Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 35 20 16 - Hydraulic Gates.

1.2 REFERENCES

.1 American Gear Manufacturers Association (AGMA)

.1 Standard 6013-A06, Standard for Industrial Enclosed Gear Drives.

.2 Association of Iron and Steel Engineers (AISE)

.1 Standard No. 7.

.3 American National Standards Institute (ANSI)

.1 ANSI Standard B4.2 – Preferred Metric Limits & Fits.

.4 American Society for Testing and Materials (ASTM)

.1 ASTM A276-10, type 304L, Stainless Steel Bars and Shapes.

.2 ASTM A240/A240M -12a, type 304L, Stainless Steel Plate, Sheet and Strip.

.3 ASTM A325-10, Bolts.

.4 ASTM A449-10, Standard Specification for Hex Cap Screws, Bolts and Studs.

.5 ASTM B209-10, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.6 ASTM B584-12a, Bronze Bearings.

.7 ASTM F593-02(2008)e1, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

.8 ASTM F594-09e1, Standard Specification for Stainless Steel Nuts.

.9 ASTM HST-4-1999, Performance Standard for Overhead Electric Wire Rope Hoists.

.5 Crane Manufacturers Association of America (CMAA)

.1 Specification 70-2010, Specification for Top Running Bridge & Gantry Type Multiple Girder Electric Overhead Traveling Cranes.

.6 Canadian Standards Association (CSA)

.1 CSA A23.3-04, Standard for Design of Concrete Structures.

.2 CSA B167-08, Overhead Travelling Cranes – Design, Inspection, Testing, Maintenance and Safe Operation.

.3 CSA S16-09, Standard for Design of Steel Structures.

.4 Ontario Electrical Safety Code.

.5 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.

.6 CSA W47.2-11, Certification of Companies for Fusion Welding of Aluminum.

.7 CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum.

.8 CSA W59-03, Welded Steel Construction.

.9 CSA W59.2-M1991, Welded Aluminum Construction.

.10 CSA/CAN3-Z299.3, Quality Assurance Program.

.11 CSA/CAN3 G40.20/G20.21, General Requirement for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

.7 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC M1-7 (R1992), Standard for Motors and Generators.

.2 EEMAC M2-1 (R1966), Standard for Lead Marking and Connections for Single-Phase and Polyphase Induction Motors.

.8 Electrical Safety Authority (ESA).

.9 Insulated Cable Engineers Association (ICEA).

.10 Institute of Electrical and Electronics Engineers (IEEE).

.11 National Electrical Manufacturers Association (NEMA)

.1 NEMA MG1-2011, Motors and Generators: Motors.

.12 Steel Structure Painting Council (SSPC)

.1 The Society for Protective Coatings (SP-1 and SP-10).

.13 United States Army Corp of Engineers (USACE)

.1 EM 1110-2-2105, Design of Hydraulic Steel Structures.

.2 EM 1110-2-2701 Engineering and Design – Vertical Lift Gates.

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop drawings sealed and signed by a Professional Engineer licensed to work in the Province of Ontario.

.3 Product Data.

.4 Operating and Maintenance Data: to include:

.1 Equipment functions, normal operating characteristics, and limiting conditions.

.2 Assembly, alignment and maintenance instructions.

.3 Lubrication instructions and required lubricant characteristics.

.4 Troubleshooting Guide.

.5 Parts List.

.5 Calculation confirmation of final hoisting speed with selected motor gearbox.

.6 Manufacturer's recommended list of spare parts.

.7 Factory Test Data.

.8 Installation and Commissioning Test Data including as-installed wiring and control schematics.

1.4 QUALITY ASSURANCE

.1 Departmental Representative reserves the right to witness factory testing.

1.5 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

Part 2 Products

2.1 HOIST - DESIGN CRITERIA

.1 Provide a hoist with a rated capacity of not less than 133% of the calculated required capacity.

.2 The normal raising and lowering speed of the gate will be 45 cm/min.

.3 The design of the hoist will take into account both normal and extreme loading conditions. The extreme loading condition will be the combinations of weight of lifting device or hoist and load resulting from the gate being jammed with maximum hoist force (full motor stall torque).

.4 The mechanical components of the hoist will be designed with a minimum safety factor of 5, based on ultimate strength of the material.

.5 Stall torque hoist capacity will not be greater than 210% of the hoist nominal capacity.

.6 Provide a hoist that is capable of raising the gate under inflow design flood (IDF) water level. The hoist will be capable of closing the gate under normal maximum water level. The design of the hoist will meet the requirements of CMAA Specification 70 for a Class B hoist.

