

# **EDERER INCORPORATED**

## **Technical Description of Hoist and Traverse Motion Electrical Controls System for 200/25 Ton Bridge Crane and 150/25 Ton Semi- Gantry Crane**

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Prepared for:  
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**Purpose:** Provide description of the electrical controls, including hoist and traverse motions, for a 200/25T Bridge and a 150/25T Semi-gantry crane. The cranes are intended for use at the proposed Private Fuel Storage Facility located in Skull Valley Utah.

**Performance:** The crane control system design provides performance characteristics as follows:

Bridge crane:	Feet per Minute
Main Hoist (rated load):	3.8±10%
Main Hoist (no load):	5.7±10%
Auxiliary Hoist(rated load):	14±10%
Auxiliary Hoist(no load):	21±10%
Trolley:	25±10%
Bridge:	40±10%
Semi-gantry crane:	
Main Hoist (rated load):	5.0±10%
Main Hoist (no load):	7.5±10%
Auxiliary Hoist(rated load):	14±10%
Auxiliary Hoist(no load):	21±10%
Trolley:	30±10%
Bridge:	50±10%

**Conditions of Service:** The crane control systems design will meet the following conditions of service:

Storage temperature:	-35°F to 110°F <sup>1</sup>
Operating temperature:	0°F to 104°F <sup>2</sup>
Relative Humidity:	20% to 100%
Integrated Lifetime	
Radiation Exposure:	2000 R
Pressure:	Atmospheric

**Applicable Standards:** The control systems will comply with NFPA 70 National Electric Code and ASME NOG-1, 1995 except as noted within this document.

Per the specification, the hoist drum rope level wind limiting device will only de-energize the hoist motion and not all crane motions.

<sup>1</sup> Space heaters must be energized to maintain enclosure interior and motor temperatures above freezing and condensation does not accumulate.

<sup>2</sup> Space heaters must be energized to maintain enclosure interior and motor temperatures above freezing and condensation does not accumulate.

**Motors:** The designs of the bridge and semi-gantry cranes utilize duplicate motors for the two cranes. Additionally, all bridge and trolley motors will be identical.

**Main Hoist Motors (one per crane):**

**Manufacturer:** Marathon Blue Max or Reuland Phasor  
vector duty  
**Horse Power:** 60  
**Voltage:** 460Volt/3Phase/60 Hertz  
**Base speed:** 1200 RPM  
**Speed range:** 1000:1  
**Insulation:** Class F or H  
**Duty:** 60 Minute, Vector Duty  
**Enclosure:** TENV  
**Other:** Thermostats, one per phase  
Conforms to NEMA MG1 part 31  
Lakeshore encoder SL56

**Auxiliary Hoist Motors (one per crane):**

**Manufacturer:** Marathon Blue Max or Reuland Phasor  
vector duty  
**Horse Power:** 25  
**Voltage:** 460Volt/3Phase/60 Hertz  
**Base speed:** 1200 RPM  
**Speed range:** 1000:1  
**Insulation:** Class F or H  
**Duty:** 60 Minute, Vector Duty  
**Enclosure:** TENV  
**Other:** Lakeshore encoder SL56  
Thermostats, one per phase  
Conforms to NEMA MG1 part 31

**Bridge and Trolley motors (two bridge and one trolley motor per crane):**

**Manufacturer:** Marathon or Reuland inverter duty  
**Horse Power:** 7.5  
**Voltage:** 460Volt/3Phase/60 Hertz  
**Base speed:** 1800 RPM  
**Speed range:** 20:1

**Bridge and Trolley motors (continued):**

**Insulation:** Class F  
**Duty:** 60 Minute, Inverter Duty  
**Enclosure:** TEFC  
**Other:** Thermostats, one per phase  
Conforms to NEMA MG1 part 31

**Note:** If the bridge and trolley motors will be operated at low end of the speed range (20:1) for an extended time, Ederer Incorporated recommends upgrading the motors to TENV.

**Controllers: Main Hoist Controller (one per crane):**

**Manufacturer:** Electromotive systems  
**Control type:** Closed loop flux vector  
**Voltage:** 460 Volt, Variable frequency  
**Ampere:** 80 amperes

**Features:**

- Microprocessor controlled
- Speed regulating > 30:1
- 5-step variable frequency in each direction
- Field adjustable swift lift
- Programmable acceleration and deceleration
- Digital display
- Line reactors 5% impedance
- Load reactors 3% impedance
- Electronic overload protection
- Electronic ground fault protection
- Over-speed protection
- Under-voltage protection
- Phase loss and phase reversal protection
- Torque proving and brake failure detection
- Load float capability
- Programmable torque limits
- External dynamic braking resistors
- Microprocessor fault watch dog circuit
- Brake contactors/relays
- Lakeshore encoder, motor mounted

**Auxiliary Hoist Controller (one per crane):**

**Manufacturer:** Electromotive systems  
**Control type:** Closed loop flux vector  
**Voltage:** 460 Volt, Variable frequency  
**Ampere:** 34 amperes

