ELEVATOR CONTROLS
SIMPLE. SOLID. SUPPORTABLE.

PIXEL Traction Controller Conformance Document and Compliance Test Procedures A17.1-2019/B44-19

GENERAL COMMENTARY

The purpose of this document is to serve as guide in describing the statements of conformance and test procedures required by TSSA in the "Application for Registration of a Design Submission Under Ontario's ***Technical Standards and Safety Act*** Elevating Devices Regulation" for Pixel Traction Elevator Controller for the following sections:

1. DEFINITIONS
2. DESIGN CONSEPTS
3. PART C1 (SCHEMATICS REFERENCES AND STATEMENTS OF COMPLIANCE)
4. PART C2 (STATEMENTS OF CONFORMANCE)
5. PART D2 TEST PROCEDURES
6. PART C2 TEST PROCEDURES
7. PART D1 TEST PROCEDURES
8. ADDITIONAL TEST PROCEDURES

NOTE: It is recommended to read the DEFINITIONS and DESIGN CONSEPTS sections below to gain a better understanding of the entire document contents.

1. DEFINITIONS

Primary components of the Pixel Control System that are referenced in this compliance document are defined here.

Pixel Main Microprocessor (P-MP). P-MP is the main control processor in the Pixel control system and is responsible for executing the logical operations of the elevator control system in a safe and code-compliant manner. These operations include elevator movement, door operations, passenger/user interaction, and controlling signal fixtures. In this document, inputs, represented by a triangle, and outputs, represented by a rectangle, associated with this processing unit are indicated with a signal acronym followed by the subscript "MP" (example: $EQRST_{MP}$). On the controller prints, inputs and outputs that are monitored and created by the main processor are shown as in Figure 1 immediately below:

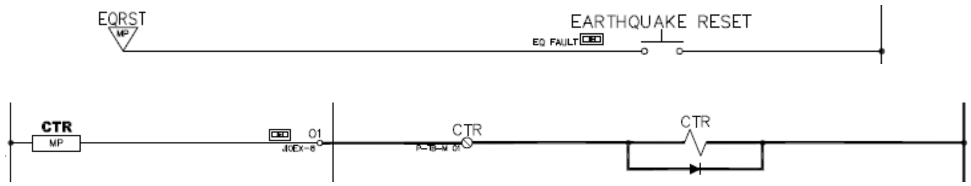

Figure 1. Representation of main processor input and output circuits

Pixel Safety Processor 1 (SP1). SP1 is one of two safety monitoring and control processor units, responsible for the oversight of physical elevator movement. Implemented via a microprocessor and associated software, SP1 is one of two gateways through which the activation of the main motor contactor, main brake, and emergency brake is controlled. A second safety monitoring and control processor unit (SP2) is the other gateway. P-MP does not directly control the motor contactor, main brake, and emergency brake; it controls them through the safety monitoring and control processors. On the controller prints, inputs read by SP1 and outputs generated by SP1 are shown as in Figures 2 and 3.

Pixel Safety Processor 2 (SP2). SP2 is one of two safety monitoring and control processor units, responsible for the oversight of physical elevator movement. Implemented via a programmable logic device, SP2 is one of two gateways through which the activation of the main motor contactor, main brake, and emergency brake is controlled. A second safety monitoring and control processor unit (SP1) is the other gateway. P-MP does not directly control the motor contactor, main brake, and emergency brake; it controls them through the safety monitoring and control processors. On the controller prints, inputs read by SP2 and outputs generated by SP2 are shown as in Figures 2 and 3.

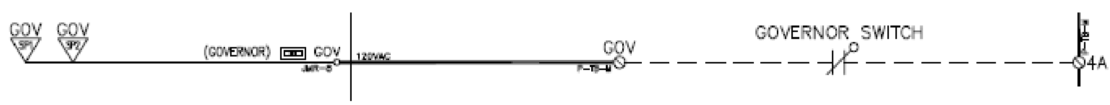

Figure 2. Schematic representation of redundant safety processor input circuits. In this example, the governor switch is monitored by both SP1 and SP2 processors through independent input circuits represented by the triangle symbols on the left hand side.

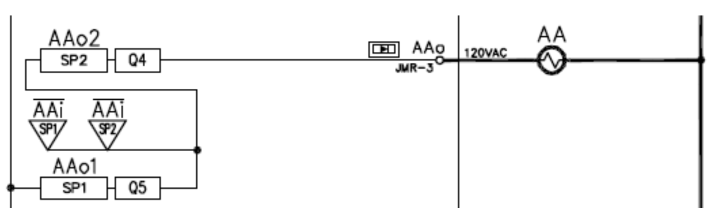

Figure 3. Schematic representation of redundant safety processor output circuits. In this example the AA contactor will only be energized when **both** SP1 and SP2 assert their respective outputs ($AAo1_{SP1}$ and $AAo2_{SP2}$). Associated inputs AAi_{SP1} and AAi_{SP2} are used to verify that the solid state output devices are operating as expected.

Pixel Safety and Logical Network. The Pixel Safety and logic Network is housed in two printed circuit boards (PCBs). The P-MP board houses the elevator logic microprocessor (NXP-LPC4357-208), and the P-MPIO board houses both the SP1 microprocessor (NXP-LPC1758FBD80) and the SP2 programmable logic device (Lattice-LFXP2-5E-5TN144C FPGA). These two PCBs are connected by a fifty-pin connector through which the following safety communication signals are shared:

a. CAB CAN BUS, Landa Aux. Sensor Head information
b. D_485 Drive, Speed Command from MP to hoist motor drive unit
c. R_485_Sel, Landa Main Sensor Head information
d. SPI, Serial communications among all three processors.
e. Power Supply and Common

Pixel P-MP. The Pixel P-MP PCB houses the elevator logic microprocessor (NXP-LPC4357-208, which executes the elevator control logic) and the graphical user interface (GUI) which is the vehicle for installation and adjustment interaction.

Pixel P-MPIO. The Pixel P-MPIO PCB houses the SP1 safety microprocessor (NXP-LPC1758FBD80), the SP2 safety FPGA (Lattice-LFXP2-5E-5TN144C), and all the safety input-output circuitry.

Pixel Top of Car Microprocessor (P-TOC). P-TOC resides on the top of the elevator cab and communicates with P-MP and SP1 via a CAN bus connection. The TOC is responsible for the direct control of the door operator as directed by the P-MP (when the operator is located on top of the elevator cab) and reads one of the two redundant absolute elevator positioning system readers (the "Auxiliary Reader"). The position data value read from the Auxiliary Reader is communicated to P-MP and SP1 via a CAN bus connection.

Landa Positioning System (Landa). Landa is comprised of three main components:

- Landa Main Car Position Reader (Main Reader)
- Landa Auxiliary Car Position Reader (Auxiliary Reader)
- Encoded steel tape that runs the length of the elevator travel

The Main Reader and Auxiliary Reader are each capable of reading and reporting absolute elevator position to an accuracy of 0.8 millimeters. Each reader is self-diagnosing, able to detect internal optical sensor failures (each sensor head utilizes an array of optical sensors to read the encoded steel tape) and failures in reading the encoded steel tape (e.g., tape mounting failure, excessive misalignment of tape and reader).

2. DESIGN CONCEPTS

The following sections describe the way in which safety-related monitoring and control is accomplished by the Pixel controller.

ⓘ **NOTE**: Pixel Traction Elevator Controller original design, listed under TSSA file number: TSSA-2017-01365, design is A17.1 2010/ B44-10, was certified by TSSA to be code compliant using the A17.1 2013/ B44-13 requirements.

How Pixel determines the position and movement (speed and direction) of the cab in the hoistway. Car position information is acquired from an absolute positioning system (Landa) that utilizes redundant sensor head units (Main Reader and Auxiliary Reader) that each read a fixed encoded steel hoistway tape. Each reader can independently resolve the car position within 0.8 millimeters.

The Pixel Main Microprocessor Board (P-MP), the Safety Processor 1 (SP1) and Safety Processor 2 (SP2) read the car's position from the Main Reader via a twisted shielded pair of wires, terminated at the "SELECTOR PORT" on the P-MP board. (Refer to pages 4, 6 and 6b of the controller prints.)

The Pixel Top of Car Microprocessor (P-TOC) reads the car's position from the Auxiliary Reader and broadcasts this data via a CAN bus connection to (SP1) and P-MP. The CAN bus connection is shown in the controller prints terminating at the "CAB CAN PORT" on the P-MP board. (Refer to pages 4, 6 and 6b of the controller prints.)

How Pixel identifies the locations of key elevator positions. Safety-critical elevator positions (e.g., floor locations, terminal landing speed profile speeds/positions) are learned and stored, independently in the P-MP, SP1, and SP2 non-volatile memory locations, as part of the controller installation process. This information is referenced in various safety-related checks and operations (e.g., unintended motion, leveling overspeed, Inspection overspeed, speed monitoring as the car approaches the terminal landings).

How critical device statuses are read by the Pixel control system entities. The statuses of the critical safety devices that are connected to the Pixel control system (electrical protective devices such as stop switches, car gate(s), and hoistway door locks) are evaluated by P-MP, SP1, and SP2. SP1 and SP2 each see the status of these devices directly, via independent safety input channels (two channels for each signal). The controller circuitry that routes these electrical signals to each safety processor is split at the connection point of the external device and is routed through separate and independent circuit components, preventing the Pixel control system from being susceptible to a common mode failure of the electronics. The independent circuitry is indicated diagrammatically on the controller prints as shown in Figure 4 below, with each independent input circuits indicated with a triangular input symbol. The processing unit to which each circuit is routed is indicated by the label inside the triangular graphic (e.g., “SP1” means that the circuit is routed to SP1).

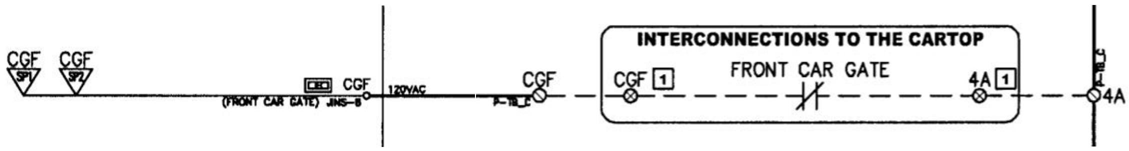

Figure 4. Schematic representation of independent input circuitry for safety-critical circuits

SP1 and SP2 each communicate the statuses of these critical devices to the P-MP for its awareness. The P-MP also serves to validate the input statuses reported by SP1 against the input statuses reported by SP2. An inconsistency between the statuses reported by SP1 and SP2 causes to remove the elevator from service, as it would indicate a failure of the input circuitry of one of the two safety systems.

Shown below (Figure 5) is the **Pixel Input-Output Flow Diagram**, representing the input and output information flow within Pixel, where all safety inputs are routed through SP1 and SP2 processors before allowing them to reach the MP for elevator logic processing, and all outputs from the MP elevator logic will be routed through the SP1 and SP2, where they will be summed with the safety logic to either allow or override MP elevator logic commands based on system status.

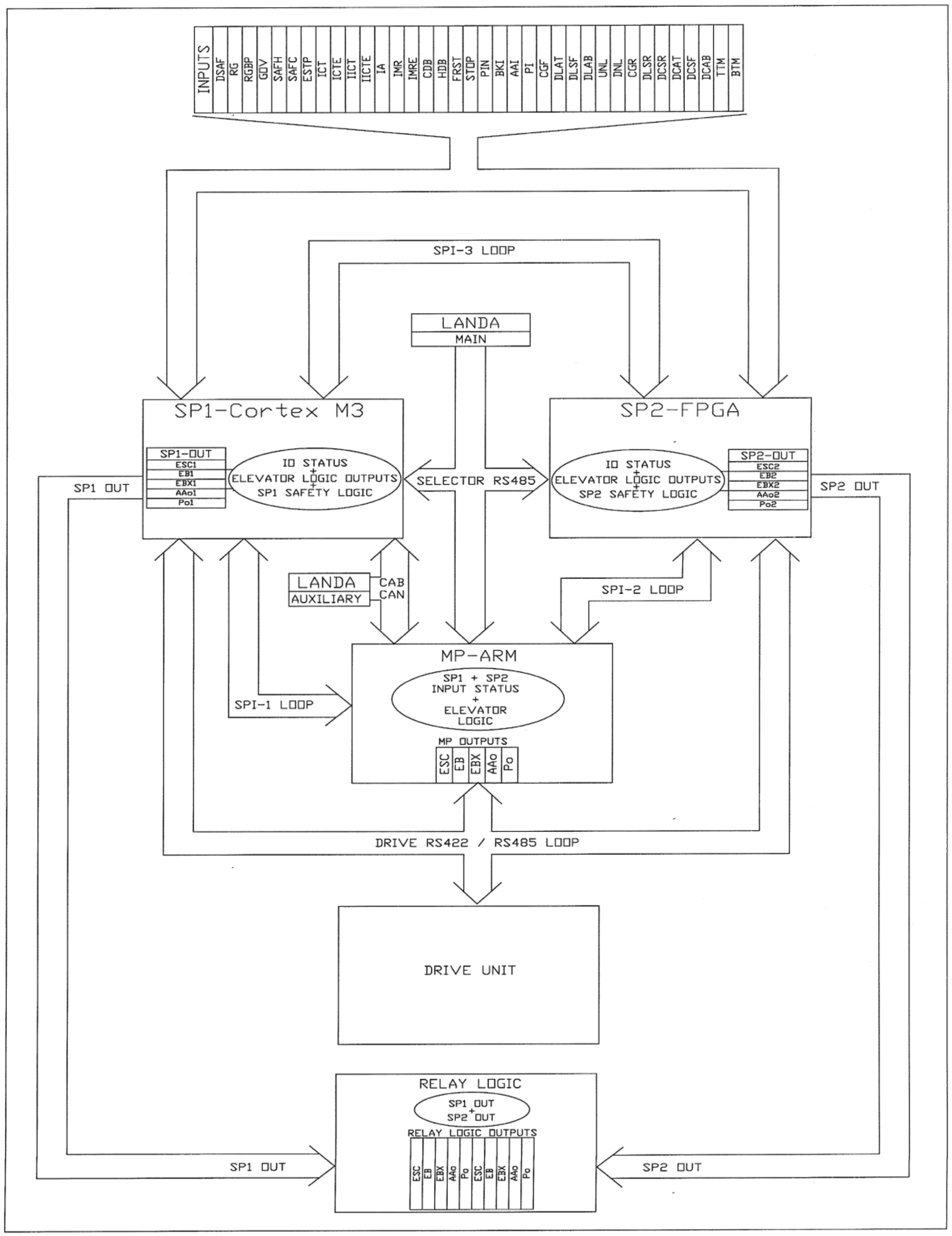

Figure 5. Pixel Input-Output Flow Diagram

How the Pixel control system validates the position values read from the Landa positioning system. The car position data values read from the Main Reader and Auxiliary Reader are continuously compared against each other, independently by the P-MP, SP1, and SP2, to validate that each reader is operating in accordance with the other. Each reader is self-diagnosing in that each is designed to detect when it can no longer reliably read the encoded hoistway tape due to internal failures, inadequate installation, or installation failures.

