METROLINX

GO Transit Signals & Communications Standards – Hot Air Switch Clearing Device Specification

Specification 34 42 05

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Preface

This is the first edition of the Switch Clearing Device Specification. It specifies the requirements with which the Switch Clearing Devices for use on the Metrolinx system shall comply.

This document was developed by the Signals & Communications Office, Engineering and Asset Management Division, Capital Projects Group, Metrolinx.

Suggestions for revision or improvements can be sent to the Metrolinx Signals and Communications office, Attention: Director of Signals and Communications who shall introduce the proposed changes to the Metrolinx Signals and Communications office. The Director of the Signals and Communications office ultimately authorizes the changes. Be sure to include a description of the proposed change, background of the application and any other useful rationale or justification. Be sure to include your name, company affiliation (if applicable), e-mail address, and phone number.

April 2020

Amendment Record

Revision	Date (DD/MM/YYYY)	Comments

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1. SCOPE

1.1.1 This specification defines the requirements for the hot air Switch Clearing Device (SCD) for application at track switches on Metrolinx property. These are comprised of three major elements, which include a Gas Fired Hot Air Blower, Air Distribution Duct System and Energy Management System "EMS".

1.1.2 The Gas Fired Hot Air Blower shall comprise a gas burner and combustion chamber with an electrically powered centrifugal blower. This blower shall produce a mixture of hot air and combustible gases which are directed at the critical areas of a Metrolinx track switch by a system of air distribution ducts and nozzles. The gas burner-combustion chamber along with its attendant control system shall be mounted within an insulated prefabricated enclosure.

1.1.3 The EMS shall comprise a precipitation detector (heated cone design), rail temperature switch, ambient temperature switch, a programmable controller and related installation components.

1.1.4 Equipment having materials or forms of design and construction differing from those contemplated or covered by this specification may be examined and tested according to the intent of the requirements and if found to be substantially equivalent may be accepted solely on the discretion of Metrolinx.

2. ABBREVIATIONS

AC	Alternating Current
ANSI	American National Standards Institute
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
BTU	British Thermal Unit
CFM	Cubic Feet per Minute
CSA	Canadian Standards Association
DC	Direct Current
EMS	Energy Management System
NEMA	National Electric Manufacturers Association
PLC	Programmable Logic Controller
PSI	Pound per Square Inch
RMS	Root Mean Square
SCADA	Supervisory Control And Data Acquisition

SCD	Switch Clearing Device
SCFM	Standard Cubic Feet per Minute
SCP	(Canadian National) Standard Codes of Practice
OESC	Ontario Electrical Safety Code
VAC	Volts of Alternating Current

3. GENERAL

3.1 SCOPE OF WORK FOR CONTRACTOR

3.1.1 The Contractor shall supply hot air SCD comprising:

a) SCD combustion assembly and associated sub-assemblies and components suitably enclosed in an insulated metal enclosure;

b) SCD air distribution duct system complete with all necessary brackets, nails, bolts, lag screws, and other fastening hardware;

c) Tie Duct assembly including the actual tie, any additional ducts required to cross under multiple tracks, rail insulating pads, rail clips, rail clip insulators, and hardware to flexibly (+/- 2 inches deflection in plan or elevation) attach the Tie Duct to the extension or offset duct;

d) EMS including the control unit and required sensors (e.g. temperature switch, snow sensor) and I/O modules; and

e) suitable heavy-duty steel deflectors, equipped with anti-skid adhesives, to protect SCD ductwork against damage from dragging equipment on passing railway rolling stock.

3.2 INTERFACE REQUIREMENTS

3.2.1 The SCD shall be tailored for the specific application, taking into account the following factors:

a) Turnout size and type of turnout (i.e. all-welded or bolted);

b) Length of switch point;

c) Weight and type of rail;

d) Distance between track centers (if more than one track);

e) Elevation differences between multiple tracks; and

f) Fuel type (propane or natural gas).

3.2.2 The SCD shall comply with latest CSA specifications, OESC and AREMA Communications & Signals Manuals.

3.3 METROLINX DRAWINGS

3.3.1 Standard Metrolinx switch layout plans, clearance plans, and standard SCD electrical interconnection drawings may be obtained from Metrolinx.

3.4 CONTRACTOR'S DRAWINGS AND DETAILS

3.4.1 The Contractor shall provide installation drawings dimensioned to show location of SCD enclosure with respect to gauge of rail, location of ducts with respect to point of switch and any other pertinent dimensions including vertical and horizontal clearances. Separate plans shall be submitted when different sizes of switches are involved. The Installation drawings shall provide the information necessary with sufficient detail to support the installation of the SCD by an independent subcontractor.

3.4.2 All plans must be approved by Metrolinx, subsequent changes to approved drawings shall only be made with the written consent and approval of Metrolinx.

3.4.3 The Contractor shall be responsible for correctness of all drawings supplied.

3.4.4 Reproducible copies of installation drawings shall be provided.

3.4.5 The Contractor shall submit drawings of any pieces of equipment or assemblies in PDF and AutoCAD format.

3.4.6 The Contractor shall provide the following information:

a) Canadian Gas Association certification;

b) power requirements of SCD including the minimum allowable terminal voltage for safe ignition, and the terminal voltage range for which proper and safe operation is obtained;

c) current requirements for starting and normal running;

d) theoretical heat input and heat output of SCD in British Thermal Units per hour (BTU/hr);

e) minimum and maximum gas pressure requirements for which proper and safe operation is obtained;

f) minimum SCD exit air rate issuing from each distribution duct system orifice in accordance with the following:

i. minimum exit air rates shall include minimum air velocity in feet per minute (kilometers per hour) and minimum air volume in cubic feet per minute (cubic meters per minute); and

ii. exit air requirements shall be determined at the nozzle discharge orifices at standard dry air conditions, or 0.075 pounds per cubic foot (0.12 kilograms per cubic meter). This corresponds to dry air at 21.1C (70F) and 29.92 inches (76 centimeters) of mercury barometric pressure;