**Features:**

- Microprocessor controlled
- Speed regulating > 30:1
- 5-step variable frequency in each direction
- Field adjustable swift lift
- Programmable acceleration and deceleration
- Digital display
- Line reactors 5% impedance
- Load reactors 3% impedance
- Electronic overload protection
- Electronic ground fault protection
- Over-speed protection
- Under-voltage protection
- Phase loss and phase reversal protection
- Torque proving and brake failure detection
- Load float capability
- Programmable torque limits
- External dynamic braking resistors
- Microprocessor fault watch dog circuit
- Brake contactors/relays
- Lakeshore encoder, motor mounted

**Bridge and trolley Controller (two bridge and one trolley controller per crane):**

**Manufacturer:** Electromotive systems  
**Control type:** Open loop variable frequency  
**Voltage:** 460 Volt, Variable frequency  
**Ampere:** 11 amperes

**Features:**

- Microprocessor controlled
- Speed regulating > 20:1
- 5-step variable frequency in each direction
- Field adjustable swift lift
- Programmable acceleration and deceleration
- Digital display
- Line reactors 5% impedance

- Load reactors 3% impedance
- Electronic overload protection
- Electronic ground fault protection
- Over-speed protection (via one speed switch per motion)
- Under-voltage protection
- Phase loss and phase reversal protection
- Load float capability
- Programmable torque limits
- External dynamic braking resistors
- Brake contactors/relays

#### Hoist Holding and Emergency Brakes:

Each hoist will utilize one motor mounted disk brake rated 150% of motor full load torque and one thrustor shoe brake also rated 150 % of motor full load torque.

The brake will be engage when power is removed by one of the following means:

- Returning the motion control to the neutral (off) position, which commands the motor controller to stop. After stopping the drive via dynamic braking, the controller de-energizes the brake contactor to apply the brakes.
- Depressing the emergency stop de-energizes the crane main line contactor; thus, removing power from the brake. A loss of power or hoist motor controller fault will also de-energizes the main line contactor.

Each hoist also utilizes a mechanically actuated brake applied to the hoist drum. The drum brake actuates via a mechanical failure detection system.

#### Bridge(Gantry) and Trolley Brakes:

Each motor will utilize one motor mounted disc brake rated 100% of the drive torque. The brakes will provide self-adjusting wear compensation.

The brake will be engage when power is removed by one of the following means:

- Returning the motion control to the neutral (off) position, which commands the motor controller to stop. After stopping the drive via dynamic braking, the controller de-energizes the brake contactor to apply the disc brake.
- The motor controller will also de-energize the brake contactor during a fault condition.
- Depressing the emergency stop de-energizes the crane main line contactor; thus, removing power from the brake. A loss of power also de-energizes the main line contactor.

**External Motor Branch-Circuit Overload Protection:**

In addition to the electronic overload protection provided by the motor controller and the motor thermostats, three phase thermal overload relays will be provided.

**External Motor Branch-Circuit Short-Circuit Protection:**

Each motor circuit will include a 3 phase, thermal magnetic circuit breaker positioned before the motor controller

**Control Circuit Over-current Protection:**

All control circuits will be fused.

**Mainline Manual Disconnect:**

A main power manually operated, fused disconnect switch will be installed on the front bridge walkway; and, located near the main power collector pick-up point. The switch will be lockable in the open position.

### Mainline Magnetic Disconnect:

A mainline magnetic contactor will be provided to disconnect power to all motors and brakes when de-energized. The contactor will be controlled from the operator control station. Energizing the contactor will also illuminate a RED power on indicating light located under the front walkway. The indicating light will be visible from the operating floor.

### Hoist Limit Switches

Each hoist will utilize the following limit switches:

- Upper and lower geared rotary limit switches, which stop motion upon actuating limit switch and allow reverse motion to “back-out” of the limit.
- Redundant lower geared rotary limit switch, which de-energizes the Mainline Magnetic Disconnect.
- Back-up (redundant) block actuated upper limit switch, which de-energizes the Mainline Magnetic Disconnect.

NOTE: The crane design utilizes a torque limiting device to accommodate two blocking; therefore, a control type weighted limit switch is used instead of a power limit switch.

### Bridge and Trolley Limit Switches:

Each traverse motion, bridge and trolley, will utilize end of travel limit switches. Each limit switch, once tripped, will allow motion in the reverse direction only.

### Overload limiting Devices:

The crane design utilizes a load cell located in the rope equalizer sheave pin. The load cell will be monitored by digital weighing system with a relay set point output. The relay output will prevent hoisting beyond 115-120% of rated load. A means to bypass the set point will be provided for load testing.

### Electrical Enclosures:

All control, limit switch, disconnect and junction box enclosures will be NEMA type 12 per ICS 6. Control enclosures will include 120V space heaters and be mounted on the front walway.



### Warning Devices:

The following warning devices, operable momentarily from the operator control location, will be supplied:

- Warning siren
- Rotating beacon

Additionally, the semi-gantry crane will include a continuously operating bell that energizes upon gantry motion command.

### Operator Controls:

Each crane will be operated via a radio control system or emergency pendant control station. A selector switch mounted at the radio receiver will determine which operator control is enabled.