

SECTION 34 42 25

TRAIN CONTROL WAYSIDE EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Switch and lock movements
- B. Derails
- C. Wayside signals
- D. Rail connections
- E. Conduits, cable trenches and accessories
- F. Switch power supply cabinets
- G. Track shunts and impedance bonds
- H. Insulated joints

1.02 MEASUREMENT AND PAYMENT

- A. General: Train control wayside equipment, as specified herein, will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Automatic Train Control System Work as indicated in the Bid Schedule of the Bid Form.

1.03 SUBMITTALS

- A. General: Refer to Section 01 33 00, Submittal Procedures, and Section 01 33 23, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Submit product information and catalog cuts of equipment and devices specified herein.

PART 2 – PRODUCTS

2.01 **GENERAL:** This Section includes specifications for wayside equipment, classified according to the type of ATC system installation.

- A. General Application: Wayside equipment applicable to both fixed-block and communication-based train control systems
- B. Fixed-Block: Wayside equipment applicable only to fixed-block ATC systems

2.02 GENERAL APPLICATION

- A. Switch and Lock Movements: Switch layouts shall include switch-and-lock movements complete with hand crank, throw rod, lock rods, point detector rods, front rod, junction box, gauge plate extensions, and all mounting hardware. Product information for the switch-and-lock movement shall be submitted for approval. Switch-and-lock movement shall be Designated Matching Product, GRS Model 55G.
1. Uniformity: All switch-and-lock movements shall be of the same type or model.
 2. Location: Switch-and-lock movements shall be mounted to the side of the device being controlled as indicated on the Contract Drawings. Access and arrangement of switch-and-lock movements shall permit all working adjustments to be made when the movement is installed and connected.
 3. Integral Unit: Switch-and-lock movements shall be complete with integral units including motor, driving mechanism, throw mechanism, lock devices, dual point detectors, overload protection, circuit controller, and terminal board.
 4. AREMA Standards: Switch-and-lock movements shall conform to all requirements specified in the AREMA Signal Manual, Part 12.2.1, Sections D through K.
 5. Power: Power for switch-and-lock movements shall be supplied from wayside switch power supply cabinets (SPSC) as indicated. All necessary cables, conduits, transformers, switches, and accessories required for distributing power for switch-and-lock motors shall be furnished.
 - a. Switch-and-Lock Movement Operating Power: Switch-and-lock movements shall operate from 110 V ac power.
 - b. Overload Protection: Switch-and-lock movements shall be provided with overload protection to disconnect power from the motor should the movement fail to complete within eight seconds. The overload protection shall be reset by a switch call opposite to the original switch call.
 - c. Loading Current: Power shall be provided to simultaneously operate the maximum number of switch-and-lock movements required for available routes at an interlocking as indicated by the route and aspect charts, assuming each motor is drawing its overload current.
 - d. Switch Motor: The switch machine motor shall operate on 110 volts DC. The motor shall be the split-field winding type or if permanent magnet type, shall be equipped with suitable devices which will prevent the motor from being operated by stray or transient voltages. Armature brushes shall be accessible by the removal of a single access cover.
 6. Manual Operation: Switch-and-lock movements shall provide for manual operation by a removable hand crank. Self-contained circuits shall open the motor circuits and prevent electrical operation of the switch-and-lock movement during manual operation.

