-proof packaging inside a wooden box clearly labeled in 2-inch tall lettering the contents.

D. One lube system pumps re-build kit in original moisture-proof packaging packed inside a wooden box clearly labeled on the exterior of the box in 2-inch tall lettering the contents.

E. Four spare vertical bronze wear plates for the span mounted guide machined to the same final dimensions as the installed plates packaged inside a wooden box with the contents labeled clearly in 2-inch tall lettering. Provide spare precision shim packs coated or submersed in anti-corrosion protection packaged in moisture-proof container zip-tied to the spare wear plates.

F. Two spare bronze wear plates for the pier mounted guide machined to the same final dimensions at the installed plates packaged inside a wooden box with the contents labeled clearly in 2-inch tall lettering. Provide spare precision shim packs coated or submersed in anti-corrosion protection packaged in moisture-proof container zip-tied to the spare wear plates.

G. One permanent storage cabinet. Provide heavy-duty storage cabinet of minimum 36 x 24 x 78-inch size steel frame with 16 gage minimum thickness and 22 gage minimum thickness sides, doors and shelves. Provide cabinet with a minimum of four shelves, hinged doors and locking handle or heavy-duty padlocks and hasps. Install one cabinet in the bascule pier at a location determined by the Engineer. Submit a list of all bolt, screw, and nut sizes to the Engineer along with the name, size, type, and manufacturer of the wrenches to be provided for review. Provide in each set, a wrench for each size and type of bolt, screw, or nut including any special hardware required as part of the Contract. Do not provide adjustable wrenches which fit more than one size bolt, screw, nut, or other item of hardware. Store all of the spare parts properly crated and labeled inside the storage cabinet.

Deliver all spare parts, tools and supplies, including any required by other Articles to the machinery room storage area at the bridge. Spare parts and tools are considered incidental to the component and pay-item to which they apply.

T468-3. SPAN DRIVE MACHINERY - SPEED REDUCER

T468-3.1. Description

This section applies to the work associated with the span drive speed reducer. Currently the split line of the speed reducer housing leaks and the pressurized lube system needs to be replaced. Hoist the top half of the speed reducer housing splitting open the reducer, drain existing lubricant and properly dispose, remove and replace the existing leaking split line seal, flush reducer with new oil per manufacturer's recommendations, re-fill the reducer with new lubricant, test new lube system, replace in kind existing fasteners and turned studs in reducer housing with high strength turned bolts and studs, and re-install top half of reducer housing per manufacturer's recommendations. Replace in kind the desiccant breather and the lube system suction strainer. Replace in kind or install new neodymium rare earth magnets inside the reducer housing. Blast and paint reducer housing ensuring that split line seal is protected from damage. Protect and do not paint the new lube system piping and valving.

The scope of this work also includes the removal and replacement in kind of the lube system including but not limited to the lube pumps, electric motors, hydraulic piping, suction strainer, gate valves, check valves, pressure gauges, pressure switches and remote alarm contacts (See TSP 508 for additional details). Remove and properly discard existing system and replace in kind the redundant pressurized lubrication system provided by the speed reducer manufacturer. Consult manufacturer for installation instructions and testing recommendations.

Do not paint the new stainless-steel pressurized lubrication system piping, valves, or pumps.

T468-3.2. Materials

A. Lubrication: Provide new gear oil as specified by the existing lubrication charts to fill the speed reducers. Speed reducers are to have provisions for oil expansion due to churning and temperature change. Provide lubricant meeting viscosity and other requirements of ANSI/AGMA 9005-E02, Industrial Gear Lubrication.

B. Desiccant Breather: Provide breathers that are moisture trap, desiccant types with a color indicator to show the desiccant moisture state.

C. Gaskets: Replace in kind case seal gaskets according to the original manufacturer's specifications.

D. Hydraulic Pumps: Remove and replace (2) existing Tuthill Close Coupled Lube Pumps model 015 mounted on the side of the speed reducer housing after approved by the Engineer.