g) maximum Tie Duct surface temperatures as measured during actual heater operation at the maximum rated SCD BTU output;

h) heat loss from the Tie Duct in BTU/h/ft of length;

i) certified results of a Tie Duct cyclic load testing regime as specified in this specification;

j) stress and deflection finite element results of Tie Duct tests as specified in this specification;

k) Tie Duct volume flow rate of air (cubic feet per minute) when attached to the remainder of the Air Distribution Duct System crossing none, one and two sets of tracks. Air volume flow rates shall be standardized to atmospheric conditions of 29.92 inches of mercury, and dry air conditions;

l) recommended spare parts with prices and ordering references; Contractor to indicate the availability of spare parts;

m) maintenance documentation, including troubleshooting guide, corrective maintenance manual, preventive maintenance manual and spare parts list with part numbers;

n) thermal insulation details for all types of ducts;

o) EMS operational flow charts and programming instructions;

p) Programmable Logic Controller (PLC) software description including instructions to modify control parameters;

q) electrical wiring/cables sizes (for 120/240 VAC, single-phase, 60 Hz electrical power or 600 VAC, 3- phase, 60 Hz power) and termination between SCD enclosure and electrical power service;

r) electrical wiring/cables sizes required to interconnect SCD and EMS with Metrolinx signal control instrument housings;

s) foundation design for mounting SCD enclosure;

t) Gas pipeline connection of the SCD with the Gas distribution line; and

u) detailed Bill of Material.

3.5 INSPECTION

3.5.1 Metrolinx shall have the right to inspect the SCD equipment as considered necessary to determine that the requirements of this Specification have been fully complied with, and to reject any equipment which fails to meet the requirements of this Specification.

3.5.2 Metrolinx shall have the right to inspect the equipment at all stages of manufacture.

3.5.3 Inspections shall not relieve the Contractor from the necessity of furnishing good material and making good and sound work in every detail of construction and assembly, and of replacing any equipment which may be found to be defective, even if such defects are disclosed after the equipment has been passed by Metrolinx Inspector.

3.5.4 With regards to all matters pertaining to inspection of equipment, the decision of Metrolinx through the Inspector designated shall be final.

4. DESIGN REQUIREMENTS

4.1 GENERAL

4.1.1 Gas-fired equipment and associated fittings shall be certified by the Canadian Gas Association, and proof of certification shall be supplied.

4.1.2 Equipment shall afford the minimum side clearance as set out in latest GO Signals & Communications Standard SCP-803 when assembled and installed in the intended manner. SCP-803 is based on minimum clearances required to permit the unrestricted passage of Metrolinx dimensional traffic and may be more restrictive than regulatory minimum railway clearance regulations.

4.1.3 Equipment shall be assembled by the Contractor in as few sub-assemblies as practicable. Each sub-assembly shall be capable of being incorporated into the final assembly, without requiring alterations, cutting, drilling, threading, welding, or similar tasks by the installer.

4.1.4 Equipment shall not be damaged by oils, grease, water, salt solution, and other chemicals found in a railroad environment. Components requiring protection from climatic conditions shall be adequately protected.

4.1.5 Equipment shall not interfere with or affect the proper functioning of the signalling equipment including track circuits. The SCD equipment shall not conduct the track circuit around a broken rail.

4.1.6 The assemblies shall withstand for not less than sixty (60) seconds, the application of a potential of 3000-volts AC (Alternating Current) RMS without flashover or puncture between all metallic parts and other metallic parts insulated there from (AREMA C&S Manual Part 11.5.1).

4.1.7 The electrical features and components of each SCD assembly shall be certified to comply with the applicable standards of the Canadian Electrical Code, and carry Underwriters Laboratory (UL) or Canadian Standards Association (CSA) ratings where typically used.

4.1.8 Equipment shall be equipped with a dirt trap, strainer with the gas manifold.

4.1.9 All external cabling shall have waterproof connections.

4.1.10 The SCD shall comply with the environmental requirements of AREMA C&S Manual Parts 11.5.1.

4.1.11 Each SCD shall prevent snow and ice from accumulating in the critical areas of a Metrolinx track switch under severe winter conditions. In no case shall the heat output, air delivery, and protected switch point length be less than specified in Table 4-1.

4.1.12 As used in this Section, severe winter conditions mean a snowfall rate of one inch per hour (2.54 cm per hour) and a wind velocity from any direction of 20 miles per hour (32 km per hour) at an ambient temperature of -32 degree Celsius.

Table 4-1: Hot Air Blower Switch Clearing Device Minimum Requirements

Length of Switch Point	Turnout Number	Minimum Heat Output (KBTU/hour)	Minimum Air Delivery Rate (CFM)	Switch Point Length to be Heated
16'-6"	# 10 B	400	1500	16'-6"
22'-0"	# 12 B	400	1700	22'-0"
31'-6"	# 10 AW	600	2000	31'-6"
33'-0"	# 16 B	600	2000	33'-0"
36'-5"	# 12 AW	600	2000	36'-5"
36'-7"	# 12 AW	600	2000	36'-7"
38'-9"	# 16 AW	600	2000	38'-9"
39'-0"	# 20 B	625	2000	39'-0"
58'-10"	# 20 AW	800	2000	49’-5"

B denotes Bolted Turnout; AW denotes All-Welded Turnout.

4.1.13 SCD shall be capable of continuous operation at maximum ratings without evidence of failure and shall be capable of operating a minimum of 2,000 hours without requiring service to combustion or gas assemblies.

a) For the purpose of interpreting this requirement, "continuous operation" shall be defined as 200 hours consecutive running at maximum input ratings in the environmental temperature and relative humidity conditions defined in 4.1.15.

4.1.14 SCD shall provide the snow melting capabilities specified herein without the use of switch covers or other types of shielding of the track switch.