Because the Main Reader and Auxiliary Reader each read the same encoded steel hoistway tape, the value that each reader obtains can be directly validated against the value read by the other. The readers are mounted in a cartop mounting assembly (bracket) which maintains a fixed linear positional offset between the two readers. This offset is learned and the values reported by the readers are continuously compared to validate that this offset is maintained throughout the operation of the elevator, any variance in this offset causes to remove the elevator from service, as it would indicate a failure of one of the two position readers and/or associated data communication circuitry.

ⓘ **NOTE**: The Main and Auxiliary Readers, Encoded Stainless Steel Tape and mounting accessories are referred to as the Landa Positioning system (or Landa).

3. PART C1 (SCHEMATICS REFERENCES AND STATEMENTS OF COMPLIANCE)

Provide an electrical schematic drawing indicating conformance with 2.19, 2.25 & 2.27 for Electric Elevators

SCHEMATIC REFERENCES AND STATEMENTS OF COMPLIANCE

Identification and explanations of the implementation of devices and/or the interface of devices to the Pixel control system are described here. References to pages of the Pixel controller prints are provided.

2.12.7.3 Hoistway Access Operation

2.12.7.3.3(b): Independent Speed Control on Access

All modes of Inspection operation, including Hoistway Access Inspection mode, share the same Inspection Speed, limited by design to a maximum of 150 ft/ min and the Inspection Trip Speed Parameter, limited to a maximum value of 20% over Inspection Speed parameter, the Inspection Speed is monitored by two independent means, SP1 and SP2 (along with the Auxiliary and Main Readers, respectively). If either SP1 or SP2 determine that the speed of the car exceeds the speed allowed by this subsection, it removes power from the driving machine motor and brake by deactivating the AA and P contactors. Refer to page 4 of the controller prints to see the AA and P contactor control circuits. Refer to page 2, for relay logic brake control, or 2bk, for electronic brake control, of the controller prints to view the application of contacts of the P contactor in the main machine brake control circuit. Refer to page 1 of the controller prints to see the application of the AA contactor in the driving machine motor circuit, and the application of contacts of the AA and P contactors in the drive enable circuits. Refer to entry 2.26.1.4.1(d)(1) below for additional information.

2.19: Ascending Car Overspeed and Unintended Car Movement Protection

2.19.1: Ascending Car Overspeed Protection

2.19.1.2: The device that detects an overspeeding ascending elevator is the car overspeed governor and its electrical contact. Each safety processor (SP1, SP2) monitors the status of the car overspeed governor's electrical contact (when the overspeed governor's electrical contact is closed, voltage is applied to safety processor inputs GOV_{SP1} and GOV_{SP2}. If the car overspeed governor's electrical contact opens (voltage removed from safety processor inputs GOV_{SP1} and GOV_{SP2} while the car is moving in the up direction (indicating that the car is overspeeding in the up direction), each safety processor independently activates the emergency braking device and removes power from the driving motor/machine and brake. Each safety processor can take such actions independently of the other. Refer to page 3 of the controller prints to see the overspeed governor electrical contact (labeled "GOVERNOR SWITCH") and the inputs GOV_{SP1} and GOV_{SP2} that monitor it.

2.19.1.2(a): The electrical contact of the car governor shall be field adjusted to open at a speed not greater than 10% higher than the speed at which the car governor is set to trip, per section 2.18.2.1.

2.19.1.2(a)(1)(a): The car overspeed governor itself shall not require electrical power for its functioning. A loss of electrical power routed to the electrical contact of the car governor (i.e., the voltage common for the safety processor input signals GOV_{SP1} and GOV_{SP2}) is seen by the control system in a way that is identical to when the governor's electrical contact opens. As a result, the system will respond by activating the emergency braking device and removing power from the motor and main machine brake. In the ascending car overspeed control means circuitry, the maintenance of the emergency braking device in its normal operational state requires the application of power to the emergency braking control circuits and devices. A loss of electrical power to the ascending car overspeed control means therefore causes the immediate activation of the emergency braking device.

2.19.1.2(a)(1)(b): The detection means is comprised of the car overspeed governor (and its electrical contact), and the redundant safety processors SP1 and SP2 and their respective input circuits (which are independent of each other).

- The occurrence of a single ground will not render the detection means inoperative. Depending upon where the ground occurs, a grounded circuit in the detection circuit may deactivate the GOV_{SP1} or GOV_{SP2} input circuit, or it may cause fuse F4 to open. Fuse F4 feeds power to all safety inputs through terminal 4A or 4CT. In either case, the emergency braking device will be activated as a result (because the grounded circuit causes one or both safety processors to think that the car is overspeeding). Refer to page 2 of the controller prints and observe that one side of the power feeding terminal 4CT through fuse F4A is referenced to terminal 3 (system ground).
- The only mechanically operated switch is the car overspeed governor itself, which shall meet the requirements of 2.26.4.3.1.
- There are no magnetically operated switches, contactors, or relays associated with the ascending car overspeed detection means.
- Because of the redundant and independent safety processors and their respective input circuits, the failure of a single solid state device will not render the detection means inoperative.
- Because SP2 safety processor is not a software system, the failure of a software system will not render the detection means inoperative.

2.19.1.2(a)(2): The only mechanically operated switch is the car governor itself, which shall comply with the requirements of 2.26.4.3.

2.19.1.2(a)(3): When a fault related to section 2.19.1.2(a)(1)(b) or 2.19.1.2(a)(2) is detected, the car is not allowed to restart. The detection of these faults is described below:

- *The occurrence of a single ground.* A single ground will cause the emergency braking device to be activated by one or both safety processors, or as a failsafe result of fuse F4A opening. The car is stopped immediately and is not allowed to restart until the emergency braking device is returned to its normal operating state (as indicated by emergency braking device monitored input RGOK, refer to page 2 and 3 of the controller prints) and the Fault Reset button is pressed in the main Pixel control cabinet.
- *The failure of a mechanically-operated switch that does not meet the requirements of 2.26.4.3.1.* The car overspeed governor is the only mechanically operated switch involved in the ascending car overspeed detection means, and the car overspeed governor shall meet the requirements of 2.26.4.3.1.
- *The failure of any single magnetically operated switch, contactor, relay.* Magnetically operated relays that are part of the ascending car overspeed control means are the EB1, EB2, EBX1, and EBX2 relays. These relays, which are used to control the emergency braking device, are continuously monitored for proper operation and are cycled at the end of each run. The proper operation of these relays is monitored via inputs RG_{SP1}, RG_{SP2}, $RGBP_{SP1}$ and $RGBP_{SP2}$. Should any one of these relays fail to operate as expected (the failure of any of the relay contact to drop when the relays are de-energized), the car is not allowed to restart. Refer to page 2 of the controller prints to see the arrangement of the EB1, EB2, EBX1, and EBX2 relay contacts, and the circuit location where these relays are monitored. These monitoring signals are routed to inputs RG and RGBP, which are shown on page 3.
- *Failure of a solid state device.* Solid state devices involved in the detection of an ascending car overspeed condition and the activation of the emergency brake are related to the input circuits used in the monitoring of the overspeed governor electrical contact (GOV_{SP1} and GOV_{SP2} inputs), and the output circuits used in the activation of the emergency brake ($EB1_{SP1}$, $EB2_{SP2}$, $EBX1_{SP1}$ and $EBX2_{SP2}$ outputs). The GOV_{SP1} and GOV_{SP2} inputs are verified at the end of each run via a cycle-testing contact (CTR) that removes power from the electrical bus (4CT) that feeds the GOV_{SP1} and GOV_{SP2} inputs. When power is removed from this bus, the GOV_{SP1} and GOV_{SP2} inputs are checked to verify that they have changed state as expected. Should either of these inputs fail to change state as expected, the car is not allowed to restart. The circuits driven by outputs $EB1_{SP1}$, $EB2_{SP2}$, $EBX1_{SP1}$, and $EBX2_{SP2}$ are used in alternating fashion from one run to the next, in order to maintain power to the emergency braking device while switching and validating the operation of each circuit branch. Should any of these output circuits fail to change state as intended (as validated via monitoring inputs RG_{SP1}, RG_{SP2}, $RGBP_{SP1}$ and $RGBP_{SP2}$), the car is not allowed to restart.

- *Failure of a software system.* The only software system associated with the ascending car overspeed detection and control means is SP1. The proper operation of SP1 is monitored by P-MP. Should SP1 fail to maintain proper and required communications with P-MP, the car is not allowed to restart. If any of the input statuses read by SP1 contradict the input statuses read by SP2, the car will not be allowed to restart. Should any of the logical decisions made by SP1 contradict those made redundantly by SP2, the car is not allowed to restart. Each of these operational checks is a means of validating the proper operation of SP1.

2.19.1.2(a)(4): Should an ascending car overspeed condition be detected, the car is not allowed to move until the car overspeed governor electrical contact is reset to the normal operating state, the controller's Fault Reset button is pressed, and the emergency braking device is returned to the normal operating state (if applicable to the specific type of emergency braking device). Refer to page 3 of the controller prints to see the governor electrical contact (labeled "GOVERNOR SWITCH") and the Fault Reset Button.

2.19.1.2(b): The emergency braking device shall conform to 2.19.3. The type and model of emergency braking device shall be capable of stopping and holding the car in compliance with sections 2.16.8(h) and 2.19.2.2(b). The operating status of the emergency braking unit (if available) is monitored via the $RGOK_{MP}$ input. The car is not allowed to run or move until the emergency braking device has been returned to its normal operating state. Refer to page 2 of the controller prints to see the emergency brake operational status monitoring circuit, and page 3 to see the $RGOK_{MP}$ input.

2.19.2: Unintended Movement Protection

2.19.2.2: Where Required and Function

2.19.2.2(a): For the purposes of Unintended Movement Protection, the state of the elevator doors and the cab location information read from the Landa positioning system are used to determine if the elevator cab has left a floor zone with both the car door and associated hoistway door open. This condition is evaluated in a redundant manner by SP1 and SP2. SP1 and SP2 each monitor the statuses of the car doors or gates (via inputs CGF_{SP1} and CGF_{SP2} respectively), the statuses of the hoistway doors (via inputs $DLAT_{SP1}$, $DLSF_{SP1}$, and $DLAB_{SP1}$ and $DLAT_{SP2}$, $DLSF_{SP2}$, and $DLAB_{SP2}$ respectively), and the position of the car in the hoistway (via the Main and Auxiliary Landa sensors respectively). If either SP1 or SP2 determine that the car has left the floor zone in either direction with the doors open it will deploy the emergency braking device and remove power from the driving motor/machine and main machine brake. Each safety processor can take such action independently. Refer to page 4 of the controller prints to see the redundant safety processor inputs for the car door and hoistway door contacts.

Unintended Car Movement Protection works in all modes of operation. If it is detected that the car leaves a floor zone with both the car door and hoistway door in the "not-closed" state, the Unintended Car Movement fault is declared, and the emergency braking device is deployed.

While on Hoistway Access operation, the safety system design recognizes intent to move the elevator by monitoring the state of the hall-mounted Access Up/Down key switches. If the elevator is being commanded to move by the appropriate Access Up/Down key switch, movement away from the floor with both car door and hall door in the open position is allowed. Should such movement away from the floor be detected in the absence of the operator's command to move, an Unintended Car Movement fault is declared.

Similar logic is applied to car movement with either the Car Door Bypass switch or the Hall Door Bypass switch in the BYPASS position. For the purpose of Unintended Car Movement monitoring, the door contact associated with each switch (when placed in the BYPASS position) is only "ignored" when an operator is commanding movement (either on Cartop Inspection or In-Car Inspection operation).

2.19.2.2(a)(1)(a): The maintenance of the emergency braking device in the normal operational state requires the application of power to the emergency braking control circuits and devices. A loss of electrical power to the unintended movement control means causes the activation of the emergency braking device. Refer to page 3 of the controller prints to see the emergency braking device control output circuits ($EB1_{SP1}$, $EB2_{SP2}$, $EBX1_{SP1}$, $EBX2_{SP2}$) and the emergency braking device control relay coils (EB1, EB2, EBX1, EBX2). Refer to page 2 for the emergency braking device and the circuit that controls it.

2.19.2.2(a)(1)(b): The detection means is comprised of redundant safety processors SP1 and SP2 and their respective input circuits, and the redundant Main and Auxiliary Landa sensors.

- The occurrence of a single ground will not render the detection means inoperative. Depending upon where the ground occurs, a grounded circuit in the detection circuit may deactivate a car door or hoistway door input circuit (indicating that the associated door is not closed), or it may cause fuse F4A to open (which causes all the door contact inputs to indicate that both the car door and hoistway doors are not closed). In either case, the unintended motion detection means is not rendered inoperative. Refer to page 4 of the controller prints to see the car door status contact inputs CGF_{SP1} and CGF_{SP2}, the hoistway door status contact inputs $DLAT_{SP1}$, $DLAT_{SP2}$, $DLSF_{SP1}$, $DLSF_{SP2}$, $DLAB_{SP1}$, $DLAB_{SP2}$ and the hoistway door lock contact connections. Refer to page 6B to see the car gate contact connection. Refer to page 2 of the controller prints to see fuse F4A.
- The mechanically-operated switches are the car and hoistway door contacts, which shall meet the requirements of 2.26.4.3.1.