E. Lube Piping: Consult manufacturer and existing installation for existing piping sizes, specifications, and installation routing. Confirm the suction piping is 1" Schedule 80 Extra Heavy stainless steel 304 pipe and fittings and the pressure piping is 3/4" Schedule 80 Extra Heavy stainless steel 304 pipe and fittings. Provide and install fittings and elbows as necessary to route the piping from the existing suction inlet, to the new pumps, and to the discharge fitting on the top of the reducer.

F. Gate Valves: Gate valves of stainless-steel construction the same inside diameter as the existing hydraulic piping. Provide gate valves such that either pump may be isolated and removed while the remaining pump remains operational.

G. Check Valves: Provide and install a check valve in system such that lube oil will be trapped in lube system when pumps are powered off. This fluid will assure that the pumps remain primed. Check valve shall be at minimum the diameter of the adjoining pipe to minimize pressure drop.

H. Pressure Gauges: Replace in kind the existing pressure gauges of stainless-steel construction.

I. Pressure switch and remote alarm contact: Replace in kind the pressure switch and remote alarm timer and relay. See Technical Special Provision T508 for additional details.

J. Suction Strainer: Provide and install a suction strainer located inside the reducer on the lube system suction line. Confirm with lube pump manufacturer that cavitation will not occur and their recommended stainless-steel mesh size. If the lube pump manufacturer no longer recommends a suction line strainer, remove the existing suction strainer and install an in-line pressure filter with a pilot to open check valve bypass on the top exterior of the reducer.

K. Gear Oil Fluid Sample: Once the reducer scope of work has been completed and the span operated at least 5 operations, collect a fluid sample for a baseline fluid analysis.

L. Neodymium Magnet (Rare Earth) – Confirm with the speed reducer manufacturer the existing magnet type, size, and mounting location and replace in kind. If magnets are not currently installed inside of the reducer or if the existing magnets are not accessible, provide new rare earth magnets of the machinable type below the normal oil level inside the speed reducer in order to accumulate metal shavings out of solution. Provide at minimum two magnets with a total of 12 in^2 of surface area with a minimum 35 pounds of magnetic pull. Machine a single hole through the center of the magnet for permanent installation with a mounting bolt. Locate magnet in a location furthest away from the rotating machinery below the normal oil level. Equally distribute the magnets around the perimeter of the reducer.

T468-3.3. Construction Requirements

T468-3.3.1. Submittals

A. Submit shop drawings to the Engineer, showing interface with other equipment and including the following:

1. Main drive speed reducer with callouts for split line seal replacement, fastener size and type, lube system components, and routing of pressurized lube system.
2. Product data for split line seal including type, size, and materials.
3. Gear oil manufacturer data and existing fluid sample analysis.
4. Desiccant breather including type and size.
5. Reducer housing hoist and cribbing plan if applicable.

6. Mounting location for the lube system components.
7. Mounting location for neodymium magnets.

B. The manufacturer is to submit for approval a certified print of each speed reducer showing as a minimum the following:

1. Manufacturer's installation instructions for all seals.
2. Operation and Maintenance data.
3. Shaft seal material along with installation instructions.
4. Split line seal material along with installation instructions.

C. Fastener details and torque specifications including turned bolts and the location of any dowels. Provide new fasteners per the manufacturer's specifications and as described in this Technical Special Provision.

D. Contractor shall submit procedure for flushing gearbox.

E. If the existing magnets are not accessible or not installed, contractor shall submit a procedure for mounting and locating neodymium rare earth magnets inside the reducer housing. Locate magnets evenly spaced around the perimeter of the housing in a location furthest from rotating machinery as possible. Avoid areas directly tangential to the rotating gears or a plane parallel to rotation through gear centerline as these areas have the highest turbulent flow. Select areas in or near corners with low oil flow. Install rare earth magnet mounting bolt using a red or permanent, non-removable type Locktite® thread-locker product.

F. Notify the Engineer at minimum 5 days prior to opening the speed reducer. Allow access to the reducer for visual inspection of the reducer internal components by the Engineer. While actual inspection time may be less, schedule at minimum 2 hours of time for the Engineer to perform inspection. Provide Engineer with any necessary lighting, ladders, scaffolding, power, or other items necessary to fully access and view the reducer internal components.