4.1.15 SCD shall operate over the temperature range of -40 Celsius to +5 Celsius, a relative humidity range from 0 to 100%, and during variations of rain, sleet, snow, and ice without requiring any adjustments.

4.1.16 SCD shall be designed and constructed to prevent tampering by unauthorized persons.

4.1.17 The noise created by the SCD shall comply with AREMA C&S Manual Part 12.6.20.

4.2 COMBUSTION ASSEMBLY

4.2.1 The Combustion Assembly shall use a high efficiency burner and shall be designed and constructed for operation on a commercial grade of either natural or propane gas.

4.2.2 The Combustion Assembly shall be designed and constructed to operate safely and reliably on the following gas pressures:

a) Natural gas – 6 inches water column (W.C.);

b) Propane gas – 11 inches water column (W.C.)

4.2.3 The design and construction of the Combustion Assembly shall afford reasonable and sufficient access to parts that require regular adjustment or service in the field. This will include access for such service operations as the replacement of components (e.g. orifices, regulators, motors, fans, electric solenoid valves) and the cleaning of parts (e.g. soot removal).

4.2.4 Provision shall also be made to permit adequate observation of the flame zone and the burner fire condition. The observation opening shall be provided with a suitable attached door or cover.

4.2.5 Where cleaning operations are to be performed by maintainer (provided by others), the arrangement of removable parts in the assembly shall be such that their restoration, following removal for cleaning, will not necessitate their readjustment to ensure proper operation or to secure their proper relationship with other parts of the assembly.

4.2.6 All parts which may cause injury through accidental contact shall be protected.

4.2.7 An electric ignition system shall be provided and may be used to ignite a pilot burner or may be used to directly ignite the main burner. This ignition system shall be adequate to ensure safe and reliable ignition of the main burner.

4.2.8 Where air regulation dampers or shutters are provided to regulate the air supply to the burner they shall be provided with positive and reliable means for adjustment and securing.

4.2.9 The failure of a locking device used to secure an air regulation damper shall not result in unsafe operation of the burner.

4.2.10 The means provided for the supply or regulation of combustion air shall not result in unsafe or unreliable operation of the burner under the anticipated conditions of use.

4.2.11 Bare high-potential conductors (electrodes) and bus bars shall be rigid, and reliably held in place, and shall be constructed so that they may be readily locked in proper position and alignment.

4.2.12 Electrodes shall be prevented from rotating within the insulator (e.g. by keying).

4.2.13 SCD complete with air distribution duct system shall be designed to ensure the combustion process is stable and complete at all rated gas inputs under the full range of operating conditions specified herein. The maximum smoke density of the hot air delivered to the air distribution duct system shall not exceed that corresponding to a No. 1 "Shell-Bacharach" smoke spot. A 5/16 inch (7.938 mm) diameter smoke density sample hole shall be provided in the sensor duct for maintenance purposes.

4.3 BLOWER ASSEMBLY

4.3.1 The blower housing shall be constructed of material of sufficient strength to contain the blower wheel in the event of a mechanical blower wheel failure.

4.3.2 Each Blower Assembly shall be provisioned for the attachment of a wheel puller to the central hub of the blower wheel. The wheel puller details shall be provided by the Contractor.

4.3.3 Suitable low temperature anti-seizing compound shall be applied between the motor shaft and blower wheel to facilitate removal.

4.4 GAS CONVEYANCE SYSTEM

4.4.1 The Gas Conveyance System shall include all necessary component parts within the SCD, such as shut-off valves, orifices, gas solenoid valves, pressure gauges, piping, bulkhead connectors and all associated fittings and connections.

4.4.2 Piping shall be Schedule 80, black, and shall comply with ASTM A 53 "Specification

for Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless."

4.4.3 A fitting used with steel pipe shall be of either malleable iron, or steel, and shall comply with ANSI Standard B16.3 "Malleable-Iron Threaded Fittings".

4.4.4 Piping joints shall be threaded, flanged, or welded. When a jointing sealant is used, it shall be of a type approved by Metrolinx and shall be applied to the male pipe threads only.

4.4.5 Gasket materials shall be of either neoprene, or other similar material resistant to any action of gas. Natural rubber shall not be used.

4.4.6 Tubing shall be of seamless copper, brass, or steel. Type GP tubing shall meet the requirements of ASTM B 75 "Specification for Seamless Copper Tube" and Types K and L copper tubing shall meet the requirements of ASTM B 88 "Specifications for Seamless Copper Water Tube". For SCDs that use natural gas, the copper tubing shall be internally tinned.

4.4.7 Tubing fittings shall be rated for a working pressure of not less than 125 pounds per square inch (PSI) or 860 kPa.

4.4.8 A joint in seamless copper, brass, or steel tubing shall be made by means of a brazed joint, flared joint, or fitted sleeve joint.

4.4.9 The location and arrangement of the pipe, tubing and connections shall ensure protection from mechanical damage. All bends in tubing shall be smooth, free of kinking and twisting, and free of flattening.

4.4.10 Each Combustion Assembly shall be equipped with an approved, manually operated, shut-off valve which clearly indicates the open and closed positions, and which shall be placed downstream of all other controls. Handles of the shut-off valve shall be parallel to the gas flow when in the open position.

4.4.11 Each Combustion Assembly shall be equipped with a certified gas pressure regulator to limit outlet pressure to the designed operating pressure of the equipment.

4.4.12 A suitable bulkhead connector or other approved means shall be provided where gas piping passes through the wall of the SCD enclosure.

4.4.13 An adaptor assembly shall be provided when the SCD is fired through a propane tank locally instead of natural gas lines. This adaptor assembly shall be certified by the Canadian Gas Association, and proof of certification shall be supplied.

4.5 HOUSING

4.5.1 SCD shall be provided with a suitable mounting frame.

4.5.2 Control circuitry shall be mounted in an insulated waterproof housing.

4.5.3 Adjustable base plates shall be provided in each corner for mounting and leveling the assembly on the foundations.

4.5.4 The SCD assembly shall be equipped with four hooks for hoisting purposes, one in each corner, secured to the frame of the assembly. The hoisting hooks shall be capable of supporting the weight of the assembly.