- There are no magnetically-operated switches, contactors, or relays associated to the detection means.
- Because of the redundant and independent safety processors and their respective input circuits, the failure of a single solid state device will not render the detection means inoperative.
- Because SP2 safety processors is not a software system, the failure of a software system will not render the detection means inoperative.

2.19.2.2(a)(2): The mechanically-operated switches are the car and hoistway door contacts, which shall meet the requirements of 2.26.4.3.

2.19.2.2(a)(3): When a fault related to section 2.19.2.2(a)(1)(b) is detected, the car is not allowed to restart. Pixel system checks for the following fault types each time the car stops, as described below.

- *The occurrence of a single ground.* A single ground in one of the redundant door status monitoring inputs will cause the SP1, SP2 and P-MP processors to detect a discrepancy between the associated safety input statuses. This results in the declaration of a safety system fault, and the car is not allowed to restart. If the single ground cause fuses F4A to open, the car will not be allowed to move. The safety system fault is maintained until the discrepancy between the inputs is resolved, and the controller Fault Reset button is pressed in the main Pixel control cabinet.
- *The failure of a mechanically-operated switch that does not meet the requirements of 2.26.4.3.1.* The car door and hoistway door contacts are the only mechanically-operated switched involved in the unintended car movement detection means, and they shall meet the requirements of 2.26.4.3.1.
- *The failure of any single magnetically-operated switch, contactor, relay.* Magnetically-operated relays that are part of the unintended car movement control means are the EB1, EB2, EBX1, and EBX2 relays. These relays, which are used to control the emergency braking device, are continuously monitored for proper operation and are cycled at the end of each run. The proper operation of these relays is monitored via inputs RG_{SP1}, RG_{SP2}, $RGBP_{SP1}$ and $RGBP_{SP2}$. Should any one of these relays fail to operate as expected (the failure of any of the relay contact to drop when the relays are de-energized), the car is not allowed to restart. Refer to page 2 of the controller prints to see the arrangement of the EB1, EB2, EBX1, and EBX2 relay contacts, and the circuit location where these relays are monitored. These monitoring signals are routed to inputs RG and RGBP, which are shown on page 3.
- *Failure of a solid state device.* Solid state devices involved in the detection of unintended car movement and the activation of the emergency brake are related to the input circuits used in the monitoring of the car and hoistway door statuses

(CGF_{SP1}, CGF_{SP2}, $DLAT_{SP1}$, $DLAT_{SP2}$, $DLSF_{SP1}$, $DLSF_{SP2}$, $DLAB_{SP1}$, $DLAB_{SP2}$), and the output circuits used in the activation of the emergency brake ($EB1_{SP1}$, $EB2_{SP2}$, $EBX1_{SP1}$ and $EBX2_{SP2}$ outputs). The redundant car and hoistway door contact inputs are continuously verified against each other (the corresponding inputs must match between SP1 and SP2), and they are cycle tested at the end of each run so that the inputs for a door contact that is infrequently exercised (the door is rarely opened) can be verified frequently. These inputs are cycle-tested via a relay contact (CTR) that removes power from the electrical bus (4CT) that feeds these inputs. When power is removed from this bus, the door contact inputs are checked to verify that they have changed state as expected. Should any of these inputs fail to change state as expected, the car is not allowed to restart. Additionally, the circuits driven by outputs $EB1_{SP1}$, $EB2_{SP2}$, $EBX1_{SP1}$, and $EBX2_{SP2}$ are used in alternating fashion from one run to the next, in order to maintain power to the emergency braking device while switching and validating the operation of each circuit branch. Should any of these output circuits fail to change state as intended (as validated via monitoring inputs RG_{SP1}, RG_{SP2}, $RGBP_{SP1}$ and $RGBP_{SP2}$), the car is not allowed to restart.

- *Failure of a software system.* The software system associated with the unintended car movement detection and control means is SP1. The proper operation of SP1 is monitored by P-MP. Should SP1 fail to maintain proper and required communications with P-MP, the car is not allowed to restart. If any of the input statuses read by SP1 contradict the input statuses read by SP2, the car will not be allowed to restart. Should any of the logical decisions made by SP1 contradict those made redundantly by SP2, the car is not allowed to restart. Each of these operational checks is a means of validating the proper operation of SP1.

2.19.2.2(a)(4): If an unintended car movement condition is detected and fault declared, the emergency braking device is deployed by SP1 and SP2. The emergency braking device shall remain in the deployed state, and the car is not allowed to move until the Fault Reset button in the Pixel main control cabinet is pressed. Once pressed, the control circuits for the emergency braking device are returned to the normal operating state, but the car is not allowed to run or move until the emergency braking device has been returned to its normal operating state.

2.19.2.2(b): The emergency braking device shall conform to 2.19.3. The type and model of emergency braking device shall be capable of stopping and holding the car in compliance with sections 2.16.8(h) and 2.19.2.2(b). The operating status of the emergency braking unit (if available) is monitored via the $RGOK_{MP}$ input. The car is not allowed to run or move until the emergency braking device has been returned to its normal operating state. Refer to page 2 of the controller prints to see the emergency brake operational status monitoring circuit, and page 3 to see the $RGOK_{MP}$ input.

2.19.3 Emergency Brake (See Nonmandatory Appendix F)
The Emergency Brake devise is provided by others.

2.19.4 Emergency Brake Supports
The Emergency Brake Supports are provided by others.

2.25: Terminal Stopping Devices

2.25.1 General Requirements

2.25.1.1: Car position and car speed are determined by dually-redundant sensing devices (Landa Main Car Position Reader and Auxiliary Car Position Reader) that each utilize multiple optical emitters/detectors to determine car position by reading an encoded steel tape. The encoded steel tape provides an absolute position value when read (it is an absolute positioning system, as opposed to an incremental positioning system).

2.25.1.2: The UP and DOWN FINAL limit switches are mechanically-operated. Refer to page QR4 of the controller prints for the physical location of these switches in the hoistway, above and below the terminal landings.

2.25.1.3: The redundant Main Reader and Auxiliary Reader sensing heads are constructed in an enclosed housing and are tolerant of the horizontal movement that is typical of an elevator. Refer to page QR5 of the controller prints for horizontal sensor heads to tape tolerances.

2.25.2 Normal Terminal Stopping Device

2.25.2.1: Landa (Main Car Position Reader and Auxiliary Car Position Reader) utilizes multiple optical emitters/detectors to determine car position by reading an encoded steel tape to comply with sections 2.25.2.1.1 and 2.25.2.1.3.

2.25.2.1.1: In the event that the car fails to reduce speed while approaching a terminal landing due to failure of Landa Main Car Position Reader (the Normal Stopping Means), an Emergency Slowdown fault is triggered by SP1 or SP2 (or both), and the Landa Auxiliary Car Position Reader (the Normal Terminal Stopping Means) is used to decelerate and bring the car into a terminal landing.

2.25.2.1.2: The Normal Stopping Means, Normal Terminal Stopping Means, and the Final Terminal Stopping Devices are described below.

The Normal Stopping Means is comprised of the following**:**
- Landa Main Car Position Reader (Main Reader)

- Pixel Main Processor (P-MP) and P-MP Learned Landings Positions

The Normal Terminal Stopping Means is implemented in a dually independent and redundant manner.

The first implementation is comprised of:

- Landa Auxiliary Car Position Reader (Auxiliary Reader)
- Pixel Safety Processor 1 (SP1) and SP1 Learned Terminal Landings Speed Profile and learned normal limits

The redundant implementation is comprised of:

- Landa Main Car Position Reader (Main Reader)
- Pixel Safety Processor 2 (SP2) and SP2 Learned Terminal Landings Speed Profile and learned normal limits

The operation of each of the Normal Terminal Stopping Means involves the determination of car speed based upon the change in car position as indicated by its respective Reader, and the indication of car position (proximity to the terminal landings) provided by that Reader.

The redundant Normal Terminal Stopping Means are inherently independent of the redundant Normal Stopping Devices, due to the independence and redundancy of the safety processor/position sensor pairs, each of which implement both the Normal Terminal Stopping Means.

When either Normal Terminal Stopping Devices determines that the car's speed is inappropriate (too high) for its position relative to a terminal landing, it raises an Emergency Slowdown Fault to command the P-MP processor to perform an emergency slowdown (a modified speed command) into the terminal landing.

The Final Terminal Stopping Devices are the mechanically operated final limit switches mounted beyond the normal extent of elevator travel at each end of the hoistway.

The common member for both the Normal Terminal Stopping Means and the Normal Stopping means is an encoded steel tape. The encoded steel tape provides an absolute position value when read.

The presence of the encoded steel tape is monitored by both SP1 and SP2 safety processors. A Main and Aux Selector Fault will be declared by SP1 and/or SP2 respectively if the tape is not detected.

If SP1 raises the fault it will switch off $AAo1_{SP1}$ and $Po1_{SP1}$ contactor control outputs to

1. Remove power to the driving machine motor through output $AAo1_{SP1}$, which (along with output $AAo2_{SP2}$) participates in the energizing of the main motor contactor AA.

2. Remove power to the driving machine brake through output $Po1_{SP1}$, which participates (along with output $Po2_{SP2}$) in energizing the potential contactor P, removing power from the brake.

Refer to page 4 of the controller prints to see the SP1 control outputs $AAo1_{SP1}$ and $Po1_{SP1}$, and the AA and P contactor coils, page 1 for AA motor contactor contacts and page 2 for P contactor contacts, relay logic driven brake control, or page 2bk for electronic brake control.

If SP2 raises the fault it will switch off $AAo2_{SP2}$ and $Po2_{SP2}$ contactor control outputs to

1. Remove power to the driving machine motor through output $AAo2_{SP2}$, which (along with output $AAo1_{SP1}$) participates in the energizing of the main motor contactor AA.

2. Remove power to the driving machine brake through output $Po2_{SP2}$, which participates (along with output $Po1_{SP1}$) in energizing the potential contactor P, removing power from the brake.

Refer to page 4 of the controller prints to see the SP1 control outputs $AAo1_{SP1}$ and $Po1_{SP1}$, and the AA and P contactor coils, page 1 for AA motor contactor contacts and page 2 for P contactor contacts, relay logic driven brake control, or page 2bk for electronic brake control

NOTE: If both SP1 and SP2 raise the fault simultaneously, each independently follows behavior described above.

For AC Motor control units, the main motor contactor (AA) is a 3-phase contactor, used to apply and remove power from all phases of a 3-phase driving machine motor. Auxiliary contacts of the AA contactor are also wired to a Drive Enable input which commands the motor drive unit to remove power from its 3-phase motor power outputs. Refer to page 1 of the controller prints to see the application of the 4 and 6 auxiliary contacts of the main motor contactor AA.

For DC Motor control units, the main motor contactor (Delta) is a 2-phase contactor, controlled by the DC drive unit, used to apply and remove power from all phases of driving machine motor. Auxiliary contacts from the AA and P contactors are wired in series to the Drive Enable input which is used to command the motor drive unit to remove or apply power from its 2-phase motor power outputs and to energize or release the Delta motor contactor. Refer to page 1 of the controller prints to see the application of auxiliary contact 1 of the AA contactor, and Auxiliary contact 1 of the P contactor.

SP1 and/or SP2 communicate the raised fault to the P-MP (main processor) for the P-MP to remove power from the brake:

a. For relay logic brake control, switch off the BK_{MP} and BH_{MP} outputs and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 4 of the controller prints to see the P-MP control outputs BK_{MP} and BH_{MP}, and the qualification of the brake relays BK and BH by contacts of AA and P contactors.
b. For controllers using the P-Brake solid state brake control board, a CAN based command is given, by both SP1 and P-MP, to the P-Brake to turn off power to the brake and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 2bk of the controller prints to see the P-MP interface circuits to the P-Brake control board, and the qualification of the brake power output by the P contactor.

The redundant Main Reader and Auxiliary Reader sensing heads are constructed in enclosed housing and are tolerant of the horizontal movement that is typical of an elevator as it travels through the hoistway while reading the steel encoded tape. Refer to page QR5 of the controller prints for horizontal sensor heads to tape tolerances.

The Normal Stopping Means and Normal Terminal Stopping Means share the same components and mounting, while the Final Terminal Stopping Devices are mounted separately (in the hoistway) and are mechanically operated by a metal cam mounted on the elevator cab.

NOTE: Pixel design utilizes the same design regardless of car speed.

2.25.2.1.3: The redundant Normal Terminal Stopping Means (both) operate for the full extent of elevator travel. The Main and Auxiliary Readers read an encoded steel tape that is run from the top to the bottom of the hoistway, encompassing the physical extents of elevator travel.

2.25.2.2: Location of Stopping Devices

2.25.2.2.1: The Main and Auxiliary Readers are mounted on the car, and each reads a stationary encoded steel hoistway tape mounted in the hoistway. The car's location in the hoistway is continuously read from the encoded steel tape (whether the car is moving or standing still).

2.25.2.2.2: The application of the Main and Auxiliary Readers is the same for an elevator that utilizes a winding-drum machine. Therefore, the statement made above under section 2.25.2.2.1 applies to this section as well.

2.25.2.3: Indirectly Operated Normal Terminal Stopping Devices. This section does not apply to the Pixel elevator control system.

2.25.3 Final Terminal Stopping Devices

2.25.3.1: General Requirements

2.25.3.1(a): The Final Terminal Stopping Devices shall be mechanically-operated, devices supplied by others.

2.25.3.1(b): The Final Terminal Stopping Device operating cam shall be constructed of metal, device supplied by others.

2.25.3.1(c): The Final Terminal Stopping Device switches shall be directly-opened mechanically, switches supplied by others.

2.25.3.2: The Final Terminal Stopping Devices are wired in series with additional devices, which together allow power to be provided to the brake control circuits. The Final Terminal Stopping Devices (along with other hoistway-mounted electrical protective devices) are monitored redundantly by SP1 and SP2 through safety inputs $SAFH_{SP1}$ and $SAFH_{SP2}$ respectively, refer to section **2.26.2 Electrical Protective Devices** below for compliance.