.7 Provide a wire rope hoist conforming to Performance Standard for Overhead Electric Wire Rope Hoists (ASTM HST-4-1999).

.8 Operating environment: outdoors, within an unheated enclosure.

.9 Hoist must be capable of lifting the lowest gate wheels clear of the deck to allow for maintenance.

2.2 HOIST - DESCRIPTION

.1 Supply wire rope hoist as per the following requirements.

.2 Provide wire rope, electric motor-driven type hoist complete with gear reduction unit(s), alternating current (AC) brake solenoid, fan brake, limit switches, mechanical position indicator, digital position resolver, control panel, cross shafting, wire ropes, drum(s), upper and lower sheave blocks and associated components. The hoist motor, brake solenoid, digital position resolver, fan brake and gear reducer will all be mounted on a common frame. Supply a digital position resolver mounting that is independent of the hoist drum/drive train.

.3 Provide sufficient space around and below the hoist to allow safe access to the hoist equipment for maintenance.

.4 Provide a hoist frame of structural steel welded construction.

2.3 WIRE ROPE HOIST

.1 All rotating components and assemblies will be accurately balanced and aligned and will operate without damage or undue noise or vibration at a speed corresponding to three times the motor synchronous speed.

.2 The design of the hoist motor will be sufficient to withstand an overspeed of three times the motor synchronous speed.

.3 An electromechanical brake is required to restrict movement of the gate when the electrical power to the motor is cut off.

.4 The reduction gearing of the hoist will be designed with a minimum service factor of 1.25 under normal operating conditions.

.5 In the event of a power failure, manual release of the motor brake is required. Releasing the brake manually will override the electrical operation of the brake and will be interlocked to prevent the motor from starting or running in either direction.

.6 The hoist will be equipped with a centrifugal fan brake which will limit the emergency lowering speed of the gate when the electromechanical brake is manually released.

.7 Utilize a suitable pulley/drum diameter to nominal rope diameter ratio and fleet angle to ensure long-term rope life and reliability.

.8 Provide a single-phase, 240-V AC, squirrel cage induction motor. The NEMA design torque characteristics of the motor will be selected so that the stall torque hoist capacity will not be greater than 210% of the hoist nominal capacity. As detailed elsewhere in this specification, the Contractor will ensure that the mechanical design of the hoist will safely handle the maximum torque developed by the motor under starting or stall conditions. This determination will consider the possibility that the motor is operating 10% overvoltage.

.9 Provide electromagnetic spring-operated shoe type brakes for holding the suspended gate. Brakes will actuate automatically when the current is switched off. The braking torque will be 150% of torque corresponding to the hoist nominal capacity motor torque. Full voltage starting of the motor will be used to maximize the amount of starting torque available and to keep the designs simple and reliable.

.10 Position the hoist so that it allows gate removal from the guides using a mobile crane. The hoist assembly will be removable, in the event of major repairs.

.11 Provide a digital position indicating device that displays gate position in metres and centimetres, complete with programmable relay outputs to provide operational limits for the hoist operation. These include the following:

.1 Gate Closed Position.

.2 Gate Full Open Position.

.12 Locate the digital position display in a location that is easy to see from the operator position.

.13 Provide additional safety switches (independent of the digital position indicating device) to prevent overtravel damage to gate structures, drive components or other adverse consequences, should the normal limit operational limiting be ineffective. These switches

will block power from being applied to the electric motor, at least in the direction that would aggravate the situation. These include the following:

.1 Hoist Overtravel Limit Switch: Used to prevent damage to the structure by directly interrupting power to the motor when the gate travels beyond the normal raise or maintenance position limit.

.2 Slack Rope Limit Switch: Used in the lower control circuit for wire rope hoist systems to stop lowering the gate if the rope becomes slack. This is necessary to prevent excessive unwinding of the rope in the event that the gate becomes jammed while it is being lowered or the gate closed position limit does not work.

.14 Provide slack rope and wire rope overload safety switches derived from a programmable load cell type device.

.15 Provided galvanized steel wire rope with the required diameter and total length to be determined by the Contractor. All rope will consist of 6 strands of not less than 19 wires, right regular lay, preformed strand with independent wire rope core and internal lubrication. The wire rope will conform generally to the requirements of the CSA Specification G4-00 for "Steel Wire Rope for General Purpose and for Mine Hoisting and Mine Haulage." Minimum number of wraps on hoist drum to be advised by hoist manufacturer.

2.4 HOIST MOUNT

.1 Design loads on the hoist supporting frame and its suggested configuration will be provided by the Contractor to the Departmental Representative and to the party responsible for the spillway structure design. The hoist to be provided complete with all attendant hardware for mounting.