T468-3.3.2. Pressurized Lube System Replacement & Reducer Flushing

A. Provide filtered gear oil as specified by the existing lubrication charts to fill the speed reducers. Speed reducers are to have provisions for oil expansion due to churning and temperature change. Fill the reducer with gear oil that has been filtered to an ISO cleanliness of 19/16/13 at minimum. Rather than require an ISO cleanliness once installed in the reducer, contractor shall either provide a fluid sample analysis from the manufacturer that shows the new oil was delivered in this filtered condition, or pre-filter the reducer oil prior to installation and provide fluid sample testing showing the oil met this minimum condition just prior to placement in the reducer. An additional fluid sample will be required once the new fluid has been operated in the reducer which will establish a baseline for the new oil once mixed with the small quantities of old oil containing contaminants.

B. Lube pump mounting and pipe routing: Currently a model 009 and larger model 015 are installed due to space restrictions between the intake line and a structural stiffener. For shipment of the reducer, the current pumps are installed within the clearance envelope of the exterior of the reducer, within the stiffeners and behind the plane of the furthest edge of base plate. Since the reducer is already installed and is stationery, replace both pumps with the two larger sized model 015 pumps which may exceed the current clearance envelope. There is an existing electrical box protruding from the floor approximately 10 inches from the current pumps. Install the pumps and route the piping such that they do not extend past the existing electrical box. Installation of the lube system shall not block, protrude into, or prevent personnel access. See mechanical plans for allowable clearance cube.

C. Flush the gearbox and refill with gear oil once the pressurized lube system has been replaced and adjoining components have all met the requirements in this Technical Special Provision, only after the approval of the Engineer.

D. Reducer Lube Oil - Baseline Fluid Sample and Analysis: Collect and send for analysis a sample of the reducer lube oil after the reducer scope of work has been completed. Operate the bridge span a minimum of 5 operations prior to taking the sample such that any existing oil and contaminants will have been thoroughly mixed with the new oil. Given the volume of new filtered oil compared to the

small amount of oil left on the surfaces of the reducer components, the baseline fluid sample analysis of the mixed oil should result in an ISO cleanliness very near the required 19/16/13.

T468-3.3.3. Machined Surfaces Corrosion Protection

Speed reducer shall not be opened or remain open if sand blasting, painting, or compressed air is being used. Speed reducer shall not be opened or remain open in inclement weather, including but not limited to rain, approaching thunderstorm, or relative humidity above 75%.

To protect internal machined surfaces and gears from moisture in the atmosphere, speed reducer shall not be opened or remain open when the surface temperature of the internal component surfaces is not at least 10°F higher than the current atmospheric dew point as determined by relative humidity. Sample minimum surface temperatures for the machined surfaces are listed in Table 2.

The anticipated change in relative humidity and temperature for the subsequent 24 hours shall be considered when determining allowable surface temperature. Monitor the surface temperatures 3 days prior to splitting the reducer such that maximum and minimum machined surface temperatures may be estimated and compared to the upcoming weather forecast.

Always protect internal reducer machined surfaces while lubrication is removed. Minimize time that gearbox is not filled with lubricant. Replace speed reducer housing top half if speed reducer is to sit without lubrication replaced for more than 8 hours. Coat internal gearing with anti-corrosive spray on lubrication every 4 hours that speed reducer cover is removed, and internal gearing exposed to ambient atmosphere. Apply anti-corrosive spray on lubrication immediately each time the housing top half is removed.

Table 2
Typical Temperature and Humidity Values with Corresponding Dew Point
(values in °F)

Air Temp (°F)	Relative Humidity (%)	Dew Point (°F)	Min. Surface Temp (°F)
80	75	71	81
80	45	56	66
60	75	52	62
60	45	39	49
35	75	28	38
35	45	16	26

T468-4. SPAN LOCK ASSEMBLIES

T468-4.1. Description

T468-4.1.1. General Requirements

Replace in kind span lock actuators. Furnish and install new bronze wear plates and shims for guide weldments. After adjusting the span balance, replacing the live load shoe strike plates, and equalizing the load on the live load shoes, adjust by shimming the span lock assemblies.

Maintain the span locks in the fully engaged position (fully driven) whenever vehicle traffic is passing over the bridge.