2.25.3.3: The Final Terminal Stopping Switches shall be mechanically-operated by a metal cam and their contacts shall directly open mechanically, devices supplied by others

2.25.3.3.1: The Final Terminal Stopping Switches shall be operated by a car-mounted metal cam, and the switches shall be mounted in the hoistway. Refer to page QR4 of the controller prints to see the location of the Final Terminal Stopping Switches (labeled "UP FINAL LIMIT and DOWN FINAL LIMIT"), and to page 3 of the controller prints for wiring in series with other hoistway-mounted devices (e.g., car and counterweight buffer switches).

2.25.3.3.2: For winding-drum-machine applications, the additional Final Terminal Stopping Switches (located on and operated by the driving machine) shall be wired in series with the ones shown on page 3 of the controller prints.

2.25.3.4: Controller Devices Controlled by Final Terminal Stopping Device.
The Final Terminal Stopping Devices are wired in series as part of the Car and Hoistway safety string, opening the safety string drops power to P, and BK for relay logic brake

control, coils removing power to the brake circuits. The Final Terminal Stopping Devices are also monitored redundantly by SP1 and SP2 through safety inputs $SAFH_{SP1}$ and $SAFH_{SP2}$ and $SAFC_{SP1}$ and $SAFC_{SP2}$ respectively. Should either SP1 or SP2 detect that the car or hoistway safety string opened it will remove power from the driving-machine motor by deactivating the main motor contactor AA through output $AAo1_{SP1}$ or $AAo2_{SP2}$ respectively, refer to page 6 and 3 of the controller prints for the Final Terminal Stopping Devices location within the safety string and the redundant SAFC and SAFH inputs, and will remove power from the brake:

a. For relay logic brake control, switch off the BK_{MP} and BH_{MP} outputs and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 4 of the controller prints to see the P-MP control outputs BK_{MP} and BH_{MP}, and the qualification of the brake relays BK and BH by contacts of AA and P contactors.
b. For controllers using the P-Brake solid state brake control board, a CAN based command is given, by both SP1 and P-MP, to the P-Brake to turn off power to the brake and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 2bk of the controller prints to see the P-MP interface circuits to the P-Brake control board, and the qualification of the brake power output by the P contactor.

2.25.3.5. Additional Requirements for Winding-Drum Machines.
Devices supplied by others

2.25.3.5.1: Stopping switches, located on and operated by the driving machine, shall not be driven by chains, ropes, or belts. Devices supplied by others.

2.25.3.5.2: The contacts from a machine-operated stop switch and/or stopping switches mounted in the hoistway will be wired in series with the contacts of the Final Terminal Stopping Devices. Refer to page 3 of the controller prints. The location of the switches shall be arranged for the contacts to open coincidently with the opening of the Final Terminal Stopping Devices.

2.25.3.5.3: The contact of the machine-operated stop switch will be wired in series with the contacts of the Final Stopping Devices. Refer to page 3 of the controller prints. The location of the machine-operated stop switch shall be arranged for the machine stop contact to open coincidently with the opening of the Final Terminal Stopping Devices.

2.25.4 Emergency Terminal Stopping Means

2.25.4.1 Emergency Terminal Speed-Limiting Device

2.25.4.1.1: The Emergency Terminal Speed-Limiting Devices are implemented in a dually independent and redundant manner. The first implementation of the Emergency Terminal Speed-Limiting Device is comprised of:

- Landa Main Car Position Reader (Main Reader)
- Pixel Safety Processor 2 (SP2) and SP2 Learned Terminal landings Speed Profile

The redundant implementation is comprised of:

- Landa Auxiliary Car Position Reader (Auxiliary Reader)
- Pixel Safety Processor 1 (SP1) and SP1 learned Terminal landings Speed Profile

The operation of each of the Emergency Terminal Speed-Limiting Devices involves the determination of car speed based upon the change in car position as indicated by its respective readers, and the indication of car position (proximity to the terminal landings) provided by that reader.

The redundant Emergency Terminal Speed-limiting Devices are inherently independent of the redundant Normal Terminal Stopping Devices, due to the independence and redundancy of the safety processor/position sensor pairs, each of which implement both the Normal Terminal Stopping Means and the Emergency Terminal Speed-limiting Means.

(a) When either of the Emergency Terminal Speed-Limiting Devices determines that the car's speed is inappropriate (too high) for its position relative to a terminal landing, it removes power from the driving-machine motor and brake by deactivating contactors AA and P via its respective outputs $AAoX_X$ and PoX_X (where "X" represents SP1 or SP2).

(b) If the car speed does not decrease, the Emergency Brake will be deployed by SP1 and/or SP2 by switching off $EB1_{SP1}$ and $EBX1_{SP1}$ and/ or $EB2_{SP2}$ and $EBX2_{SP2}$ to remove power from the Emergency Brake control circuit. Refer to page 3 of the controller prints for $EB1_{SP1}$, $EBX1_{SP1}$, $EB2_{SP2}$, and $EBX2_{SP2}$ relay outputs and the EB1, EBX1, EB2, and EBX2 relay coils. Refer to page 2 of the controller prints for the Emergency Brake control circuit.

2.25.4.1.2: The Pixel Main Microprocessor Board (P-MP), the Safety Processor 1 (SP1) and Safety Processor 2 (SP2) read the car's position from the Main Reader via a twisted shielded pair of wires, terminated at the "SELECTOR PORT" on the P-MP board. (Refer to pages 6 6b and 4 of the controller prints), and the Pixel Top of Car Microprocessor (P-TOC) reads the car's position from the Auxiliary Reader and broadcasts this data via a CAN bus connection to (SP1) and P-MP. The CAN bus connection is shown in the controller prints terminating at the “CAB CAN PORT” on the P-MP board. (Refer to pages 6, 6b and 4 of the controller prints), such that the failure of any component or communication channel does not inhibit Pixel from independently operating the Emergency Speed-Limiting means.

The common member for both the Normal Terminal Stopping Device and the Emergency Terminal Speed Limiting Device means is an encoded steel tape. The encoded steel tape provides an absolute position value when read.

The presence of the encoded steel tape is monitored by both SP1 and SP2 safety processors. A Main and Aux Selector Fault will be declared by SP1 and/or SP2 respectively if the tape is not detected.

If SP1 raises the fault it will switch off $AAo1_{SP1}$ and $Po1_{SP1}$ contactor control outputs to

1. Remove power to the driving machine motor through output $AAo1_{SP1}$, which (along with output $AAo2_{SP2}$) participates in the energizing of the main motor contactor AA.
   Remove power to the driving machine brake through output $Po1_{SP1}$, which participates (along with output $Po2_{SP2}$) in energizing the P contactor.
   Refer to page 4 of the controller prints to see the SP1 control outputs $AAo1_{SP1}$ and $Po1_{SP1}$, and the AA and P contactor coils.

If SP2 raises the fault it will switch off $AAo2_{SP2}$ and $Po2_{SP2}$ contactor control outputs to

1. Remove power to the driving machine motor through output $AAo2_{SP2}$, which (along with output $AAo1_{SP1}$) participates in the energizing of the main motor contactor AA.
2. Remove power to the driving machine brake through output $Po2_{SP2}$, which participates (along with output $Po1_{SP1}$) in energizing the potential P contactor.
   Refer to page 4 of the controller prints to see the SP2 control outputs $AAo2_{SP2}$ and $Po2_{SP2}$, and the AA and P contactor coils.

ⓘ **NOTE**: If both SP1 and SP2 raise the fault simultaneously, each independently follows the behavior described above.

For AC Motor control units, the main motor contactor (AA) is a 3-phase contactor, used to apply and remove power from all phases of a 3-phase driving machine motor. Auxiliary contacts of the AA contactor are also wired to a Drive Enable input which commands the motor drive unit to remove power from its 3-phase motor power outputs. Refer to page 1 of the controller prints to see the application of the 4 and 6 auxiliary contacts of the main motor contactor AA.

For DC Motor control units, the main motor contactor (Delta) is a 2-phase contactor, controlled by the DC drive unit, used to apply and remove power from all phases of driving machine motor. Auxiliary contacts from the AA and P contactors are wired in series to the

Drive Enable input which is used to command the motor drive unit to remove or apply power from its 2-phase motor power outputs and to energize or release the Delta motor contactor. Refer to page 1 of the controller prints to see the application of auxiliary contact 1 of the AA contactor, and Auxiliary contact 1 of the P contactor.

SP1 and/or SP2 communicate the raised fault to the P-MP (main processor) for the P-MP to remove power from the brake:

a. For relay logic brake control, switch off the BK_{MP} and BH_{MP} outputs and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 4 of the controller prints to see the P-MP control outputs BK_{MP} and BH_{MP}, and the qualification of the brake relays BK and BH by contacts of AA and P contactors.
b. For controllers using the P-Brake solid state brake control board, a CAN based command is given, by both SP1 and P-MP, to the P-Brake to turn off power to the brake and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 2bk of the controller prints to see the P-MP interface circuits to the P-Brake control board, and the qualification of the brake power output by the P contactor.

The redundant Main Reader and Auxiliary Reader sensing heads are constructed in enclosed housing and are tolerant of the horizontal movement that is typical of an elevator as it travels through the hoistway while reading the steel encoded tape. Refer to page QR5 of the controller prints for horizontal sensor heads to tape tolerances.

The Normal Terminal Stopping Device and the Emergency Terminal Speed-Limiting Device share the same components and mounting, while the Final Terminal Stopping Devices are mounted separately (in the hoistway) and are mechanically operated by a metal cam mounted on the elevator cab.

ⓘ **NOTE**: Pixel design utilizes the same design regardless of car speed.

2.25.4.1.3: Section does not apply to Pixel design where the car speed sensing devices for the Emergency Terminal Speed-Limiting Devices are the Main Reader and Auxiliary Reader. The normal speed control system uses an encoder mounted to the driving machine/motor to control car speed.

2.25.4.1.4: The Emergency Terminal Speed-Limiting Devices do not apply car safety.

2.25.4.1.5: The dual-redundant safety system, car position and speed monitoring methods, and multiple points of control over the driving machine and brake ensure that a single ground or short circuit does not render the Emergency Terminal Speed-Limiting Devices ineffective.

2.25.4.1.6: The Main Reader and Auxiliary Reader are mounted on the elevator car and always read the absolute car position from an encoded stainless steel tape. This redundant information is used by SP1 and SP2 to determine car speed and direction of travel, and for its awareness of the car's proximity to the terminal landings.

2.25.4.1.7: No mechanically-operated switches are used as part of the Emergency Terminal Speed-limiting Device.

2.25.4.1.8(a): No friction or traction drive is utilized as part of the Emergency Terminal Speed-limiting Device.

2.25.4.1.8(b): No tape, chain, or rope connected to the car is utilized as part of the Emergency Terminal Speed-limiting Device.

2.25.4.1.9: Car position is sensed redundantly by the Main Reader and Auxiliary Reader, which are optical sensing devices.

2.25.4.1.9(a): Should a failure of one of the readers (or its associated data communications circuitry) occur, the other reader and associated data communications circuitry remains operative and will perform the full functionality of an Emergency Terminal Speed-limiting Device.

2.25.4.1.9(b): The data read from each car position reader is compared against the data read from the other reader. Any variation between these sets of data is an indication of the failure of one of the two readers (or associated data communications circuitry). When a failure of a reader or associated circuitry is detected, the car is not allowed to restart.

2.25.4.2 Emergency Terminal Stopping Device

An Emergency Terminal Stopping Device is not required because of the existence of the Emergency Terminal Speed-Limiting Devices as specified in section 2.25.4.1.

2.26: Operating Devices and Control Equipment

2.26.1: Operation and Operating Devices

Devices listed in subsections of section 2.26.1 shall comply as described in each subsection. Devices that are disallowed as described under each subsection (if applicable) shall not be used. Devices that are shown on the controller prints if not provided with controller are assumed to be code compliant for the purpose of this submittal and are noted as provided by others in this document.

2.26.1.2: Handles for Car-Switch operation provided by others

2.26.1.3: Carry One-Piece Loads Greater than Rated Load, Operation is not part of this submittal

2.26.1.4: The Pixel control system provides for the following types of inspection operation with the following hierarchy:

1. Top of Car Inspection
2. In-car Inspection
3. Hoistway Access
4. Machine Room Inspection

The signals that place the elevator on each of these modes of operation are routed to safety processors SP1 and SP2 via independent and separate inputs:

1. Top of Car Inspection: ICTSP1 and ICT_{SP2}
2. In-car Inspection: IIC_{SP1} and IIC_{SP2}
3. Hoistway Access Inspection: IA_{SP1} and IA_{SP2}
4. Controller Inspection: $IMR1_{SP1}$ and $IMR2_{SP2}$

SP1 and SP2 serve as a point of validation for the input circuitry related to the inspection mode inputs. If a single failure of an input circuit device occurs, the redundant inspection mode input circuit ensures that the car is removed from automatic operation despite that failure. The Car Top, In Car, Access inspection and Machine Room inspection switch mode inputs are cycle tested to ensure that the failure of an infrequently used input circuit is detected prior to each run. Refer to page 3 of the controller prints to see the redundant inputs for the top of car inspection switch, the in-car inspection switch, the hoistway access enable switch, and the machine room inspection switch. Refer to page 6 of the controller prints to see the wiring of the car top, in car, and access inspection switches, and the connection of the common side of these switches to bus 4CT (the voltage bus created through the contact of the cycle-test relay CTR), and to page 3 of the controller prints for the machine room inspection switch while the Machine Room inspection switch normally open and normally closed positions are monitored in addition to cycle testing via the CTR1 output.

The safety processors transfer the state of the top of car inspection, in-car inspection, hoistway access, and Machine Room inspection and enable inputs to P-MP.

The main processor P-MP enforces the operational hierarchy among these modes of operation per ASME 17.1-2019/ CSA B44:19 Appendix R, Table R-1.

2.26.1.4.1 General Requirements

2.26.1.4.1(a)(1)(a): The Pixel control system provides for the following types of inspection operation:

1. Top of Car Inspection – required as stated in this subsection
2. In-car Inspection
3. Hoistway Access
4. Controller Inspection

2.26.1.4.1(a)(1)(b): The Pixel control system is not designed to be installed in a hoistway space. As a result, all circuits and devices specified in section 2.7.6.5.1(b) are accessible from outside the hoistway. No provision for an Inspection and Test Panel (section 2.7.6.5) exists.