2.5 DOGGING DEVICE

.1 For maintenance, it is intended that the gate be fully raised to a position suitable for dogging of the gate.

.2 Design and provide a dogging device or mechanism to hold the gate in position to allow for hoist removal. Lifting points will also be provided on the gate to facilitate removal/handling.

2.6 MOTOR

.1 Supply the totally enclosed fan cooled (TEFC) hoist motor with a NEMA 4X rated junction box.

.2 Utilize full-voltage starting to maximize the amount of starting torque available and to keep the designs simple and reliable.

.3 Motor insulation systems will be capable of withstanding the full voltage that could occur if a single-phase conductor becomes grounded.

2.7 GEARING AND GEAR REDUCERS

.1 The gear reducers will be multi-stage, parallel-shaft, helical or herringbone gear units with extended low-speed and high-speed shafts connecting the drive motor and brakes with the hoisting drums.

.2 All gears will have machine-cut teeth, and will be manufactured in accordance with American Gear Manufacturers Association (AGMA) Standard 6013-A06. They will be designed to perform under all conditions of loading without noise or vibration. The reduction gearing will be designed to the following criteria:

a) Normal Operating Conditions

(100% Full-Load Motor Torque)

Duty	3 h/d intermittent, moderate shock
Service factor (minimum)	1:25

b) Overload Conditions

(225% Full-Load Motor Torque)

Duty	Heavy shock instantaneous
Service factor (minimum)	0.50

or the condition of the electromechanical brake producing a minimum torque of 150% full-load motor torque when stopping the gate from the lowering speed specified.

.3 All gear shafts will be of substantial construction designed to maintain accurate support and alignment of gearing under all possible loading conditions. All shafts will be supported on antifriction bearings. Through shafts will be fitted with lip type oil seals.

.4 The gear cases will be horizontally split with provision for sealing on the joint face with either gaskets or compound. The top and bottom sections will have adequate strength and stiffness to provide the necessary support and gear alignment under all operating conditions. The cases will have substantial base construction to provide the necessary attachment to the support structure. The top section will be removable without the need to disturb the bearing or gear alignment.

.5 The gear reducers will be provided with splash lubrication systems suitable for the expected frequency of operation in the temperature range -25°C to 30°C without use of immersion heaters. Each reducer will be fitted with a sight-glass type oil level indicator or calibrated dipstick, drain plug or cock, and breather filter unit.

.6 Mechanical properties, including minimum BHN, heat treatment and process of all materials used on gears, and shafting and gear reduction ratios will be shown on the Contractor’s drawings.

2.8 CENTRIFUGAL FAN BRAKE

.1 The fan brake will be selected for minimum horsepower absorption at normal raising speed and will be equipped with inlet and outlet screens.

.2 As a minimum, the fan shall be rated so that the power absorbed at a nominal operating speed equal to twice motor synchronous speed is 150% of the energy generated by the self-weight of the gate lowering at the corresponding speed.

.3 The fan brake will be designed to operate without damage at a speed equal to three times the motor synchronous speed in the lowering direction.

.4 The fan brake will be capable of operation under the most severe conditions of speed and power input that can result in variations in hoist friction, drag and temperature.

2.9 HOIST CONTROL FUNCTIONAL DESCRIPTION

.1 Local/Remote Selection:

.1 When remote controls are provided, the ability to operate equipment locally must be retained. Local control is required for normal local operation and testing or as may be required for a contingency where the remote controls fail for any reason.

.2 A secure selector switch will be provided to select between “Local” and “Remote” modes of operation. The Local/Remote selector switch will be mounted on the control panel and access will be restricted to authorized personnel only.

.3 The state of the Local/Remote selector switch must be monitored by the remote controls via the Departmental Representative-supplied remote terminal unit (RTU).

.2 Local Mode:

.1 Selection to “Local” mode must enable only the “Local” controls to control gate movement. It must completely block control from all other sources including the remote controls. Emergency release of the brake for drop of the gate will remain effective from all sources including remote sources when in the local mode.

.2 Three push buttons (or equivalent) must be provided for local control of gates – “Raise”, “Lower” and “Emergency Stop”. The push buttons must be in a position providing a clear view of the actual gate position or a reliable mechanical indicator. Momentary depression of either “Raise” or ‘‘Lower” push button will activate the respective motor control output. The outputs will remain in that condition until the push button is released or the limit switch contacts open to de-energize the motor control circuit.

.3 The momentary depression of the “Emergency Stop” push button must override any “Raise” or “Lower” operation that may be in progress.