T468-4.1.2. Related Work

Coordinate work with adjacent structural, mechanical, electrical, and control system work. Refer to specifications herein and in Technical Special Provision T465 for requirements on Bascule Span Realignment Requirements and Counterweight Adjustment and Leaf Balancing. See this Technical Special Provision for requirements on Live Loads Shoes, Shims, and Fasteners.

T468-4.2. Materials

Provide materials for Span Lock modifications as shown in the Plans and as specified in this Technical Special Provision.

Replace in kind the existing Earle span lock actuator as shown in the plans as detailed with 12” stroke and manual crank operation.

Shims less than ½” thick shall be stainless steel.

T468-4.3. Construction Requirements

T468-4.3.1. Submittals

Provide Shop Drawings in accordance with FDOT Specifications Section 105. Including but not limited to:

A. Indicate adjustment tolerance, fits, finishes, profiles, sizes, fasteners, and accessories. Indicate locations of connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include as-built drawings, tolerances, elevations, span lock layout with component configuration, and details where applicable.

B. Proposed procedure for the removal and replacement of the span lock shims and associated hardware after alignment and adjustment of Bascule Leaf live load shoes; including details on installation of temporary span locks if necessary.

C. Initial values for all adjustable components. Clearly indicate these values on the system schematic.

D. Provide shop drawings for span lock actuators, span lock guide weldments, and span lock system installation with reference to existing structural components.

E. Names and certification numbers (See this Technical Special Provision T468-1.2. Qualifications) of individuals proposed for mechanical installation and startup.

F. Paint material and painting procedures, including color identifications, surface preparation procedures and product specifications.

G. As-Built measurements of the clearance between lock bar and guide shoes of the receiving, front and rear guides at the top and bottom of the lock bar. Submit the total shim thickness for each guide shoe after final alignment.

H. Provide shop drawings for temporary live load shoe assemblies.

T468-4.3.2. Installation

A. Do not field cut or alter structural members without authorization of the Engineer.

B. After final span balancing, equalize the load in the live load shoes by shimming as necessary. Provide temporary live load shoe assemblies.

C. After live load shoes are adjusted, adjust and shim span locks using smaller temporary fasteners. Temporary fasteners may be the existing fasteners. See Technical Special Provision T465 for requirements of live load shoe adjustment, shimming, and load equalization.

D. Once span locks have been shimmed and adjusted, remove temporary fasteners one at a time, ream and bore the hole to the next larger standard size, and install new fasteners according to Technical Special Provision T468-1.5. Fasteners.

T468-4.3.3. Span Lock Adjustment

Adjust Span Locks to the following conditions and tolerances:

A. Do not make the final adjustment of the lock bars until the live load shoes are properly adjusted, the elevations at the tip ends of the bascule girders are within 1/16-inch of one another, and the bridge is balanced within the final requirements detailed herein and in Technical Special Provision T465.

B. Ensure the alignment and position of the lock bar is such that no more than 1/32-inch of offset misalignment and no more than ¼° angular misalignment exist at the connection to the actuator or to the span and pier guide weldments in either the fully driven or fully retracted positions.

C. Adjust span locks such that driving or pulling the locks causes no change in the contact of the live load shoes.

D. Shim lock bars to obtain a total vertical clearance of 0.008 to 0.018-inch between bar and sockets. Clearance may vary between top and bottom faces of bar, but neither clearance shall be less than 0.005 inch.

T468-4.3.4 Recommended Procedure for Adjustment of Span Locks

Considering only the mechanical scope of work with exception to the time that the speed reducer is split, the span shall always remain operational. However, additional or extended operational time to throw and withdraw temporary span locks shall be allowed. See maximum allowed operational time constraint within these Contract Documents. Alternatively, the span lock adjustment may be made during other allowed closure limits within these Contract Documents provided the span lock system is returned to proper operation prior to the end of closure.

A. Submit and receive Engineer's acceptance for all relevant submittals pertaining to the rehabilitation of the span locks, bascule span re-alignment, counterweight adjustment, adjust/modify live load shoes, and leaf balancing.