2.26.1.4.1(a)(2): The Pixel control system provides for the following types of inspection operation:

1. Top of Car Inspection - subsection 2.26.1.4.1(a)(1)(a)
2. In-car Inspection – permitted in subsection 2.26.1.4.1(a)(2)(a)
3. Hoistway Access
4. Controller Inspection – permitted in subsection 2.26.1.4.1(a)(2)(c)

2.26.1.4.1(b)(1) through 2.26.1.4.1(b)(3): The inspection switches shall comply with the requirements of this subsection in construction and labeling

2.26.1.4.1(b)(4): Operation of the elevator when on any mode of Inspection Operation listed above shall comply with the requirements stated in this subsection. The mechanical operation of the inspection switches shall comply with section 2.26.1.4.1(b)(4)(b).

2.26.1.4.1(b)(5): Operation of the elevator by the inspection operating devices shall be disabled when the inspection switch is in the NORMAL position.

2.26.1.4.1(c): The inspection operating devices are shown along with their respective inspection switches on pages 3 and 6 of the controller prints. The operating devices shall be continuous-pressure devices and be labeled as required in this subsection.

2.26.1.4.1(d)(1): The speed of the car under any mode of inspection shall not exceed 0.75 m/s (150 ft/min). This speed is monitored by two independent means, SP1 and SP2 (along with the Auxiliary and Main Readers, respectively).
If either SP1 or SP2 determine that the speed of the car exceeds the speed allowed by this subsection, it removes power from the driving machine motor and brake by deactivating the AA and P contactors.
If SP1 raises the fault it will switch off $AAo1_{SP1}$ and $Po1_{SP1}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo1_{SP1}$, which (along with output $AAo2_{SP2}$) participates in the energizing of the main motor contactor AA. Remove power to the driving machine brake through output $Po1_{SP1}$, which participates (along with output $Po2_{SP2}$) in energizing the P contactor. Refer to page 4 of the controller prints to see the SP1 control outputs $AAo1_{SP1}$ and $Po1_{SP1}$, and the AA and P contactor coils.

If SP2 raises the fault it will switch off $AAo2_{SP2}$ and $Po2_{SP2}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo2_{SP2}$, which (along with output $AAo1_{SP1}$) participates in the energizing of the main motor contactor AA. Remove power to the driving machine brake through output $Po2_{SP2}$, which participates (along with output $Po1_{SP1}$) in energizing the potential P contactor. Refer to page 4 of the controller prints to see the SP2 control outputs $AAo2_{SP2}$ and $Po2_{SP2}$, and the AA and P contactor coils.

NOTE: If both SP1 and SP2 raise the fault simultaneously, each independently follows the behavior described above.

For AC Motor control units, the main motor contactor (AA) is a 3-phase contactor, used to apply and remove power from all phases of a 3-phase driving machine motor. Auxiliary contacts of the AA contactor are also wired to a Drive Enable input which commands the motor drive unit to remove power from its 3-phase motor power outputs. Refer to page 1 of the controller prints to see the application of the 4 and 6 auxiliary contacts of the main motor contactor AA.

For DC Motor control units, the main motor contactor (Delta) is a 2-phase DC contactor, controlled by the DC drive unit, used to apply and remove power from all phases of driving machine motor. Auxiliary contacts from the AA and P contactors are wired in series to the Drive Enable input which is used to command the motor drive unit to remove or apply power from its 2-phase motor power outputs and to energize or release the Delta motor contactor. Refer to page 1 of the controller prints to see the application of auxiliary contact 1 of the AA contactor, and Auxiliary contact 1 of the P contactor.

SP1 and/or SP2 communicate the raised fault to the P-MP (main processor) for the P-MP to remove power from the brake:

a. For relay logic brake control, switch off the BK_{MP} and BH_{MP} outputs and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 4 of the controller prints to see the P-MP control outputs BK_{MP} and BH_{MP}, and the qualification of the brake relays BK and BH by contacts of AA and P contactors.
b. For controllers using the P-Brake solid state brake control board, a CAN based command is given, by both SP1 and P-MP, to the P-Brake to turn off power to the

brake and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 2bk of the controller prints to see the P-MP interface circuits to the P-Brake control board, and the qualification of the brake power output by the P contactor.

NOTE: Refer to section 2. DESIGN CONCEPTS above for description of Pixel's speed monitoring functionality.

2.26.1.4.1(d)(2): Inspection operations are subject to the electrical protective devices required by 2.26.2. SP1 and SP2 monitor the status of the electrical protective devices and disallow movement of the car should one of these protective devices be activated.

2.26.1.4.2 Top-of-Car Inspection Operation

2.26.1.4.2(a): A stop switch shall be installed as required by this subsection. Refer to page 6 of the controller prints to see the stop switch (labeled on the controller prints as "CARTOP INSPECTION STOP SW.") located in the car safety circuit (which terminates at terminal SAFC).

2.26.1.4.2(b): The type and location of the transfer switch shall comply with the requirements of this subsection.

2.26.1.4.2(c) and 2.26.1.4.2(d): An enable button shall be provided and located as described in this section to qualify the operation of the Top-Of-Car Inspection operating devices. Refer to page 6 of the controller prints to see the wiring of this button to the control system. The signal from this button is monitored by SP1 and SP2 via redundant inputs $ICTE_{SP1}$ and $ICTE_{SP2}$. SP1 and SP2 only allow operation of the car while on Top-of-Car Inspection if this enable button is pushed. Refer to page 3 of the controller prints to see the redundant safety inputs $ICTE_{SP1}$ and $ICTE_{SP2}$.

2.26.1.4.2(e): Portable Top-of-Car Inspection operating devices shall comply with the requirements of this subsection.

2.26.1.4.2(h): The location of the Top-of-Car Inspection operating devices shall comply with the requirements of this subsection.

2.26.1.4.3 In-Car Inspection Operation

2.26.1.4.3(a) and 2.26.1.4.3(b): The type and location of the transfer switch shall comply with the requirements of this subsection.

2.26.1.4.3(c): If top-of-car inspection operation is enabled, in-car inspection operation is rendered inoperative by P-MP, SP1 and SP2.

2.26.1.4.3(d): The in-car inspection transfer switch shall not enable hoistway access. A separate input is provided to enable hoistway access operation. Refer to page 3 of the controller prints to see the redundant hoistway access enable inputs (labeled IA_{SP1} and IA_{SP2}). Refer to page 6 of the controller prints to see the connection of the hoistway access enable switch to terminal IA.

2.26.1.4.4 Machinery Space Outside the Hoistway, Machine Room, Control Space Outside the Hoistway, Control Room, Pit, Landing, and Working Platform Inspection Operations
The Pixel control system does not provide for any of these types of inspection operations.

2.26.1.5 Inspection Operation with Open Door Circuits

2.26.1.5(a) and 2.26.1.5(b): The Car Door Bypass and Hoistway Door Bypass switches are in the Pixel controller enclosure. The Pixel controller shall be located outside the hoistway. Refer to page 3 of the controller prints to see these switches, labeled "CAR DOOR BYPASS" and "HOISTWAY DOOR BYPASS". These switches are located on the main Pixel control board P-MP.

The two operating positions of each of these switches are each routed to a separate input ($CDB1_{SP1}$ and $CDB2_{SP2}$ for the Car Door Bypass switch, and $HDB1_{SP1}$ and $HDB2_{SP2}$ for the Hoistway Door Bypass switch). This ensures that a single circuit failure can be detected and will not render either of these transfer switches inoperative.

2.26.1.5.1: Each of the switches is single-pole, double-throw in design. When placed in one position, the contact closure associated with the opposite position is positively opened mechanically and are to cycle tested via the CTR1 output, refer to page 3 of the prints.

2.26.1.5.2: The labeling of the positions of each of the switches is "BYPASS" and "OFF". Refer to page 3 of the controller prints.

2.26.1.5.3: The Car Door Bypass and Hoistway Door Bypass switches are each protected against failure by the type of switch used, and the method in which the status of each of the switches is monitored. The Car Door Bypass and Hoistway Door Bypass switches are mechanically operated switches, which in and of themselves do not:

- render any electrical protective device inoperative
- permit the car to move beyond the leveling or truck zone with open car or hoistway door contacts
- permit speeds in excess of those specified in sections 2.12.7.4.2, 2.26.1.4.1(d)(1), or 2.26.1.6.6
- permit the car to revert to normal operation

- render any car door contact or hoistway door interlock contact ineffective

The positions of these switches are read by SP1 and SP2, which along with P-MP determine and control the operation of the car. Should a failure of a solid state input device occur, it is detected by SP1 and SP2 and the car is not allowed to operate.

2.26.1.5.4: When either SP1 or SP2 detects that either the Car Door Bypass or Hoistway Door Bypass switch has been placed in the BYPASS position, automatic operation of the elevator is disabled. Operation of the elevator is then limited to top-of-car inspection or in-car inspection. The hierarchy of the inspection operations is enforced by the P-MP.

2.26.1.5.5 Through 2.26.1.5.6: The operation provided by the Pixel system complies with these subsections.

2.26.1.5.8: The required verbiage specified in this subsection is provided adjacent to the switches on the P-MP board.

2.26.1.6 Operation in Leveling or Truck Zone

2.26.1.6.1 Through 2.26.1.6.2: Devices described in subsections 2.26.1.6.1 through 2.26.1.6.2, where applicable, shall comply with the requirements stated in these subsections.

2.26.1.6.3: The Pixel leveling zone is limited by design to a maximum of 6” above and 6” below any landing.

2.26.1.6.4: The Pixel leveling zone by design is the same as the truck zone and is limited by design to a maximum of 6” above and 6” below any landing

2.26.1.6.5: The Pixel Leveling zones by design do not allow for zone overlapping.

2.26.1.6.6: The speed of the car while leveling into a landing shall not exceed 0.75 m/s (150 ft/min). This speed is monitored by two independent means, SP1 and SP2 (along with the Auxiliary and Main Readers, respectively). If either SP1 or SP2 determine that the speed of the car exceeds the speed allowed by this subsection, it removes power from the driving machine motor and brake by deactivating the AA and P contactors.

If SP1 raises the fault it will switch off $AAo1_{SP1}$ and $Po1_{SP1}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo1_{SP1}$, which (along with output $AAo2_{SP2}$) participates in the energizing of the main motor contactor AA.

Remove power to the driving machine brake through output $Po1_{SP1}$, which participates (along with output $Po2_{SP2}$) in energizing the P contactor.

Refer to page 4 of the controller prints to see the SP1 control outputs $AAo1_{SP1}$ and $Po1_{SP1}$, and the AA and P contactor coils.

If SP2 raises the fault it will switch off $AAo2_{SP2}$ and $Po2_{SP2}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo2_{SP2}$, which (along with output $AAo1_{SP1}$) participates in the energizing of the main motor contactor AA.

Remove power to the driving machine brake through output $Po2_{SP2}$, which participates (along with output $Po1_{SP1}$) in energizing the potential P contactor.

Refer to page 4 of the controller prints to see the SP2 control outputs $AAo2_{SP2}$ and $Po2_{SP2}$, and the AA and P contactor coils.

ⓘ **NOTE**: If both SP1 and SP2 raise the fault simultaneously, each independently follows the behavior described above.

For AC Motor control units, the main motor contactor (AA) is a 3-phase contactor, used to apply and remove power from all phases of a 3-phase driving machine motor. Auxiliary contacts of the AA contactor are also wired to a Drive Enable input which commands the motor drive unit to remove power from its 3-phase motor power outputs. Refer to page 1 of the controller prints to see the application of the 4 and 6 auxiliary contacts of the main motor contactor AA.

For DC Motor control units, the main motor contactor (Delta) is a 2-phase DC contactor, controlled by the DC drive unit, used to apply and remove power from all phases of driving machine motor. Auxiliary contacts from the AA and P contactors are wired in series to the Drive Enable input which is used to command the motor drive unit to remove or apply power from its 2-phase motor power outputs and to energize or release the Delta motor contactor. Refer to page 1 of the controller prints to see the application of auxiliary contact 1 of the AA contactor, and Auxiliary contact 1 of the P contactor.

SP1 and/or SP2 communicate the raised fault to the P-MP (main processor) for the P-MP to remove power from the brake:

a. For relay logic brake control, switch off the BK_{MP} and BH_{MP} outputs and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 4 of the controller prints to see the P-MP control outputs BK_{MP} and BH_{MP}, and the qualification of the brake relays BK and BH by contacts of AA and P contactors.
b. For controllers using the P-Brake solid state brake control board, a CAN based command is given, by both SP1 and P-MP, to the P-Brake to turn off power to the brake and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 2bk of the controller prints to

see the P-MP interface circuits to the P-Brake control board, and the qualification of the brake power output by the P contactor.

NOTE: Refer to section 2. DESIGN CONCEPTS above for description of Pixel's speed monitoring functionality.

2.26.1.6.7: The Pixel Inner Landing zone, Dead Zone Parameter, is limited by design to a maximum of 3" above and 3" below any landing.

2.26.1.7 Executable Software

The executable version, USI, of the controller running software can be viewed using the controller on board diagnostics navigating to:

Home

Install

About

Software version: Parameter displays Elevator Microprocessor Logic Version

SP1 Software version: Parameter displays Safety Microprocessor Version

2.26.2 Electrical Protective Devices (EPDS)

The Electrical Protective devices in sections **2.26.2.1, 2.26.2.3, 2.26.2.6 through 2.26.2.9, 2.26.2.11, 2.26.2.13, 2.26.2.18, 2.26.2.20 through 2.26.2.27, 2.26.2.31 through 2.26.2.39** EPDS, as required, are wired in series as part of the Car and Hoistway safety string through where power to P contactor, and for relay logic brake interface also the BK coil is routed, opening the safety string drops power to P and BK coils removing power to the brake circuits. These EPDS are also monitored redundantly by SP1 and SP2 through safety inputs SAFH$_{SP1}$ and SAFH$_{SP2}$ and SAFC$_{SP1}$ and SAFC$_{SP2}$ respectively. Should either SP1 or SP2 detect that the car or hoistway safety string is open it removes power from the driving machine motor and brake by deactivating the AA and P contactors.