7. Hand Crank Mounting: The hand crank shall be mounted to the side of the switch-and-lock movement when not in use.
 8. Restoring Feature: The switch-and-lock movement and its associated operating circuits shall be configured with a restoring feature. The restoring feature shall cause the switch-and-lock movement to return to its original position if the auxiliary switch call is changed while the switch machine is in transition or mid-position. Restoring the switch-and-lock movement to power after hand-cranking for less than eight seconds shall cause the restoring feature to be effective. After hand cranking for eight seconds or more, the restoration feature shall be disabled by a timer. To enable restoration, the switch shall be called first to the position opposite its original position to reset the timer then called to its original position.
 9. Controller: Switch-and-lock movements shall include an integral circuit controller which shall indicate the switch position when the points are fully closed and locked by the lock rod in the normal and reverse positions. Separate point detection shall be provided for each switch point.
 10. Method of Furnishing Rods: All rods shall be furnished to the proper length, threaded, and machined for on-site installation. Lock and throw rods shall be covered with a black 3/32-inch, heat-shrinkable insulating sleeve that shall be shrunk in place. Detector rods for both switch points shall be provided with an insulated section as indicated. All machined surfaces shall be packaged for protection during shipping and handling.
 11. Insulation: Switch-and-lock movements shall be insulated from the rail by an insulated section in each rod and gauge plate. The insulation shall be capable of withstanding a test voltage of 1,500 V ac for not less than three seconds, without flashover or puncture between all metallic parts.
 12. Rod Bends: The main portion of all rods shall be straight, except for bends permitted at the ends to facilitate connections.
 13. Dimensions: Switch-and-lock movements shall be used with track having a gauge of five feet and six inches. Points shall have a 4 3/4-inch throw. Switch-and-lock movements shall be designed for application with steel rail at 119 pounds per yard. Points shall not be less than 16 1/2 feet, nor more than 39 feet in length.
- B. Derails: Derails shall be provided at locations indicated on the Contract Drawings, complete including switch-and-lock movements, indicators, bell cranks, rods, cable, and all installation hardware. Derail Indicators shall be provided at all derail locations. The indicator light aspects shall be FAA green and AREMA Standard red. Each assembly shall include two Taxiway Centerline light units with bi-directional apertures as manufactured by Crouse-Hinds Airport Lighting Products 852NF-65W, or District approved equivalent. Product information shall be submitted to the District for approval.

1. Derail indicators shall display the following aspects:

<u>Aspect</u>	<u>Indication</u>	<u>Functional Characteristic</u>
Red	Stop	Derail not clear (up)
Green	Clear	Derail clear (down)

2. The light units and transformers shall be mounted in a single indicator enclosure with removable cover made of 10 gauge steel, hot-dipped galvanized after fabrication and painted flat black.
3. Encapsulated step down (120V - 9V) transformers shall be provided as required. An in-line adjustable resistor shall be provided in the high voltage side of the transformer circuit (preferably in the switch junction box) to adjust lamp voltage for extended lamp life.
4. The indicator shall be installed between the running rails not closer than 48 inches in approach to the derail throw rod and not interfering with any other signaling apparatus.
5. The indicator assembly shall be directly energized and controlled from its corresponding derail switch machine. Derail number plate shall be mounted on front and back of indicator assembly box.

C. Wayside Signals: Wayside signals shall be provided at locations specified herein and as indicated on the Contract Drawings. All signals, brackets, poles, concrete foundations, and hardware required to mount the signals shall be furnished. All signals shall be complete, equipped with lamps, lamp receptacles, lenses, resistors, transformers, terminals, number plates, masts, and bases, as required. The signals shall, insofar as possible and practicable, be assembled and wired at the factory. Signal heads, after installation, shall be covered with durable opaque bags or other approved methods to prevent visibility of the signal aspects. The bags shall be removed during testing and reinstalled at the end of each test. The bags shall remain in place until the District authorizes their removal. Product information for all types of wayside signals shall be submitted for approval.

1. General: Fixed signals and route indicator signals shall meet the following requirements.
 - a. Fixed Signals: Fixed signals shall be single lens color light signals capable of providing from one to four different color indications, as indicated. Fixed signals shall be located on the right-hand side at gates governing entry to a route.
 - b. Route indicator signals shall be two aspect color light signals with masks as shown on the Contract Drawings. Route indicator locations with their corresponding masks shall be as indicated on the Contract Drawings. A route indicator aspect shall be illuminated when the corresponding route is aligned and locked.
2. Electrical Illumination: Signals shall be electrically illuminated without mechanical movement of any kind. Signal aspects shall be generated utilizing

light transmitted from individual lamp-filter modules to a single common output lens by use of fiber optic cable.