4.6 POWER DISTRIBUTION

4.6.1 The SCD power shall be provided by a NEMA 4X rated power distribution enclosure to provide power to one or more SCD.

4.6.2 The power distribution breakers shall be sized based on the number of SCDs.

4.6.3 The foundation of power distribution enclosure shall comply with AREMA C&S Manual Part 14.4.1.

4.6.4 Design and installation of the distribution breaker and breaker panel shall be in accordance with CSA standards.

4.7 ELECTRICAL

4.7.1 Electric motors shall have a continuous duty rating. Overload protection shall be provided for all motors.

4.7.2 The SCD shall be controllable from the Metrolinx Signal and Train Control System. The SCD shall have interfaces to accept control inputs from both the Local Control Panel (LCP) located in an adjacent bungalow and the remote (central control) Signalling equipment.

4.7.3 The SCD shall be controlled locally at the field.

4.7.4 The SCD shall support both local and remote “force shut ON/OFF” commands.

4.7.5 The SCD shall have the option to be monitored and controlled wirelessly.

4.7.6 The normal and degraded condition of the SCD shall be recorded and displayed at both Local Control Panel (LCP) and at a remote location via an interface with SCADA (Supervisory Control And Data Acquisition) or any other controlling and monitoring device as specified by Metrolinx.

4.8 ELECTRICAL ISOLATION

4.8.1 The metal components of the SCD, including the Air Distribution Duct System, shall not cause the rails to become grounded or shorted together. To provide for this requirement, two levels of electrical isolation shall be provided as follows:

a) LEVEL "1" assembly shall provide complete rail-to-rail electrical isolation; and

b) LEVEL "2" assembly shall provide complete track-to-track electrical isolation. This shall be accomplished by electrically isolating the adjacent flanges of the Main Duct and the Main Extension Duct.

c) Additional Level "1" and Level "2" electrical isolation assemblies shall be provided as required when Extension Ducts are provided to carry discharge air under additional Metrolinx tracks.

4.8.2 Each End Point Nozzle shall be electrically isolated from the Tie Duct assembly.

4.9 AIR DISTRIBUTION DUCT SYSTEM

4.9.1 The Air Distribution Duct System shall effectively distribute and direct the necessary flow rate of hot air from the Combustion Assembly to the critical areas of the track switch. For convenience, the short term "Ductwork" is used herein.

4.9.2 Ductwork shall include the following major components as shown in Figure 7-4:

a) Tie Duct;

b) Flexible Duct (with Ballast shield);

c) Sensor Duct;

d) Offset Duct;

e) Transition Duct;

f) Extended, insulated, swivel, Point End Nozzles (two required);

g) Track Ducts (two required);

h) 90-degree Transition Assemblies to connect Track Duct to Tie Duct (two required);

i) All brackets, clamps, bolts, nuts, washers and other fastening hardware; and

j) Track Duct Elbows (to connect track ducts to cross ducts).

4.9.3 The Ductwork shall include an Extension Duct as necessary to comply with site-specific side clearance requirements.

4.9.4 The Ductwork shall include an additional Tie Duct (main line crossing) and additional Flexible Duct to carry discharge air across additional Metrolinx tracks as required by the arrangement of the specific site.

4.9.5 The Ductwork shall be designed and constructed so that the SCD enclosure is located approximately at the point end of the track switch. Hot air from the Combustion Assembly shall be conducted below the rails in an insulated Tie Duct located ahead of the switch points. Two (2), in-track, Point End Nozzles shall be

provided to discharge the necessary flow rate of hot air along the rail towards the switch points. Adjacent to these shall be two (2), in-track, centrally- mounted, Track Ducts which shall conduct the necessary flow rate of hot air parallel with the fixed stock rails and discharge it over the switch slide plates. The two Track Ducts shall also discharge hot air into the tie cribs between the rail which contain switch operating rods.

4.9.6 It is intended that air discharge slots will be installed during field installation of the SCD. The Contractor shall provide a suitable label affixed to all Track Duct sections to guide and assist installation personnel in determining the quantity and location of air discharge slots. This information, augmented with slot dimensional information (e.g. width, length, angle of discharge, and relationship to switch slide plates and switch operating rods), shall also be included within the Service Manual.

4.9.7 A series of air discharge slots shall be provided on the "outside" lip of the Track Duct so as to direct hot air across the switch slide plates. An additional series of air discharge slots shall be provided on both the "inside" and "outside" lips of the Track Duct so as to direct hot air into the tie cribs containing switch and switch machine operating rods. Air discharge slots shall be approximately 3-inches long by 3/4-inches wide and located such that the leading edge of the slot is directly in line with the trailing edge of the tie. Slots shall be formed such that air is discharged 30 degrees downward (from horizontal plane) into its respective tie crib. Two special air discharge slots (except on #20 AW Turnout) shall be provided on the “outside” lip of the Track Duct so as to direct hot air at the rail in the vicinity of the two switch heel block assemblies. Heel block discharge slots shall be approximately 9-inches long by 3/4-inch wide and located such that the trailing edge of the slot is adjacent to the center line of the heel block assembly.

4.9.8 The Ductwork shall not project above top of rail, nor infringe on wheel flangeway allowances, when assembled and installed in the intended manner.

4.9.9 The Ductwork shall be designed and constructed to permit installation of SCD on either side of the track switch.

4.9.10 The Ductwork shall be designed and constructed for power operated track switches equipped with either horizontal or vertical switch rods.

4.9.11 The Ductwork shall be designed and constructed to accommodate small variations in switch tie sizes and spacing.

4.9.12 The Ductwork shall be watertight when assembled and installed in the intended manner.

4.9.13 The Ductwork shall be clear of all clearance envelopes and shall not infringe the flange way allowances of all rolling stock that operate on the Metrolinx Territory.