If SP1 raises the fault it will switch off AAo1$_{SP1}$ and Po1$_{SP1}$ contactor control outputs to

Remove power to the driving machine motor through output AAo1$_{SP1}$, which (along with output AAo2$_{SP2}$) participates in the energizing of the main motor contactor AA.

Remove power to the driving machine brake through output Po1$_{SP1}$, which participates (along with output Po2$_{SP2}$) in energizing the P contactor.

Refer to page 4 of the controller prints to see the SP1 control outputs AAo1$_{SP1}$ and Po1$_{SP1}$, and the AA and P contactor coils.

If SP2 raises the fault it will switch off AAo2$_{SP2}$ and Po2$_{SP2}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo2_{SP2}$, which (along with output $AAo1_{SP1}$) participates in the energizing of the main motor contactor AA. Remove power to the driving machine brake through output $Po2_{SP2}$, which participates (along with output $Po1_{SP1}$) in energizing the potential P contactor. Refer to page 4 of the controller prints to see the SP2 control outputs $AAo2_{SP2}$ and $Po2_{SP2}$, and the AA and P contactor coils.

NOTE: If both SP1 and SP2 raise the fault simultaneously, each independently follows the behavior described above.

For AC Motor control units, the main motor contactor (AA) is a 3-phase contactor, used to apply and remove power from all phases of a 3-phase driving machine motor. Auxiliary contacts of the AA contactor are also wired to a Drive Enable input which commands the motor drive unit to remove power from its 3-phase motor power outputs. Refer to page 1 of the controller prints to see the application of the 4 and 6 auxiliary contacts of the main motor contactor AA.

For DC Motor control units, the main motor contactor (Delta) is a 2-phase DC contactor, controlled by the DC drive unit, used to apply and remove power from all phases of driving machine motor. Auxiliary contacts from the AA and P contactors are wired in series to the Drive Enable input which is used to command the motor drive unit to remove or apply power from its 2-phase motor power outputs and to energize or release the Delta motor contactor. Refer to page 1 of the controller prints to see the application of auxiliary contact 1 of the AA contactor, and Auxiliary contact 1 of the P contactor.

SP1 and/or SP2 communicate the raised fault to the P-MP (main processor) for the P-MP to remove power from the brake:

a. For relay logic brake control, switch off the BK_{MP} and BH_{MP} outputs and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 4 of the controller prints to see the P-MP control outputs BK_{MP} and BH_{MP}, and the qualification of the brake relays BK and BH by contacts of AA and P contactors.
b. For controllers using the P-Brake solid state brake control board, a CAN based command is given, by both SP1 and P-MP, to the P-Brake to turn off power to the brake and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 2bk of the controller prints to see the P-MP interface circuits to the P-Brake control board, and the qualification of the brake power output by the P contactor.

2.26.2.2 Motor Generator Running Switch

Pixel is not designed to operate a DC motor using motor generator control.

2.26.2.4 Motor Field Sensing Means

The motor field sensing device is part of the DC drive unit design. The DC drive behavior upon loss of motor field current flow is to disable to DC motor Armature, drop the DELTA motor contactor, drop the drive Run Engaged output which drops the $DSAF_{SP1}$ and $DSAF_{SP2}$ monitored redundantly by SP1 and SP2 through safety inputs. Should either SP1 or SP2 detect that the Drive Safety input is open it will remove power from the driving machine motor and brake by deactivating the AA and P contactors.

If SP1 raises the fault it will switch off $AAo1_{SP1}$ and $Po1_{SP1}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo1_{SP1}$, which (along with output $AAo2_{SP2}$) participates in the energizing of the main motor contactor AA.

Remove power to the driving machine brake through output $Po1_{SP1}$, which participates (along with output $Po2_{SP2}$) in energizing the P contactor.

Refer to page 4 of the controller prints to see the SP1 control outputs $AAo1_{SP1}$ and $Po1_{SP1}$, and the AA and P contactor coils.

If SP2 raises the fault it will switch off $AAo2_{SP2}$ and $Po2_{SP2}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo2_{SP2}$, which (along with output $AAo1_{SP1}$) participates in the energizing of the main motor contactor AA.

Remove power to the driving machine brake through output $Po2_{SP2}$, which participates (along with output $Po1_{SP1}$) in energizing the potential P contactor.

Refer to page 4 of the controller prints to see the SP2 control outputs $AAo2_{SP2}$ and $Po2_{SP2}$, and the AA and P contactor coils.

NOTE: If both SP1 and SP2 raise the fault simultaneously, each independently follows the behavior described above.

The main motor contactor (Delta) is a 2-phase DC contactor, controlled by the DC drive unit, used to apply and remove power from all phases of driving machine motor. Auxiliary contacts from the AA and P contactors are wired in series to the Drive Enable input which is used to command the motor drive unit to remove or apply power from its 2-phase motor power outputs and to energize or release the Delta motor contactor. Refer to page 1 of the controller prints to see the application of auxiliary contact 1 of the AA contactor, and Auxiliary contact 1 of the P contactor.

SP1 and/or SP2 communicate the raised fault to the P-MP (main processor) for the P-MP to remove power from the brake:

a. For relay logic brake control, switch off the BK_{MP} and BH_{MP} outputs and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 4 of the controller prints to see the P-MP control outputs BK_{MP} and BH_{MP}, and the qualification of the brake relays BK and BH by contacts of AA and P contactors.
b. For controllers using the P-Brake solid state brake control board, a CAN based command is given, by both SP1 and P-MP, to the P-Brake to turn off power to the

brake and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 2bk of the controller prints to see the P-MP interface circuits to the P-Brake control board, and the qualification of the brake power output by the P contactor.

2.26.2.5 Emergency Stop Switch

NOTE: Section applies to Freight Elevators only, passenger elevators shall not be provided with an Emergency Stop Switch.

The redundant Emergency Stop Switch $ESTP_{SP1}$ and $ESTP_{SP2}$ inputs are continuously verified against each other (the corresponding inputs must match between SP1 and SP2), and they are cycle tested at the end of each run. These inputs are cycle-tested via a relay contact (CTR) that removes power from the electrical bus (4CT) that feeds these inputs. When power is removed from this bus $ESTP_{SP1}$ and $ESTP_{SP2}$ are checked to verify that they have changed state as expected. Should any of these inputs fail to change state as expected, the car is not allowed to restart. Refer to page 7 of the controller prints for switch wiring and page 3 of the controller prints for $ESTP_{SP1}$ and $ESTP_{SP2}$ inputs. Should either SP1 or SP2 detect that the Emergency Stop Switch is open it removes power from the driving machine motor and brake by deactivating the AA and P contactors.

If SP1 raises the fault it will switch off $AAo1_{SP1}$ and $Po1_{SP1}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo1_{SP1}$, which (along with output $AAo2_{SP2}$) participates in the energizing of the main motor contactor AA.
Remove power to the driving machine brake through output $Po1_{SP1}$, which participates (along with output $Po2_{SP2}$) in energizing the P contactor.
Refer to page 4 of the controller prints to see the SP1 control outputs $AAo1_{SP1}$ and $Po1_{SP1}$, and the AA and P contactor coils.

If SP2 raises the fault it will switch off $AAo2_{SP2}$ and $Po2_{SP2}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo2_{SP2}$, which (along with output $AAo1_{SP1}$) participates in the energizing of the main motor contactor AA.
Remove power to the driving machine brake through output $Po2_{SP2}$, which participates (along with output $Po1_{SP1}$) in energizing the potential P contactor.
Refer to page 4 of the controller prints to see the SP2 control outputs $AAo2_{SP2}$ and $Po2_{SP2}$, and the AA and P contactor coils.

NOTE: If both SP1 and SP2 raise the fault simultaneously, each independently follows the behavior described above.

For AC Motor control units, the main motor contactor (AA) is a 3-phase contactor, used to apply and remove power from all phases of a 3-phase driving machine motor. Auxiliary contacts of the AA contactor are also wired to a Drive Enable input which commands the motor drive unit to remove power from its 3-phase motor power outputs. Refer to page 1 of the controller prints to see the application of the 4 and 6 auxiliary contacts of the main motor contactor AA.

For DC Motor control units, the main motor contactor (Delta) is a 2-phase DC contactor, controlled by the DC drive unit, used to apply and remove power from all phases of driving machine motor. Auxiliary contacts from the AA and P contactors are wired in series to the Drive Enable input which is used to command the motor drive unit to remove or apply power from its 2-phase motor power outputs and to energize or release the Delta motor contactor. Refer to page 1 of the controller prints to see the application of auxiliary contact 1 of the AA contactor, and Auxiliary contact 1 of the P contactor.

SP1 and/or SP2 communicate the raised fault to the P-MP (main processor) for the P-MP to remove power from the brake:

a. For relay logic brake control, switch off the BK_{MP} and BH_{MP} outputs and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 4 of the controller prints to see the P-MP control outputs BK_{MP} and BH_{MP}, and the qualification of the brake relays BK and BH by contacts of AA and P contactors.
b. For controllers using the P-Brake solid state brake control board, a CAN based command is given, by both SP1 and P-MP, to the P-Brake to turn off power to the brake and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 2bk of the controller prints to see the P-MP interface circuits to the P-Brake control board, and the qualification of the brake power output by the P contactor.

ⓘ **NOTE**: Refer to section 2.27.3.1.6(c) Fire Service Emergency Stop switch verification for Pixel behavior upon detection of opening of the Emergency Stop Switch.

2.26.2.10 Speed-Governor Switch

The redundant Governor Switch, GOV_{SP1} and $GOV_{SP2,}$ inputs are continuously verified against each other (the corresponding inputs must match between SP1 and SP2), and they are cycle tested at the end of each run. These inputs are cycle-tested via a relay contact (CTR) that removes power from the electrical bus (4CT) that feeds these inputs. When power is removed from this bus GOV_{SP1} and GOV_{SP2} are checked to verify that they have changed state as expected. Should any of these inputs fail to change state as expected, the car is not allowed to restart. Refer to page 3 of the controller prints for switch wiring and for GOV_{SP1} and GOV_{SP2} inputs. Should either SP1 or SP2 detect that the Governor Switch is open it removes power from the driving machine motor and brake by deactivating the AA and P contactors and a Governor Switch Opened latching fault is raised.

If SP1 raises the fault it will switch off $AAo1_{SP1}$ and $Po1_{SP1}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo1_{SP1}$, which (along with output $AAo2_{SP2}$) participates in the energizing of the main motor contactor AA.
Remove power to the driving machine brake through output $Po1_{SP1}$, which participates (along with output $Po2_{SP2}$) in energizing the P contactor.
Refer to page 4 of the controller prints to see the SP1 control outputs $AAo1_{SP1}$ and $Po1_{SP1}$, and the AA and P contactor coils.
Remove power to the Emergency Brake through the emergency brake relays EB1-EBX1, switching off EB1 and EBX1 outputs, these relays are continuously monitored for proper operation and are cycled at the end of each run. The proper operation of these relays is monitored via inputs RG_{SP1}, $RGBP1_{SP1}$. Should any one of these relays fail to operate as expected (the failure of any of the relay contacts to open when the relays are de-energized), the car is not allowed to restart. Refer to page 2 of the controller prints to see the arrangement of the EB1, EB2, EBX1, and EBX2 relay contacts, and the circuit location where these relays are monitored. These monitoring signals are routed to inputs RG and RGBP, which are shown on page 3.

If SP2 raises the fault it will switch off $AAo2_{SP2}$ and $Po2_{SP2}$ contactor control outputs to
Remove power to the driving machine motor through output $AAo2_{SP2}$, which (along with output $AAo1_{SP1}$) participates in the energizing of the main motor contactor AA.
Remove power to the driving machine brake through output $Po2_{SP2}$, which participates (along with output $Po1_{SP1}$) in energizing the potential P contactor.
Refer to page 4 of the controller prints to see the SP2 control outputs $AAo2_{SP2}$ and $Po2_{SP2}$, and the AA and P contactor coils.
Remove power to the Emergency Brake through the emergency brake relays EB2-EBX2, switching off EB2 and EBX2 outputs, these relays are continuously monitored for proper operation and are cycled at the end of each run. The proper operation of these relays is monitored via inputs RG_{SP2}, $RGBP1_{SP2}$. Should any one of these relays fail to operate as expected (the failure of any of the relay contacts to open when the relays are de-energized), the car is not allowed to restart. Refer to page 2 of the controller prints to see the arrangement of the EB1, EB2, EBX1, and EBX2 relay contacts, and the circuit location where these relays are monitored. These monitoring signals are routed to inputs RG and RGBP, which are shown on page 3.

NOTE: If both SP1 and SP2 raise the fault simultaneously, each independently follows the behavior described above.

For AC Motor control units, the main motor contactor (AA) is a 3-phase contactor, used to apply and remove power from all phases of a 3-phase driving machine motor. Auxiliary contacts of the AA contactor are also wired to a Drive Enable input which commands the motor drive unit to remove power from its 3-phase motor power outputs. Refer to page 1 of the controller prints to see the application of the 4 and 6 auxiliary contacts of the main motor contactor AA.

For DC Motor control units, the main motor contactor (Delta) is a 2-phase DC contactor, controlled by the DC drive unit, used to apply and remove power from all phases of driving machine motor. Auxiliary contacts from the AA and P contactors are wired in series to the Drive Enable input which is used to command the motor drive unit to remove or apply power from its 2-phase motor power outputs and to energize or release the Delta motor contactor. Refer to page 1 of the controller prints to see the application of auxiliary contact 1 of the AA contactor, and Auxiliary contact 1 of the P contactor.

SP1 and/or SP2 communicate the raised fault to the P-MP (main processor) for the P-MP to remove power from the brake:

a. For relay logic brake control, switch off the BK_{MP} and BH_{MP} outputs and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 4 of the controller prints to see the P-MP control outputs BK_{MP} and BH_{MP}, and the qualification of the brake relays BK and BH by contacts of AA and P contactors.
b. For controllers using the P-Brake solid state brake control board, a CAN based command is given, by both SP1 and P-MP, to the P-Brake to turn off power to the brake and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 2bk of the controller prints to see the P-MP interface circuits to the P-Brake control board, and the qualification of the brake power output by the P contactor.