B. Perform bascule span re-alignment, counterweight adjustment, adjustment of live load shoes with shims and load equalization according to Technical Special Provision Section T465-3. If not already installed as a requirement of the previous scope of work, install a temporary span lock prior to any adjustment of live load shoes or span balance which could render the existing span lock inoperable.

C. Attempt to drive the locks manually measuring any interference. See this Technical Special Provision T468-4.3.3 Span Lock Adjustment for conditions and tolerances.

D. Determine the method of adjustment, including but not limited to, the required shims necessary to meet the alignment and clearance criteria having the necessary components onsite prior to commencement of the work.

E. Components which shall be completely removed, mark accordingly such that existing components are replaced in the same location.

F. Mark all existing fasteners to be removed with bright red paint or paint pen. Do not re-use fasteners that have previously been torqued to rated capacity.

G. Secure the lock bar with temporary supports or with contractor's preferred temporary actuation method such that minor adjustments may be made once all fasteners are removed or loosened. The lock bar may be removed but contractor shall always maintain positive connection of the span to the pier, per the requirements herein. Provide to Engineer for approval the intended method of positive connection including any relevant calculations.

H. Disconnect the lock bar from the existing span lock actuator and remove the actuator from the span.

I. Replace the bronze wear plates in both the span and pier guide weldments.

J. Insert or remove shims such that tolerances between the lock bar and the span and pier guide weldments are met.

K. Fasten the new span lock actuator to the floor beam structure with temporary bolts of a smaller diameter or the existing bolts removed from the existing span lock actuator.

L. Tighten temporary fasteners and manually operate span lock actuator and lock bar to confirm proper clearances and operation. Removing, installing, and replacing fasteners; replacing and installing shims; and removing and replacing the span lock actuator multiple times may be necessary to obtain proper tolerances and operation at no additional cost.

M. Once final lock bar alignment and proper operational clearances are obtained, remove temporary fasteners one at a time or other partially staged removal sequence, drill or ream holes to the next larger diameter size, and replace with new final fasteners of appropriate size according to this Technical Special Provision T468-1.5 Fasteners.

N. Tighten bolts to proper torque according to this Technical Special Provision T468-1.5.5.1. Field Installation of Fasteners.

O. Confirm proper operational parameters and clearance during manual operation of span locks.

P. Once the containment system is installed, protect span lock actuator shop applied paint and remove wear plates, sand blast the span and pier mounted guide weldments to near white metal, and paint machinery components per this Technical Special Provision T468-1.4.6 Painting of Machinery.

Q. Remove temporary span locks.

T468-5. LIVE LOAD SHOES

T468-5.1. Description

T468-5.1.1. General Requirements

The work consists of furnishing, installing, and adjusting live load shoes assemblies. Live load shoe assemblies include live load shoes, fasteners, shims, bearing plates, and non-shrink epoxy grout in accordance with this Technical Special Provision T468-2.1.5 Non-Shrink Epoxy Leveling Grout.

T468-5.1.2. Related Work

Coordinate work with general machinery requirements described herein and in FDOT Specification 460 - Structural Steel and Miscellaneous Metals.

T468-5.2. Materials

Ensure that shims less than 1/2-inch thick are stainless steel.

Provide live load shoes, masonry plates, and anchor bolt materials as shown in the Plans.

Use Non-Shrink Epoxy Leveling Grout to grout between concrete pier and sole plate.

T468-5.3. Construction Requirements

T468-5.3.1. Submittals

Provide Shop Drawings in accordance with FDOT Specification 105. Including but not limited to:

Fully detailed drawings of live load shoe assemblies, including live load shoes, bearing plates, fasteners and anchor bolts as shown in the Contract documents.

Manufacturer's data sheets for Non-Shrink Epoxy Leveling Grout and sheet lead.

Indicate fits, finishes, size and type of fasteners, and accessories.

Indicate number and location of leveling screws, jacks, or other materials and equipment used to set and adjust the live load shoe assembly. Indicate anchor bolt tensioning or nut tightening as required.

T468-5.3.2 Load Equalizing

See detailed procedure for load equalization of the live load shoes as part of the procedure for re-aligning the span in Technical Special Provision T465-2.3.2 Load Equalizing.