.3 Emergency Conditions:

.1 Provide a manual release of the motor brake to enable gate closure in the event of a power failure. This manual release will be in a safe and accessible location and will disable all power to the hoist motor.

.2 Provision will be included in the design of the hoist to allow the gates to be raised in the absence of electrical power. This may include use of a gasoline backup motor or an electric wrench connection to supply motive power to the drive train.

2.10 CONTROL/ELECTRICAL PANEL

.1 General:

.1 Provide NEMA 4X hoist control enclosures of stainless steel, rigid, self-supporting construction.

.2 Provide panels mounted on legs or supports integral with the panel that allows for bottom access to cable glands.

.3 Provide all terminal blocks, as required for the application. All necessary barriers, jumper bars and end stops will be provided to segregate voltages and to eliminate the need for wired jumpers.

.4 Provide panels with provision for bottom entry cable glands and provide adequate working clearance for the termination of cables.

.5 Provide a thermostatically controlled anti-condensation heater fitted in any supplied panels containing control and/or relay equipment. The design will be such that when the equipment is in service, the maximum permitted rise in temperature for the equipment will not be exceeded.

.6 Provide stranded copper wire, Type SIS, not less than #14 AWG with 600-V flame-resistant insulation meeting CSA Flame test FT4 standard requirements.

.7 Terminal blocks will be arranged so that there will be only one wire per terminal clamping point for all interconnecting control wiring to and from the control panel. Provide multiple terminal blocks where multiple connections are required.

.8 Clearly identify control wiring between devices and terminal blocks at both ends with white engraved heat shrink tube wire marker with black alphanumeric lettering. Tape type markers will not be acceptable.

.9 The wire number will be identical on both sides of a terminal block.

.10 Provide suitable engraved identification nameplates to identify all terminal blocks, internal devices (fused, power supplies, relays, timers, etc) and all front-mounted panel devices. Warning labels indicating fed from multiple sources or identifying lock out points, etc, will be provided. Affix all nameplates by at least metallic screws in addition to self-adhesive backing materials.

.11 Operating and indicating devices such as push buttons will be heavy-duty, oiltight, corrosion-resistant, EEMAC 4X type. A spare contact blocks with a minimum of one ‘normally open’ (NO) and one ‘normally closed’ (NC) contact will be provided in addition to all requisite contacts required by the control scheme. Contact blocks will be current rated for the application.

.12 All indicating lights will be push to test, and will be fitted with multiple light-emitting diode (LED) type bulbs for long life and service under conditions of shock, vibration and rough handling. LEDs will match the voltage of the supply voltage and will be suitable for operation over the specified voltage range. Incandescent bulbs are not acceptable.

.13 Colour LED bulbs need to be matched with the proper colour lens.

.14 Local indication in the form of panel lights will be provided for each operational limit and for each safety switch operation. For remotely controlled gates, status alarms mimic these signals to the remote operator via the RTU.

.15 Relays will be of the type designed for machine tool application featuring contact reliability and accessibility. Contacts and coils will have a rating suitable for the application. Each relay will have at least one spare NO and one spare NC contact. Power interruptions or transient over or under-voltages should not result in spurious operations of the motor and brake controls.

.16 Supply a “red” mushroom head hoist emergency stop push button mounted on the door of the control panel. This will be a maintained pushbutton design with a turn to reset type operation. This push button will be mechanically protected by a ring or collar to prevent accidental operation.

.17 Supply a mushroom head emergency drop momentary contact push button that is clearly identified by colour and labelling to be distinct and separate from the

hoist emergency stop push button. This push button will be mechanically protected by a ring or collar to prevent accidental operation.

.18 Provide the following outputs as isolated dry contacts for use by the Departmental Representative as status inputs to their programmable logic controller (PLC)/RTU. These contacts will be suitable for 120-V AC wetting voltage feeding into a high impedance PLC input card with no interposing relay requirements.

.1 Gate full open position.

.2 Gate full closed position.

.3 Gate overtravel position.

.4 Gate raising.

.5 Gate lowering.

.6 Local control.

.7 Remote control.

.8 AC control and motive power supply failure.

.19 Provide a 0 to 12-V direct current (DC) signal proportional to the gate position output from the digital position resolver. This signal will be spanned to cover the gate from the "Gate Closed" position to the gate overtravel position.

.2 Motor Starters:

.1 Motor starter will be NEMA rated, full voltage, reversing combination starter or equivalent. Reversing starters will also be provided with forward and reverse contactors which will be mechanically and electrically interlocked against simultaneous operation.