Once a Governor Switch Opened latching fault is raised, the car will not be allowed to move until the car overspeed governor electrical contact is reset to the normal operating state, the controller's Fault Reset button is pressed, and the emergency braking device is returned to the normal operating state (if applicable to the specific type of emergency braking device). Refer to page 3 of the controller prints to see the governor electrical contact (labeled "GOVERNOR SWITCH") and the Fault Reset Button.

2.26.2.12 Emergency Speed-Limiting Devices
Refer to Section 2.25.4 above for compliance.

2.26.2.14 Hoistway Door Interlocks and Hoistway Door Closed Detections Means & 2.26.2.15 Car Door and Gate Closed Detections Means
The Hoistway Door Interlocks, Hoistway Door Electric Contracts, and Car Door and Gate Electric Contacts are divided, for monitoring, into the following redundant inputs:

a. $DLAT_{SP1}$ and $DLAT_{SP2}$ Door $_{Lock}$ Access Top
b. $DLAB_{SP1}$ and $DLAB_{SP2}$ Door $_{Lock}$ Access Bottom
c. $DLSF_{SP1}$ and $DLSF_{SP2}$ Front Door $_{Lock}$ String
d. $DLSR_{SP1}$ and $DLSR_{SP2}$ Rear Door $_{Lock}$ String
e. $DCAT_{SP1}$ and $DCAT_{SP2}$ Door Closed Access Top

f. $DCAB_{SP1}$ and $DCAB_{SP2}$ Door Closed Access Bottom
g. $DCSF_{SP1}$ and $DCSF_{SP2}$ Front Door Closed String
h. $DCSR_{SP1}$ and $DCSR_{SP2}$ Rear Door Closed String
i. CGF_{SP1} and CGF_{SP2} Car Gate Front
j. CGR_{SP1} and CGR_{SP2} Car Gate Rear

Each pair of inputs are continuously verified against each other (the corresponding inputs must match between SP1 and SP2), and they are cycle tested at the end of each run. These inputs are cycle-tested via a relay contact (CTR) that removes power from the electrical bus (4CT) that feeds these inputs. When power is removed from this bus each input is checked to verify that they have changed state as expected. Should any of these inputs fail to change state as expected, the car is not allowed to restart. Refer to page 3 of the controller prints for switch wiring and inputs.

While car is outside the trucking zone, it will not be permitted to start if any of switches are not in the closed position, if the car is already moving and one of the switches opens the P-MP will execute a stop sequence, and the car will not be allowed to restart until all door switches are in the closed position.

Should either SP1 or SP2 detect that the stop sequence is not executed it will remove power from the driving machine motor and brake by deactivating the AA and P contactors.

If SP1 raises the fault it will switch off $AAo1_{SP1}$ and $Po1_{SP1}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo1_{SP1}$, which (along with output $AAo2_{SP2}$) participates in the energizing of the main motor contactor AA.

Remove power to the driving machine brake through output $Po1_{SP1}$, which participates (along with output $Po2_{SP2}$) in energizing the P contactor.

Refer to page 4 of the controller prints to see the SP1 control outputs $AAo1_{SP1}$ and $Po1_{SP1}$, and the AA and P contactor coils.

If SP2 raises the fault it will switch off $AAo2_{SP2}$ and $Po2_{SP2}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo2_{SP2}$, which (along with output $AAo1_{SP1}$) participates in the energizing of the main motor contactor AA.

Remove power to the driving machine brake through output $Po2_{SP2}$, which participates (along with output $Po1_{SP1}$) in energizing the potential P contactor.

Refer to page 4 of the controller prints to see the SP2 control outputs $AAo2_{SP2}$ and $Po2_{SP2}$, and the AA and P contactor coils.

NOTE: If both SP1 and SP2 raise the fault simultaneously, each independently follows the behavior described above.

For AC Motor control units, the main motor contactor (AA) is a 3-phase contactor, used to apply and remove power from all phases of a 3-phase driving machine motor. Auxiliary contacts of the AA contactor are also wired to a Drive Enable input which commands the motor drive unit to remove power from its 3-phase motor power outputs. Refer to page 1 of the controller prints to see the application of the 4 and 6 auxiliary contacts of the main motor contactor AA.

For DC Motor control units, the main motor contactor (Delta) is a 2-phase DC contactor, controlled by the DC drive unit, used to apply and remove power from all phases of driving machine motor. Auxiliary contacts from the AA and P contactors are wired in series to the Drive Enable input which is used to command the motor drive unit to remove or apply power from its 2-phase motor power outputs and to energize or release the Delta motor contactor. Refer to page 1 of the controller prints to see the application of auxiliary contact 1 of the AA contactor, and Auxiliary contact 1 of the P contactor.

SP1 and/or SP2 communicate the raised fault to the P-MP (main processor) for the P-MP to remove power from the brake:

a. For relay logic brake control, switch off the BK_{MP} and BH_{MP} outputs and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 4 of the controller prints to see the P-MP control outputs BK_{MP} and BH_{MP}, and the qualification of the brake relays BK and BH by contacts of AA and P contactors.
b. For controllers using the P-Brake solid state brake control board, a CAN based command is given, by both SP1 and P-MP, to the P-Brake to turn off power to the brake and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 2bk of the controller prints to see the P-MP interface circuits to the P-Brake control board, and the qualification of the brake power output by the P contactor.

If the car is operating on Hoistway Access mode and is within the top access zone, the $DLAT_{SP1}$ and $DLAT_{SP2}$ inputs (Door Lock Access Top) are ignored. If the car is within the bottom access zone, the $DLAB_{SP1}$ and $DLAB_{SP2}$ inputs (Door Lock Access Bottom) are ignored. In both cases the CGF_{SP1} and CGF_{SP2} inputs (Car Gate Front) is ignored if access operation is assigned to front doors, and the CGR_{SP1} and CGR_{SP2} inputs (Car Gate Rear) are ignored if access operation is assigned to the rear doors.

If the Car Door Bypass switch is placed in the BYPASS position, the Car Gate Front inputs (CGF_{SP1} and CGF_{SP2}) and the Car Gate Rear inputs (CGR_{SP1} and CGR_{SP2}) are ignored when the car is operating on either Car Top Inspection or In-Car Inspection.

If the Hoistway Door Bypass switch is placed in the BYPASS position, the Hoistway Door Lock inputs ($DLAT_{SP1}$, $DLAT_{SP2}$, $DLAB_{SP1}$, $DLAB_{SP2}$, $DLSF_{SP1}$, $DLSF_{SP2}$, $DLSR_{SP1}$, and $DSLR_{SP2}$) and the

Hoistway Door Closed Contact inputs ($DCAT_{SP1}$, $DCAT_{SP2}$, $DCAB_{SP1}$, $DCAB_{SP2}$, $DCSF_{SP1}$, $DCSF_{SP2}$, $DCSR_{SP1}$, and $DCLR_{SP2}$) are ignored when the car is operating on either Car Top Inspection or In-Car Inspection.

2.26.2.16 Emergency Terminal Stopping Devices
Refer to Section 2.25.2 above for compliance.

2.26.2.19 Motor-Generator Overspeed Protection
Pixel is not designed to operate a DC motor using motor generator control.

2.26.2.28 Car Door Interlock
Car Door interlocks if required provided by others.

2.26.2.29 Ascending Car Overspeed Protection
The device that detects an overspeeding ascending elevator is the car overspeed governor and its electrical contact; refer to sections 2.19.1 and 2.26.10 above for code compliance overview.

2.26.2.30 Unintended Movement Device
Refer to section 2.19.2 above for code compliance overview.

2.26.3 Contactors and Relays for Use in Critical Operating Circuits

Pixel design complies with requirements for sections 2.26.8.2 and 2.26.9.3. Section 2.26.9.7 does not apply to Pixel design. Pixel is not designed to operate a DC motor using motor generator control.

2.26.4 Electrical Equipment and Wiring

2.26.4.2 Pixel elevator controllers bear the CSA approval and are listed under file #068101_0_000.

2.26.4.3 The devices covered by 2.26.2, EPD devices, shall meet the requirements of 2.26.4.3.1 or 2.26.4.3.2

2.26.4.3.1 Elevator Controls only supplies devices for 2.26.2.12 and 2.26.2.16, which are exempted from this requirement. Refer to sections 2.26.2.12 and 2.26.2.16 above for device code compliance.

2.26.4.3.2 Covered as Section 2.26.4.3.1 above.

2.26.4.4 Pixel control has been independently tested by CKC Laboratories, and a report is in their files under Report #91656-3.

2.26.5 System to Monitor and Prevent Automatic Operation of the Elevator with Faulty Door Circuits

The Hoistway Door Interlocks, Hoistway Door Electric Contracts, Car Door and Gate Electric Contacts, door open, and closed positions are monitored through the following inputs:

a. $DLAT_{SP1}$ and $DLAT_{SP2}$ Door Lock Access Top
b. $DLAB_{SP1}$ and $DLAB_{SP2}$ Door Lock Access Bottom
c. $DLSF_{SP1}$ and $DLSF_{SP2}$ Front Door Lock String
d. $DLSR_{SP1}$ and $DLSR_{SP2}$ Rear Door Lock String
e. $DCAT_{SP1}$ and $DCAT_{SP2}$ Door Closed Access Top
f. $DCAB_{SP1}$ and $DCAB_{SP2}$ Door Closed Access Bottom
g. $DCSF_{SP1}$ and $DCSF_{SP2}$ Front Door Closed String
h. $DCSR_{SP1}$ and $DCSR_{SP2}$ Rear Door Closed String
i. CGF_{SP1} and CGF_{SP2} Car Gate Front
j. CGR_{SP1} and CGR_{SP2} Car Gate Rear
k. $DOLF_{MP}$ and $DOLR_{MP}$
l. $DCLF_{MP}$ and $DCLR_{MP}$

(a) The car will be prevented from starting an automatic run from any position in the hoistway if the doors are not fully closed and locked, except as permitted for re-leveling the car into position as permitted in section 2.26.1.6.

(b) An elevator door will be prevented from closing if:
   a. Both the Door Open Limit contact ($DOLF_{MP}$ or $DOLR_{MP}$) and Door Close Limit contact ($DCLF_{MP}$ or $DCLR_{MP}$, respectively) are open, or
   b. The Door Open Limit contact ($DOLF_{MP}$ or $DOLR_{MP}$) is open, and the associated Car Gate Contact (CGF or CGR, respectively) appears to be closed, or
   c. The Door Open Limit contact ($DOLF_{MP}$ or $DOLR_{MP}$) is open, and the associated Door Lock Contacts appear to be closed (DLAB, DLSF, DLAT, or DLAB, DLSR, DLAT respectively, as appropriate)
   d. The Door Open Limit contact ($DOLF_{MP}$ or $DOLR_{MP}$) is open, and the associated Door Close Contacts appear to be closed (DCAB, DCSF, DCAT, or DCAB, DCSR, DCAT respectively, and as applicable and appropriate)

2.26.6 The variable frequency AC and the DC drives design incorporate as part of their design phase loss detection and phase reversal.

2.26.7 The Pixel controller design does not include the application of capacitors or other devices that would make Electrical Protective Devices ineffective.

2.26.4 Release and Application of Driving Machine Brakes

2.26.8.1 Pixel P-MP interface to the motor control drive unit is through a dedicated RS-485 port, refer to page 1 of the prints for interface connections, the communications protocol includes status of the drive unit being ready to take control of the driving motor, the Brake Enable, Pixel P-MP will only signal the safety processors to engage brake circuits if there is an intention to move and the Brake Enable status has been asserted.
The safety processors will independently allow the brake to be energized though P contactor, refer to page 4 of the prints for the P contactor coil interface and to page 2 of the prints for the P contactor contacts for relay logic interface or page 2bk for electronic brake control interface energizing of the brake.

2.26.8.2 The P contactor is used in conjunction with the BK contactor for relay Logic interface or the P-Brake, electronic brake control board, for electronic brake control interface to remove power from the brake coil. Refer to section 2.26.2 above for compliance.

2.26.8.3(a) Car Switch or Continuous Pressure operations are not part of the scope of the Pixel controller line.

2.26.8.3(b) Refer to section 2.25.2 above for compliance.

2.26.8.3(c) Refer to section 2.26. 2 above for compliance.

2.26.8.3(d) The brake requires power to lift; loss of power applies the brake.

2.26.8.3(e) Traction Loss detection is accomplished by comparing the commanded speed against the actual cab speed readings from Landa. Refer to sections 2.26.4.4, 2.26.7, 2.26.8.3, 2.26.9.5.3, and 2.26.9.6.3 for additional requirements for compliance.
Should either SP1 or SP2 detect a Traction Loss condition it will remove power from the driving machine motor and brake by deactivating the AA and P contactors.

If SP1 raises the fault it will switch off $AAo1_{SP1}$ and $Po1_{SP1}$ contactor control outputs to

> Remove power to the driving machine motor through output $AAo1_{SP1}$, which (along with output $AAo2_{SP2}$) participates in the energizing of the main motor contactor AA.
> Remove power to the driving machine brake through output $Po1_{SP1}$, which participates (along with output $Po2_{SP2}$) in energizing the P contactor.
> Refer to page 4 of the controller prints to see the SP1 control outputs $AAo1_{SP1}$ and $Po1_{SP1}$, and the AA and P contactor coils.

If SP2 raises the fault it will switch off $AAo2_{SP2}$ and $Po2_{SP2}$ contactor control outputs to

Remove power to the driving machine motor through output $AAo2_{SP2}$, which (along with output $AAo1_{SP1}$) participates in the energizing of the main motor contactor AA. Remove power to the driving machine brake through output $Po2_{SP2}$, which participates (along with output $Po1_{SP1}$) in energizing the potential P contactor. Refer to page 4 of the controller prints to see the SP2 control outputs $AAo2_{SP2}$ and $Po2_{SP2}$, and the AA and P contactor coils.

NOTE: If both SP1 and SP2 raise the fault simultaneously, each independently follows the behavior described above.

For AC Motor control units, the main motor contactor (AA) is a 3-phase contactor, used to apply and remove power from all phases of a 3-phase driving machine motor. Auxiliary contacts of the AA contactor are also wired to a Drive Enable input which commands the motor drive unit to remove power from its 3-phase motor power outputs. Refer to page 1 of the controller prints to see the application of the 4 and 6 auxiliary contacts of the main motor contactor AA.