T468-5.3.3 Span Vertical Alignment

See detailed procedure for the vertical alignment of the span as part of the procedure for re-aligning the span in Technical Special Provision T465-2.3.3 Span Vertical Alignment.

T468-6. MECHANICAL DRUM BRAKES

T468-6.1. Description

T468-6.1.1. General Requirements

This work consists of minor reconditioning of the brake drums of the existing machinery and equipment brake. Remove corrosion on brake drum and hub with small hand tools. Assure full brake pad contact and proper operation after removal of corrosion. If necessary, adjust brakes according to manufacturer's instructions and the operations manual. Apply touch-up paint to the brakes, hubs, shafts, and structural supports as described herein and in the Contract Documents. Removal or partial disassembly of one of the motor brakes may be necessary as incidental work to allow the replacement of the tachometer and overspeed sensor and coupling as described in Technical Special Provision T508.

T468-6.2. Materials

Intentionally left blank.

T468-6.3. Construction Requirements

This work consists of removing the corrosion on the brake drums, cleaning and painting machinery components as part of the general project painting pay item, and adjustment of the brake assembly to proper working order.

T468-6.3.1. Submittals

Submit Shop Drawing indicating means and methods of refurbishing existing brake drums. Include cleaning method.

T468-7. METHOD OF MEASUREMENT

A. Recondition Speed Reducer and Gear Train, Replace Lube System:

The work of replacing in kind the existing speed reducer split line seal, replacement and flushing of gear lubrication, replacement of the speed reducer housing fasteners, installation of neodymium magnets, sand blast and painting of speed reducer housing (except lube system), and cleaning to dry clean surface and re-lubrication of the open gearing as detailed in this Technical Special Provision and on the Plans will be paid by a Contract lump sum price. Included in the same lump sum price is the work of replacing the reducer's pressurized lube system including the hydraulic pumps, electric motors, stainless steel piping, stainless steel valves, filters or strainer, and alarm pressure switches as detailed in this Technical Special Provision and on the Plans will be paid by a Contract lump sum price. Do not paint the new pressurized lube system components or piping.

Removal and proper disposal of the existing components to be replaced will not be paid for separately.

B. Replace Actuators and adjust Span Locks and Wear Plates:

The work of replacing in kind, repairing required components, shimming, and adjusting span lock assemblies including the replacement of both span lock actuators, pier and span mounted guide weldments bronze wear plates, shimming and adjusting the clearance between the lock bar and the wear plates, providing a positive connection between the span and pier at all times with temporary span locks or other means, and sand blasting and painting the machinery and supports as detailed in this Technical Special Provision and on the Plans will be paid by a Contract each of the (2) system locations.

Removal and proper disposal of the existing Span Lock components will not be paid for separately. Design, fabrication, installation, removal, and proper disposal of any required access equipment as well as temporary span locks or tie-down devices will not be paid for separately.

D. Recondition Brake Drums:

The work of reconditioning the motor and machinery brake drums and adjusting the electro-mechanical span drive system motor and machinery brake as detailed in this Technical Special Provision and on the Plans will be paid by a Contract lump sum price. Due to the small quantity of work involved with this portion of the scope, include cost in Pay Item 0465-2-401 Recondition Speed Reducer & Gear Train.

E. Clean, Prepare, and Paint Machinery and Supports:

The work of cleaning, preparation of surface, protection of surfaces, and painting of surfaces detailed in this Technical Special Provision and on the Plans will be paid for at the Contract lump sum price. See additional Technical Special Provisions and Plans for the inclusion of additional scope in addition to the machinery and machinery supports such as the bascule leaf structural steel.

T468-8. BASIS OF PAYMENT

Price and payment will be full compensation for all work specified in this Section, including furnishing and installing all equipment and materials. When an item of Mechanical Equipment is included in the proposal, price and payment will be full compensation for all work and costs specified under this Section except as may be specifically covered for payment under other items.

Payment will be made under:

Pay Item	Description	Unit
0465-2-401	Movable Bridge Machinery and Castings – Rehabilitation, Recondition, Speed Reducer & Gear Train…….....	LS
0465-2-405	Movable Bridge Machinery and Castings – Rehabilitation, Recondition, Span Locks…….....	AS