- a. Lamps: Signal lamps shall be 10V, 18-watt, double-filament, S-11 with SC bayonet base. Bulb life shall be rated 1,000 hours. Lamps shall conform to the requirements of AREMA Signal Manual, Part 14.2.1.
 - b. Signal Power: Power for signals shall be supplied from the 120V Essential Power bus in the train control equipment rooms. All necessary cables, conduits, transformers, rectifiers, switches, overload protection, and accessories required for distributing power for signals shall be furnished.
 - c. Transformers: A multi-tap lamp transformer with separate taps for each aspect shall be mounted in each signal head. Transformers shall have a primary voltage of 120V, and an adjustable secondary voltage of 6 to 12 Volts in steps of 2 Volts.
3. Readability: Signals shall be designed to avoid reflection of light from an exterior source and shall be readable from the Transit Vehicle operator's position at a distance of 250 feet for main line signals. Signals shall be readable under adverse environmental conditions at distances ranging from 250 feet to 5 feet in approach to the signal.
 4. Cone of Visibility: The cone of visibility shall be such that it complies with the requirements, as indicated, and shall be sufficiently side shielded to avoid projection of confusing aspects from signals on adjacent tracks.
 5. Resistor: Signals shall be furnished with one independently-mounted, voltage-adjusting resistor for each aspect. Lamps and accessory equipment in the signal power circuit shall be rated to operate at the same voltage and current.
 6. Type: The signal type shall be as indicated. Maintenance of the signal shall be possible from the back or side of the unit. Cable entry shall be through the unit base.
 7. Exposed Surface: The exposed surface of the signal lens outer unit shall be smooth and shall develop neither checks nor cracks, nor deform with age.
 8. Signals shall be furnished with screened ventilators.
 9. Chromaticity: Chromaticity shall comply with either AREMA or IES Standards.
 10. Doors: Signals shall be provided with a hinged door capable of being locked with a padlock. A padlock shall be provided for each door and shall be fastened to the signals with a nine-inch bronze sash chain. The door shall not be lockable unless the door is fully closed.
 11. Shipping: Lamps shall be shipped separately from the signal heads to avoid breakage.
 12. Alignment: The signals shall be aligned and focused, horizontally and vertically, to obtain the sighting distances specified.

13. AREMA Standards: Wayside signals shall conform to all requirements contained in the AREMA Signal Manual, Part 7.1.1, Sections 6 through 16 and 18 through 21.
- D. Rail Connections: Cable to rail connections shall be made by drilling and pinning as indicated. Product information for rail connections shall be submitted to the District for approval. Specific product requirements shall be as indicated.
1. Track Circuits: Track circuit connections including all connections to impedance bonds and rails shall be provided as required for ATC purposes.
 2. Switch and Track Bonding: Frog assemblies and switch points shall be connected by bonds to the running rails. Rail mechanical joints, if implemented, shall be bonded. Other electrical bonding for ATC purposes shall be provided, as required, using the materials and methods as indicated in the Contract Drawings.
 3. Cross Bonding: Cables required for cross bonding between adjacent tracks shall be provided and connected
 - a. Cross bond cables shall be as specified in Section 34 42 16, Train Control Wires and Cables.
 - b. Connections and number of cables shall be as indicated in the Contract Drawings.
 - c. Cross bonding cables between adjacent tracks shall be installed in conduit.
 4. Negative Returns: Substation negative return cables to impedance bonds or track shunts shall be connected as indicated in the Contract Drawings.
 5. Gap Breaker Negative Connection: A gap breaker negative connection to impedance bonds or track shunts shall be connected as indicated in the Contract Drawings.
 - a. Negative connections and connecting hardware shall be provided by the Contractor as described above for negative returns.
 - b. Additional No. 6 AWG voltage sensing cables shall be connected to the running rails with pin bonds as specified in Section 34 42 16, Train Control Wires and Cables.
- E. Conduits, Cable Trenches, and Accessories: Conduits, cable trenches and accessories shall be furnished as required for wayside ATC equipment. Layout drawings showing conduit arrangement shall be submitted for approval.
- F. Switch Power Supply Cabinets (SPSC): SPSC's shall be NEMA 4, weather tight enclosures and shall be equipped, arranged, and wired as specified. SPSC's shall be installed at interlocking locations.
1. Power: SPSC's shall receive 480-volt ac single phase power from the adjacent train control room/house. At critical TM zones or diverging/converging points, an alternate power source, 480 V ac, shall be provided.