4.9.14 The Ductwork shall include a Main Offset Duct. The amount of offset provided shall be in accordance with Figure 7-1. The Main Offset Duct shall raise the base of the enclosure from ground level in order to eliminate undue ingress of surface water.

4.9.15 Each 90-degree Transition Assembly shall be secured to the Tie Duct with hexagon head bolts, heavy spring lock washers, and hexagon head nuts. The hexagon head nuts shall be tack-welded to the inside surface of the Main Duct. Fastening hardware shall be minimum 5/16-inch (7.938 mm) nominal size.

4.9.16 Tack-welded nuts may be replaced by a one-piece blind threaded insert. These are intended to permit quick removal of the Transition Assemblies from the Tie Duct.

4.9.17 Transition Assemblies shall have a protective coating of corrosion inhibiting primer paint.

4.9.18 Sensor Duct, Offset Duct, Extension Duct(s) and 90-degree Transition Assemblies shall be 11 AWG cold-rolled steel. Point End Nozzles shall not be heavier than 14 AWG cold-rolled steel. Track Duct shall be a minimum of 18 AWG galvanized steel sheet commercial grade; but not heavier than 14 AWG.

4.9.19 Sensor Duct, Offset Duct, Extension Duct(s) and all other ductwork assemblies in direct contact with ballast or earth (i.e. at ground level) shall be provided with a hot dip galvanized coating after fabrication to minimize corrosion. Minimum coating thickness shall be 1.4 ounces per square feet (427 grams per square meter) per side.

4.9.20 Offset Duct, Extension Duct(s), and other special application ductwork shall be provided with thermal insulation to minimize heat losses. Thermal insulation shall be provided with a metal covering to provide mechanical protection. Metal cover over Offset Duct shall be a minimum of No. 26 AWG galvanized steel sheet commercial grade. Metal cover over Sensor Duct and Extension Duct (and special application ductwork) shall be a minimum of No. 18 AWG galvanized steel sheet commercial grade.

4.9.21 Connecting ends of the Sensor Duct, Offset Duct and Extension Duct(s) shall be provided with external bolting flanges. Each flanged joint shall be provided with a 1/4-inch (6.35 mm) thick, heat-resistant, silicone rubber gasket.

4.9.22 Track Duct on either side of switch machine throw rod adjustment assembly ("basket") shall be provided with a "quick disconnect" feature to permit easy removal for maintenance purposes. Quick disconnect feature shall be designed to permit complete removal of the Track Duct section adjacent to the "basket" without use of special tools, removal of nuts, bolts and other hardware, and without removal of the 90-degree Transition Assembly or adjacent Track Duct sections.

a) Depending on the length of switch points there may be two switch machine throw rods: one located adjacent to the "Number 1" switch operating rod, and one located adjacent to the "Number 5" switch operating rod. Quick disconnect features shall be provided for both of these throw rod "baskets".

4.9.23 Each Point End Nozzle shall be designed and constructed so that its discharge orifice may be rotated to direct discharge air flow. A locking arrangement shall be provided to secure each Point End Nozzle in its final orientation.

4.9.24 Point End Nozzles and Transition Assemblies shall be given a protective coating of

corrosion inhibiting primer paint.

4.9.25 Final installed clearance between Point End Nozzle discharge orifice and switch point lug shall not exceed two inches (50.8 mm).

a) Due to variations in tie spacing and types of switch point lugs this requirement shall be met by manufacturing Point End Nozzles longer than necessary, with final "trimming" of Point End Nozzle performed by field installation personnel.

4.9.26 Track Duct shall be secured to Metrolinx cross ties with approved steel mounting brackets. Mounting brackets shall be manufactured from galvanized steel or from 1/4-inch (6.350 mm) by 1-inch (25.4 mm) strap iron, suitably painted to resist corrosion. Brackets shall be secured to cross ties using two 3/8-inch by 2-inch plated lag screws. Track Duct shall be subsequently secured to mounting brackets. Drawings detailing acceptable mounting brackets are available upon request.

4.9.27 All ductwork hardware, such as bolts, washers, nuts, shall be suitably protected from corrosion with a substantial plating of cadmium, zinc or equivalent material.

4.10 TIE DUCT

4.10.1 Each Tie Duct shall be designed to deliver the maximum amount of heated air to the critical areas** of the track switch. The minimum amount of heated air shall be 1500 CFM @ 3" static pressure. The duct shall be 10 inches high by 8 or 10 inches wide.

a) For the purposes of this Specification, the critical areas of switch shall be defined as the area between the two switch points and the heel blocks, in particular the area between the two switch points and the stock rail and any areas where there are moveable switch components, such as areas around the switch rods, helper rods and switch machine operating rods.

4.10.2 The Tie Duct shall be capable of withstanding the following loads under a cyclic load regime:

a) Lateral Load: 260 lb. min. to 13,000 lb. max. per rail seat

b) Vertical Load: 500 lb. min. to 25,000 lb. max. per rail seat

4.10.3 To be considered for use, all system components shall show no cracks or evidence of failure that exceeds those allowable by a recognized testing facility. The above tests shall run for a minimum duration of one (1) million cycles. Results of all deflections and cracks of any length versus the number of cycles shall be reported before approval for use on Metrolinx property.

4.10.4 A comprehensive finite element stress analysis report of the Tie Duct shall be submitted for approval. This stress analysis shall simulate a minimum 33,000 lb. vertical load per rail seat and an allowable stress of 12,000 PSI.

4.10.5 All materials used on the Tie Duct system shall not deteriorate or show signs of deterioration when subjected to temperatures ranging from -40 Degrees Celsius to +260 Degrees Celsius.

4.10.6 Each Tie Duct shall have an air sealed internal liner that resists the corrosion of the products of combustion and moist air.

4.10.7 All Tie Ducts shall be designed to use Pandrol PR631A Safelock or equivalent fastening system to attach the rail to the tie-duct.