.2 Full-voltage magnetic contactors will be CSA approved for motor starting applications and complete with auxiliary contacts. Operating coil voltage will be 120 V AC, 60 Hz. Contactor coil will be equipped with a surge arrestor.

.3 All circuit breakers or motor circuit protectors will be completely enclosed, moulded case. Each pole will have instantaneous magnetic trips only for short-circuit protection of the controls. An insulated common trip bar will open all poles when an overcurrent occurs. Interpole barriers will isolate one pole from another to eliminate flashover. The contacts will be made of nonwelding silver alloy. Arc extinguishers will be accomplished by means of arc chutes. Contacts will be readily visible in the circuit make or break positions.

.4 Each motor requires a motor overload relay sized to the motor rating required. The motor overload protection must self-reset after the motor windings have had sufficient time to cool down.

.5 Circuit breakers will be operated by a toggle type handle, and will have a quick-make, break switching mechanism that is mechanically trip free from the handle so that contacts will not be held closed against short circuits and abnormal currents. Tripping due to overloaded and short circuit will be clearly indicated.

.6 Each starter will be provided with at least two NO and one NC auxiliary contact wired up to the terminal block.

.7 Maximums number of auxiliary contacts will be six for sizes one (1) through four (4).

.8 Auxiliary contacts will be rated 240 V AC and 10 A continuous at 140 V DC with a L/R of 28 ms.

.9 Auxiliary contacts are in addition to those required for seal-in and interlocking and will be electrically independent of one another.

.10 The control circuit 120 V AC will be supplied from the 120/240-V source.

Part 3 Execution

3.1 GENERAL

.1 The Contractor will be responsible for the levelling and securing of the machinery bases and the mounting of the hoist on the bridge.

3.2 SHOP FABRICATION - MACHINERY BRIDGE

.1 Fabrication will comply with the requirements of the latest issue of CMAA Standard 70, CSA B167-08 and CSA Standard S16.

.2 All plate and structural steel will be accurately fabricated true to line and free from warp or rust. The edges to be joined will expose sound metal, free of visual laminations, cracks, and other injurious defects.

.3 Tolerances for fabrication will be within the limits specified in CSA Standard S16.

.4 The maximum permissible camber or sweep on any structural member will be 1/1000 of the length of the member.

3.3 WELDING

.1 All welding will be in accordance with CSA Standard W59-M and be performed by those qualified to CSA W47.1 and W55.3.

.2 Perform welding by shielded metal arc (SMAW), submerged arc (SAW), gas metal arc (GMAW), or flux cored arc (FCAW) welding processes. Gas tungsten arc (GTAW) welding may also be used where necessary.

.3 All welds will be continuous unless otherwise stated.

.4 Carry out all welding according to qualified procedures and under qualified supervision.

.5 Welding will be subject to inspection by Departmental Representative. Identify all weldments with vendor’s and welder’s or welding operator’s assigned symbol.

3.4 PROTECTIVE COATINGS

.1 In accordance with Section 09 90 00 - Painting and Coating.

3.5 SPARE PARTS

.1 Provide a price list for any spare parts considered necessary for maintenance of supplied equipment.

.2 All spare parts will be interchangeable with and of the same material and workmanship as the original parts of the equipment furnished.

.3 Supply all spare parts packed and treated for long-term storage at site, and each part will be clearly marked with its description and purpose on the outside of the packing.

3.6 ATTENDANCE DURING HOIST INSTALLATION

.1 Ensure hoist is installed in accordance with the drawings and procedures.

.2 After completion of installation, touch-up paint the hoist and support structure. Supply suitable quantity of touch-up paint.

.3 Arrange for hoist manufacturer's Factory Authorized Representative (FAR) to inspect the completed installation and witness commissioning. Submit to Departmental Representative a written certificate of FAR's approval of installation. FAR will submit a report for each site visit made.

3.7 COMMISSIONING

.1 Perform checks and tests of individual components and complete units, including recording of alignment dimensions, to demonstrate that the Work has been correctly installed, meets the design requirements, and is adjusted to operate correctly and safely.

.2 Demonstrate installation and removal of the gate in the dry. Clearances will be checked and recorded.

.3 Demonstrate operation of the gate in the wet.

.4 Demonstrate operation of all hoist controls, limit switches and safety devices. Any defects related to equipment design, manufacture, assembly, and installation that become evident during the design tests will be immediately corrected.

.5 Correct promptly, at own expense, any defects or deficiencies in the work provided under this contact which appear during the period of one year from the date of delivery.

.6 Prepare a detailed commissioning procedure, which describes the sequence of operations and methods to be used for commissioning.

.7 Attendance by the FAR at the commissioning is mandatory.

END OF SECTION