2. Transformers: Each SPSC shall include a 480-volt to 120-volt stepdown transformer and a 120-volt to 12-volt stepdown transformer with taps.
3. Wiring: 120-volt ac power shall be wired from the SPSC to each switch machine and maintenance receptacles as indicated.
4. Termination: Switch machine correspondence and control wiring shall be terminated in accordance with AREMA standards.
5. Eyes: The cabinet shall be equipped with lifting eyes to facilitate installation.
6. Finish: The cabinet shall be hot-dipped galvanized and shall receive the manufacturer's standard shop primer paint coat. Scratches in the prime coat or finish coat shall be repaired following installation. Cabinets in known corrosive areas shall be constructed of stainless steel or other non-corrosive materials.
 - a. Zinc coatings that have been damaged in handling, transporting, welding, riveting, or bolting shall be repaired by the application of a thick paste made from galvanizing repair compound conforming to MIL Spec. P-21035, 2 coats of 2 mils dry film thickness per coat. Areas to be repaired shall be cleaned thoroughly, including removal of slag on welds, before paste is applied.
 - b. The cabinet shall receive a finish coat of exterior paint, in accordance with the requirements, indicated in Section 09 91 00, Painting.
 - c. The concrete foundation pad surface shall be free of paint when painting is completed.
7. Screens: Bug screens on inside of ventilating louvers shall be corrosion resistant and shall be removed during painting and replaced when paint is dry.
8. Ground: Cabinet grounding shall be as indicated on the Contract Drawings.

2.03 FIXED BLOCK ATC SYSTEMS

- A. Track Shunts and Impedance Bonds: Track shunts and impedance bonds required for the ATC System, including all mounting hardware, connectors, cable, and other appurtenances shall be furnished, installed, and tested. Track shunts and impedance bonds shall be installed at locations as indicated. Product information for shunts and impedance bonds shall be submitted for approval.
 1. Functions: Track shunts, impedance bonds, and tuning units shall be assembled in units and installed between the running rails. Shunts and bonds shall provide a traction power current return path from running rails to cross-bond or substation negative connections and around insulated joints. In audio frequency track circuit applications, shunts and bonds shall also couple track signals between running rails and transmitters or receivers.
 2. Performance Requirements. Track shunts, impedance bonds, and associated cabling and connections for audio frequency applications shall be designed to carry a minimum of 2,500 amperes per rail continuously, and peak currents at three times the continuous rating for one minute.

- a. Shunts and impedance bonds shall function properly with traction current imbalance of 12 percent and ripple current imbalance of up to 30 percent of the per-rail current capacity. Shunt or bond dc resistance between track winding terminal lugs shall not exceed 0.0003 ohm for power frequency bonds, and 0.00008 ohm for audio frequency bonds as measured with a Double Kelvin bridge. Current imbalance of the rails is defined as the ratio of the larger current in one rail to the smaller current in the other rail minus one.
- 3. Rail Connections: Track shunt and impedance bond track windings shall be provided with a minimum of two terminal lugs per rail, each of which shall accept two 500-kcmil cables.
 - a. At impedance bond layouts which define track circuit limits, provide a minimum of two 500-kcmil cable connections to each rail.
 - b. At impedance bond layouts providing connection to substation negative returns, or providing propulsion current path around insulated joints, provide a minimum of four 500-kcmil cable connections to each rail.
- 4. Center-tap Connections. Shunts and impedance bonds shall also be provided with one center-tap adapter plate for back-to-back bond, cross bond, or substation return connections.
 - a. Center-tap adapter plate shall be copper silver plated at connection areas and shall have current and connection capacity required for its particular application. Cable connections to center taps shall be tin-plated, or approved equivalent.
 - b. Center-tap adapter plate shall accommodate connections of 500 and 750 kcmil cables as indicated.
 - c. Shunt or impedance bond center taps shall be used:
 - 1) To terminate cross-bonding cables.
 - 2) To connect neutral cables between impedance bonds on same track at insulated joints.
 - 3) To terminate substation negative return cables.
 - d. Connectors: Watertight plug connectors shall be used for external connections to the tuning unit and for connection to the shunt or bond from the tuning unit.
 - e. Installation: Shunts, impedance bonds, and tuning units shall be sized to facilitate mounting between running rails on all types of roadbed without any part extending above the top of rail. Shock mounting shall be provided to offset the effects of track vibration. Assemblies shall be isolated from ground.
- B. Insulated Joints: Insulated joints shall be provided at gates in crossovers and turnouts in the interlocking areas. Additional insulated joints shall be furnished as required to meet Contractor's ATC system design.

PART 3 – EXECUTION

Not used

END OF SECTION 34 42 25