4.10.8 All Tie Ducts shall include a minimum of two lift points capable of lifting four (4) times the weight of the tie without any permanent deformation of the lifting lug or Tie Duct.

4.10.9 All Tie Ducts shall be equipped with a device/feature to prevent lateral movement of the tie in the ballast.

4.10.10 All flexible duct sections shall be designed to withstand or be protected from railroad personnel stepping on those sections, without any permanent deformation or damage to the flexible tie section.

4.10.11 Tie Duct shall not provide Rail Cant at the switch point. Tie Duct used for main line crossing (not at switch point) shall provide a 1:40 Rail Cant. (Rail Cant is the sloped part of the concrete tie beneath the rail tie pad). Refer to Figure 7-3 for further details.

4.10.12 The Tie Duct shall be insulated with at least 5/8 inches of thermal insulation to reduce heat transfer to the ballast.

4.10.13 The Tie Duct shall be isolated from the SCD unit to allow +/- 2 inches deflection of the Tie Duct relative to the unit in the plan and elevation directions. Refer to Figure 7-2 for further details.

4.11 Energy Management System (EMS)

4.11.1 The SCD shall be controlled by the Energy Management System (EMS). The EMS shall be designed to be located in a nearby Signal House.

4.11.2 The EMS shall include:

a) the necessary gas burner operating circuitry; and

b) in addition to the basic Flame Safeguard Primary Control, the following safety control components:

i. an air flow sensing device designated "AIR SWITCH" to continuously monitor blower discharge pressure. Contacts activated by the air flow sensor shall remain closed when air flow is within normal operating limits and shall open to stop burner operation whenever air flow drops below normal operating limits; and

ii. an over-temperature sensing device designated "HIGH TEMP. LIMIT" to continuously monitor the sensor duct temperature. Contacts activated by the over-temperature sensor shall remain closed when the duct temperature is below or within normal operating limits and shall stop the supply of gas whenever the temperature of the hot air exceeds +215 degree Celsius preventing the burner from operating until manually reset.

4.11.3 The EMS Controller shall be equipped with a user adjustable delay-on timer and a delay-off timer. Each timer period shall be independently adjustable from 1 to 30 minutes in order to allow for staggered switching ON of the SCD associated with the EMS Controller to control maximum in rush current.

4.11.4 The EMS Controller shall have a low temperature cutout feature which allows user to disable the on-cycle control when the ambient temperature reaches -35 degree Celsius.

4.11.5 If the SCD fails to start on the initial EMS duty ON cycle, the EMS Controller shall attempt to restart it up to three times. If it fails to start after the retry, the EMS Controller shall provide an alarm indication. The retry feature shall be reset once the SCD starts, or after a manual reset.

4.11.6 The EMS Controller shall have a “switch warming” feature, which when enabled, turns the SCD on for a defined time (X) when ambient temperature drops below a set point (Y) for more than (Z) hours. These following parameters shall be user definable:

X = Between 1 and 8 hours;

Y = Between 0 and -35 degree Celsius;

Z = Between 1 and 84 hours.

4.11.7 The EMS Controller shall detect the following conditions and control the duty cycle accordingly:

a) Environmental temperature;

b) Environmental precipitation (rain or snow);

c) Ambient temperature;

d) Rail temperature; and

e) Current consumption.

4.11.8 The EMS shall include gas pressure monitoring and associated emergency gas shut off.

4.11.9 The EMS shall include an event recorder that records all fault data and normal

operating parameters.

4.11.10 The Contractor shall indicate how sensors are to be mounted, and the range of available adjustments for each sensor. Operating voltage for externally mounted sensors shall not exceed 24V AC/DC.

5. GENERAL QUALITY REQUIREMENTS

5.1 SAFE OPERATION

5.1.1 The SCD shall operate safely and reliably under normal conditions of installation and use, including start-up, continuous operation at all gas input ratings and heat output ratings, flame stability, incomplete combustion, smoke density and shut down, and also under such abnormal conditions that are likely to arise in service. The following characteristics and effects shall be evaluated and covered in a compliance report;

a) Ignition characteristics;

b) Safety control performance;

c) Temperature effects; and

d) Abnormal conditions of draft, voltage, and gas pressure.

5.1.2 The SCD shall be free of mechanical hazards, including the following:

a) Leakage of gas;

b) Sharp metal edges;

c) Contact with moving parts;

d) Lack of stability;

e) Excessive corrosion;

f) Excessive Tie Duct surface temperatures;

g) Structural failures; and

h) Leaking seams in ducts, combustion chambers and hot air discharge passages.

5.1.3 The SCD shall be free of electrical hazards that might result in an unsafe condition, including potential hazards to life or property.

5.2 WORKMANSHIP

5.2.1 The SCD shall comply with minimum industry standard of workmanship and design.

5.2.2 The SCD shall be suitable for installation and use on Metrolinx switch layouts.

5.3 MARKING REQUIREMENTS

5.3.1 The basic markings shall include the following in English:

a) Contractor's name, trademark or any other recognized symbol;

b) The model or type number of the complete unit with serial number;

c) Date of manufacture;

d) Applicable rail weight (for Tie Ducts);

e) The gas orifice size of pilot and main burner;

f) Minimum and maximum manifold pressures;

g) The type of gas; and

h) The electrical ratings.

5.3.2 The markings shall include suitable caution and warning indications where necessary to ensure safety to persons, including on components or sub-assemblies where dangerous moving parts (such as fans) and dangerous electrical potentials (such as ignition transformers) are present.

5.3.3 The basic markings shall be:

a) Located on a permanent metal part or a separate metal nameplate permanently attached;

b) Etched, engraved, die-stamped or indented, embossed, or suitable lithographed;

c) Clearly and permanently legible; and

d) Individually provided for each component of the SCD.

6. INSTALLATION DOCUMENTATIONS AND SERVICE MANUALS

6.1 INSTALLATION INSTRUCTIONS

6.1.1 The Installation Instructions shall outline a satisfactory standard installation procedure.

6.1.2 The Installation Instructions shall contain any special information required for safe and correct installation.

6.1.3 The Installation Instructions shall contain as a minimum the following information:

a) Adequate information for the complete installation of the equipment;

b) All individual parts required for the assembly of the equipment readily identified, or a suitable drawing provided;

c) Field erection and wiring instructions, together with installation location information;

d) Backfill and tamping instructions for any open trenches as a result of ductwork laying; and

e) Setup instructions for the SCD controls.

6.2 SERVICE MANUALS

6.2.1 A detailed Service Manual shall be provided for each SCD and EMS.

6.2.2 The Service Manual shall outline a satisfactory standard service procedure.

6.2.3 The SCD Service Manual shall contain as a minimum the following applicable information:

a) Smoke and output temperature readings which may normally be expected and the location where such readings are to be taken. Where smoke readings may vary with ambient temperature, the smoke readings corresponding to various temperatures shall be included;

b) Necessary plans and diagrams;

c) A detailed pre-winter check list which shall ensure that the SCD is capable of safe and reliable service;

d) A detailed procedure for checking that the safety devices and systems are operating as designed;

e) Recommended procedures for removal and restoration of parts which may require periodic replacement such as gas orifices, flame sensors, motors, and fans;

f) The recommended procedure to be followed in adjusting the supply of air and gas for proper combustion;

g) The dimensional relationship of the electrode tips with one another, and with adjacent fixed and adjustable components. The foregoing dimensions shall be given by suitable drawings;

h) A detailed trouble finding procedure; and

i) The number, location and dimensional details (length, width, angle of discharge) required in the extended nozzles. Details shall include the proper dimensional relationship of slots to switch slide plates, switch operating rods, and heel block assemblies.

6.2.4 The EMS Manual shall contain as a minimum the following applicable information:

a) Plans and diagrams;

b) A detailed pre-winter check list which shall ensure that the EMS is capable of safe and reliable service;

c) A detailed programming guide;

d) A detailed procedure for checking that the safety devices and systems are operating as designed;

e) Recommended procedures for removal and restoration of parts which may require periodic replacement; and

f) A detailed trouble finding procedure.

7. FIGURES

Figure 7-1 Main Offset Duct

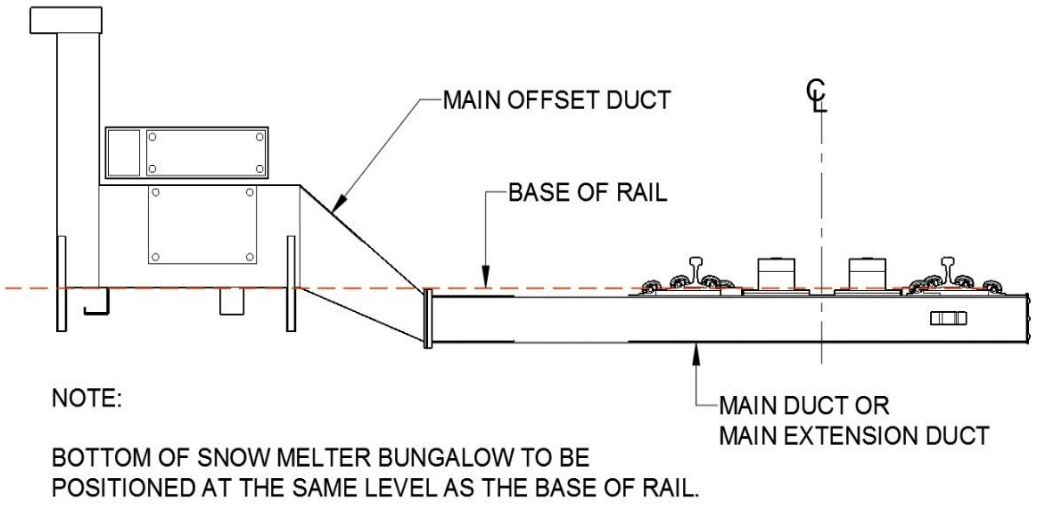


Figure 7-2 Tie Duct

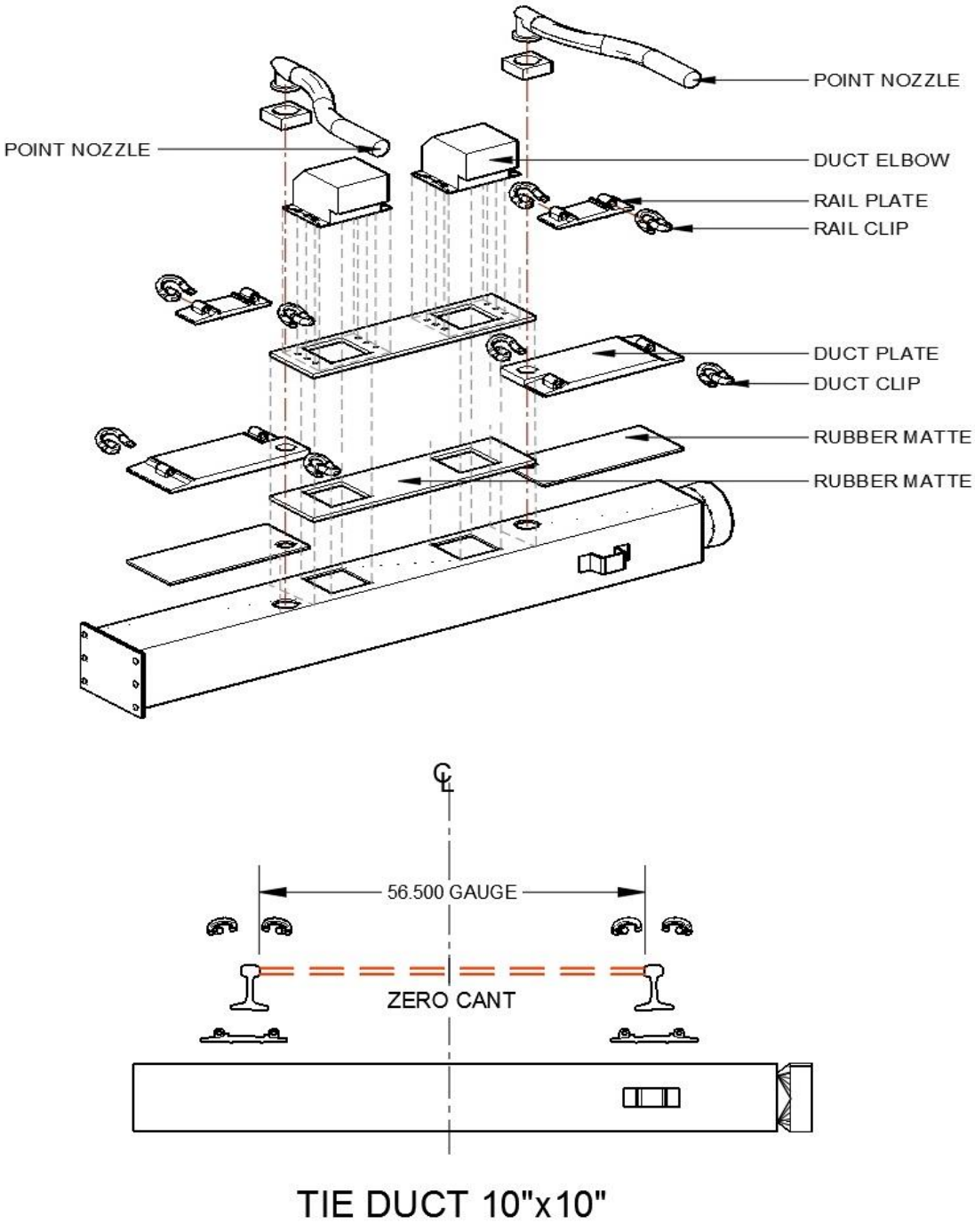
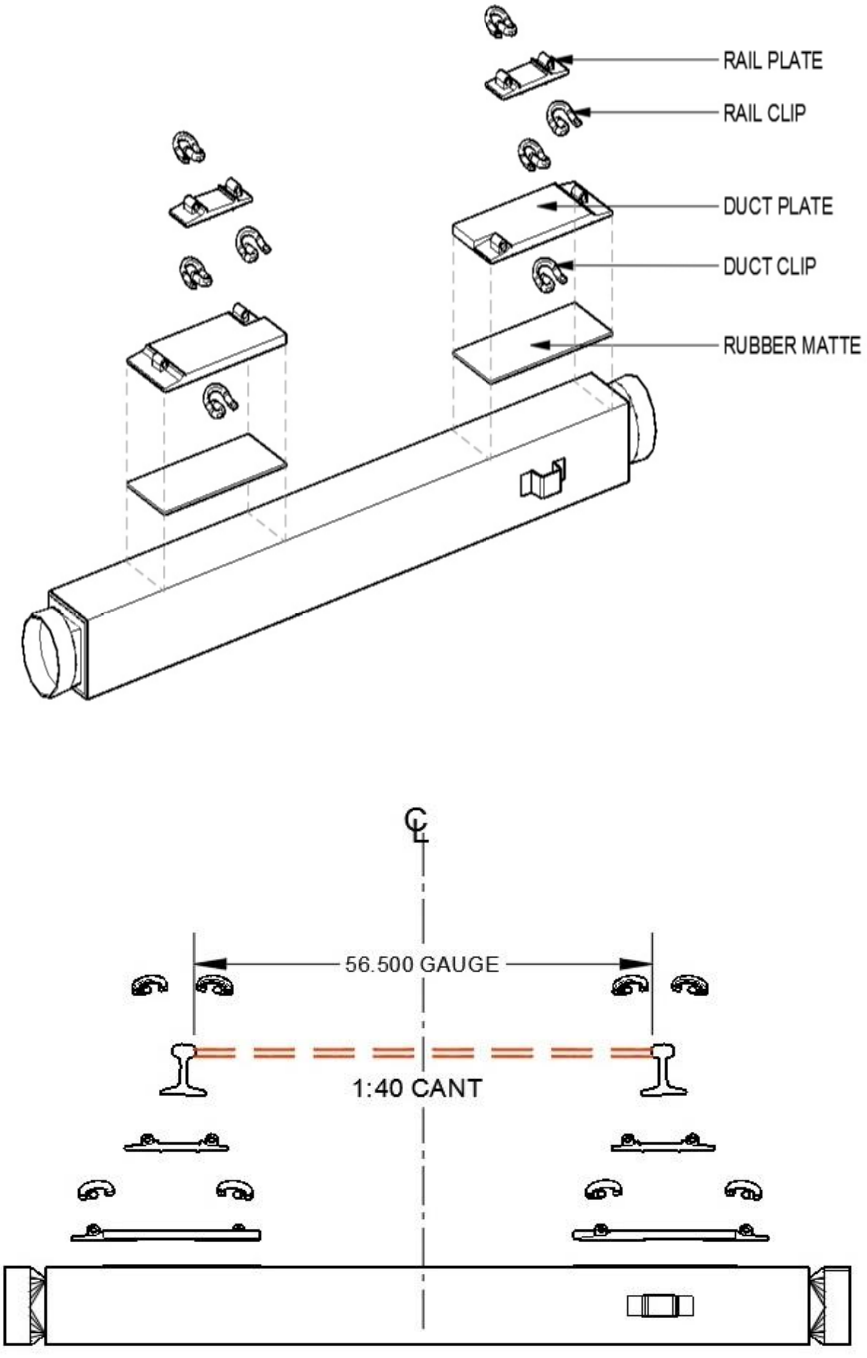


Figure 7-3 Tie Duct Main Line Crossing



TIE DUCT 10"x10"
MAIN LINE CROSSING 1:40 CANT

Figure 7-4 Air Distribution Duct System