For DC Motor control units, the main motor contactor (Delta) is a 2-phase DC contactor, controlled by the DC drive unit, used to apply and remove power from all phases of driving machine motor. Auxiliary contacts from the AA and P contactors are wired in series to the Drive Enable input which is used to command the motor drive unit to remove or apply power from its 2-phase motor power outputs and to energize or release the Delta motor contactor. Refer to page 1 of the controller prints to see the application of auxiliary contact 1 of the AA contactor, and Auxiliary contact 1 of the P contactor.

SP1 and/or SP2 communicate the raised fault to the P-MP (main processor) for the P-MP to remove power from the brake:

a. For relay logic brake control, switch off the BK_{MP} and BH_{MP} outputs and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 4 of the controller prints to see the P-MP control outputs BK_{MP} and BH_{MP}, and the qualification of the brake relays BK and BH by contacts of AA and P contactors.
b. For controllers using the P-Brake solid state brake control board, a CAN based command is given, by both SP1 and P-MP, to the P-Brake to turn off power to the brake and a command to the motor drive unit, via dedicated RS-485 network, to remove power from the hoist motor. Refer to page 2bk of the controller prints to see the P-MP interface circuits to the P-Brake control board, and the qualification of the brake power output by the P contactor.

NOTE: Once a Traction Lost fault is declared, the car will not be allowed to move until the controller's Fault Reset button is pressed.

2.26.8.4 Section does not apply to Pixel design; the Brake is kept lifted during slowdown and leveling operations.

2.26.8.5 The Brake power and control circuits are separate from hoist motor armature control circuits.

2.26.9 Control and Operating Circuits Protection

2.26.9.1 The AA and P contactors design contains a spring of compression type.

2.26.9.2 Pixel design complies with this requirement

2.26.9.3 Protection Against Failures

List of components verified against failures prior to allowing the car to start an automatic run:

1. Landa Positioning System
2. EB1-EB2, EBX1-EBX2, emergency brake relays
3. AA, Motor Contactor
4. BK, Brake Contactor
5. Potential Contactor
6. SP1 Learned terminal speed profiles, landing positions and virtual limit positions Flash memory contents Integrity.
7. SP2 Learned terminal speed profiles, landing positions and virtual limit positions Flash memory contents Integrity.
8. P-MP Learned terminal speed profiles, landing positions and virtual limit positions Flash memory contents Integrity.
9. AAoSP1 and AAoSP2 AA Motor Contactor control outputs
10. PoSP1 and PoSP2 P Motor Contactor control outputs
11. Safety Inputs:
    a. GOV_{SP1} and GOV_{SP2} Governor
    b. $SAFC_{SP1}$ and $SAFC_{SP2}$ Safety String Cab
    c. $SAFH_{SP1}$ and $SAFH_{SP2}$ Safety Sting Hoistway
    d. ICT_{SP1} and ICT_{SP2} Car top Inspection
    e. $ICTE_{SP1}$ and $ICTE_{SP2}$ Car top Inspection Enable
    f. IIC_{SP1} and IIC_{SP2} In Car Inspection
    g. IIC_{SP1} and IIC_{SP2} In Car Inspection Enable
    h. IA_{SP1} and IA_{SP2} Hoistway Access
    i. $ESTP_{SP1}$ and $ESTP_{SP2}$ COP Emergency Stop
    j. IMR_{SP1} and IMR_{SP2} Machine Room Inspection
    k. $IMRE_{SP1}$ and $IMRE_{SP2}$ Machine Room Inspection Enable
    l. CDB_{SP1} and CDB_{SP2} Car Door Bypass
    m. HDB_{SP1} and HDB_{SP2} Hoistway Door Bypass
    n. $DLAT_{SP1}$ and $DLAT_{SP2}$ Door Lock Access Top
    o. $DLAB_{SP1}$ and $DLAB_{SP2}$ Door Lock Access Bottom
    p. $DLSF_{SP1}$ and $DLSF_{SP2}$ Front Door Lock String

q. $DLSR_{SP1}$ and $DLSR_{SP2}$ Rear Door Lock String
r. $DCAT_{SP1}$ and $DCAT_{SP2}$ Door Closed Access Top
s. $DCAB_{SP1}$ and $DCAB_{SP2}$ Door Closed Access Bottom
t. $DCSF_{SP1}$ and $DCSF_{SP2}$ Front Door Closed String
u. $DCSR_{SP1}$ and $DCSR_{SP2}$ Rear Door Closed String
v. CGF_{SP1} and CGF_{SP2} Car Gate Front
w. CGR_{SP1} and CGR_{SP2} Car Gate Rear

2.26.9.3.1 There are no magnetically operated switches, contactors, or relays associated with the Leveling or truck zone.

2.26.9.3.1(a) Because of the redundant and independent safety processors and their respective input circuits, the failure of a single solid state device will not render the detection means inoperative. Because one of the safety processors, SP2, is not a software system, the failure of a software system will not render the detection means inoperative.

2.26.9.3.1(b) Refer to Section 2.26.1.6 above for compliance.

2.26.9.3.1(c) Refer to sections 2.26.4.1(d)(1) and 2.26.6.6 above for compliance.

2.26.9.3.1(d) The electrical contact from the mechanical device provided to stop vertical car movement to create a vertical clearance as required by 2.7.4.5 should be wired in series with the Car Top Inspection switch feeding SP1 and SP2 car top inspection inputs, ICT_{SP1}-$ICT_{SP2, to}$ place the car on car top inspection mode if contact is placed on the open position. Refer to section 2.26.1.4 above for Inspection modes of operation compliance.

2.26.9.3.1(e) Refer to sections above 2.26.2.15 for Car Door and Gate Electric Contacts, 2.26.1.4 for Inspection modes of operation compliance and 2.26.1.5 for Inspection Operation with Open Door Circuits.

2.26.9.3.2

2.26.9.3.2(a) Because of the redundant and independent safety processors and their respective input circuits, the failure of a single solid state device will not render the detection means inoperative, and because one of the safety processors, SP2, is not a software system, the failure of a software system will not render the detection means inoperative.

2.26.9.3.2(b) Compliance met through section 2.26.9.3.2(a) above.

2.26.9.4 Refer to Section 2.26.9.3 above for a list of components that are cycle tested to verify performance prior to allowing the car to start a run and their corresponding functional verification process below.

1. Landa Positioning System
   The car position data values read from the Main Reader and Auxiliary Reader are continuously compared against each other, while the car is running or at rest, independently by the P-MP, SP1, and SP2, to validate that each reader is operating in accordance with the other. Each reader is self-diagnosing in that each is designed to detect when it can no longer reliably read the encoded hoistway tape due to internal failures, inadequate installation, or installation failures.
   Because the Main Reader and Auxiliary Reader each read the same encoded steel hoistway tape, the value that each reader obtains can be directly validated against the value read by the other. The readers are mounted in a cartop mounting assembly (bracket) which maintains a fixed linear positional offset between the two readers. This offset is learned and the values reported by the readers are continuously compared to validate that this offset is maintained throughout the operation of the elevator. Any variance in this offset is cause to remove the elevator from service, as it would indicate a failure of one of the two position readers and/or associated data communication circuitry.

2. EB1-EB2, EBX1-EBX2, emergency brake relays.
   These relays, which are used to control the emergency braking device, are continuously monitored for proper operation and are cycled at the end of each run. The proper operation of these relays is monitored via inputs RG1, RG2, RGBP1 and RGBP2. Should any one of these relays fail to operate as expected (the failure of any of the relay contacts drop when the relays are de-energized), the car is not allowed to restart. Refer to page 2 of the controller prints to see the arrangement of the EB1, EB2, EBX1, and EBX2 relay contacts, and the circuit location where these relays are monitored. These monitoring signals are routed to inputs RG and RGBP, which are shown on page 3.

3. AA, Motor Contactor
   The output AAo1 and AAo2 status when logically set to off are compared against the monitored contact from the AA contactor, STOP1 and STOP2 inputs, to verify AA contactor drop out. Refer to page 4 of the controller prints for AA Motor Contactor outputs, inputs and circuit interface.

4. BK, Brake Contactor
   The output Po1 and Po2 and Logical P-MP BK output status when logically set to off are compared against the monitored contact from the BK contactor, BK1 and BK2 inputs, to verify BK contactor drop out. Refer to page 4 of the controller prints for BK Brake Contactor outputs, inputs and circuit interface.

5. Potential Contactor
   The output Po1 and Po2 status when logically set to off are compared against the monitored contact from the P contactor, Pi1 and PI2 inputs, to verify P contactor drop out. Refer to page 4 of the controller prints for P Potential Contactor outputs, inputs and circuit interface.

6. SP1 Learned terminal speed profiles, landing positions and virtual limit positions Flash memory contents Integrity. SP1 will perform a memory Checksum of flash memory containing learned information to eliminate data corruption.

7. SP2 Learned terminal speed profiles, landing positions and virtual limit positions Flash memory contents Integrity. The SP2 will perform a memory Checksum of flash memory containing learned information to eliminate data corruption.

8. P-MP Learned terminal speed profiles, landing positions and virtual limit positions Flash memory contents Integrity.
   The P-MP will perform a memory Checksum of flash memory containing learned information to eliminate data corruption.

9. AAoSP1 and AAoSP2 AA Motor Contactor control outputs
   a. While the car at rest AAi1 & AAi2 inputs are verified to be off, indicating AAo2 output has been turned off.
   b. AAo2 is turned on momentarily and AAi1 & AAi2 inputs are verified to be on, indicating AAo1 has turned off.

10. PoSP1 and PoSP2 P Potential Contactor control outputs
    a. While the car at rest Pi1 & Pi2 inputs are verified to be off, indicating Po2 output has been turned off
    b. Po2 is turned on momentarily and Pi1 & Pi2 inputs are verified to be on, indicating Po1 has turned off.

11. Safety Inputs that may not change state on every run are cycled tested through CTR relay.

2.26.9.5 (Direct Current Motors)

The two means provided to remove power from the motor are the Delta Motor Contactor and the Drive Enable logic though auxiliary contacts of the AA and P contactors that disable the motor drive unit motor power devises, refer to page 1 of prints.

2.26.9.5.1(a) The Delta Motor contactor removes power from the motor and is arranged to open every time the car stops. The car is not allowed to reverse or start without stopping first. Refer to page 1 of the controller prints for Delta motor contactor contacts wired in series with each power leg of the hoist motor and to page 4 for the Delta Auxiliary contact monitored by SP1 and SP2 through $STOP_{SP1}$ and $STOP_{SP2}$ inputs.

2.26.9.5.1(b) Compliance met through section 2.26.9.5.1(a) above, no SIL devises are used to comply.

2.26.9.5.2
Relay Logic Brake control:
The auxiliary contact of the AA contactor is wired in series with the brake contactor coil. The dropping of the AA contactor causes the BK contactor to drop, removing power from the machine brake coil. Refer to page 4 of the controller prints for the AA contact and the brake contactor coil wiring, and to page 2 for the machine brake coil wiring.

Electronic Brake Control (Using the P-brake electronic brake control board)
The auxiliary contact of the AA contactor is wired in series with the P contactor coil. The dropping of the AA contactor causes the P contactor to drop, removing power from the machine brake coil. Refer to page 4 of the controller prints for the AA contact and the P contactor coil wiring, and to page 2bk for the machine brake coil wiring.

2.26.9.5.3 Refer to section 2.26.2 Electrical Protective Devices compliance and to 2.26.8.3(e) for Traction-Loss detection means of compliance above.

2.26.9.5.4
Relay Logic Brake control:
The Delta (motor), AA (Motor Auxiliary), BK (brake), and P (potential) contactors are verified to be in the deactivated state (control contacts open) before the car is allowed to restart by SP1 and SP2 safety processors. The states of these contactors are monitored through the following inputs STOPSP1, BKiSP1 and PinSP1 and STOPSP2, BKiSP2, and PinSP2. Refer to page 4 of the controller prints for detail of the wiring of the contactor monitoring contacts.

Electronic Brake Control (Using the P-brake electronic brake control board)
The Delta (motor), AA (Motor Auxiliary), P (potential) contactors are verified to be in the deactivated state (control contacts open) before the car is allowed to restart by SP1 and SP2 safety processors. The states of these contactors are monitored through the following inputs STOPSP1 and PinSP1 and STOPSP2, and PinSP2. Refer to page 4 of the controller prints for detail of the wiring of the contactor monitoring contacts and page 2bk for P-Brake to brake interface circuits.

ⓘ **NOTE**: The P-MP will not issue a CAN command to the P-Brake to energize the brake unless The Delta, AA (Motor Auxiliary), P (potential) contactors are in the deactivated state, and the drive unit reports to be ready to drive the motor

2.26.9.6 (Alternating Current Motors)

The two means provided to remove power from the motor are the AA Motor Contactor and the Drive Enable logic though auxiliary contacts of the AA contactor that disable the motor drive unit motor power devises, refer to page 1 of prints.

2.26.9.6.1(a) The AA Motor contactor removes power from the motor and is arranged to open every time the car stops. The car is not allowed to reverse or start without stopping first. Refer to page 1 of the controller prints for AA motor contactor contacts wired in series with each power leg of the hoist motor and to page 4 for the AA Auxiliary contacts monitored by SP1 and SP2 through $STOP_{SP1}$ and $STOP_{SP2}$ inputs.

2.26.9.6.1(b) Compliance met through section 2.26.9.5.1(a) above, no SIL devises are used to comply.

2.26.9.6.2
Relay Logic Brake control:
The auxiliary contact of the AA contactor is wired in series with the brake contactor coil. The dropping of the AA contactor causes the BK contactor to drop, removing power from the machine brake coil. Refer to page 4 of the controller prints for the AA contact and the brake contactor coil wiring, and to page 2 for the machine brake coil wiring.

Electronic Brake Control (Using the P-brake electronic brake control board)
The auxiliary contact of the AA contactor is wired in series with the P contactor coil. The dropping of the AA contactor causes the P contactor to drop, removing power from the machine brake coil. Refer to page 4 of the controller prints for the AA contact and the P contactor coil wiring, and to page 2bk for the machine brake coil wiring.

2.26.9.6.3 Refer to section 2.26.2 Electrical Protective Devices compliance and to 2.26.8.3(e) for Traction-Loss detection means Compliance above.

2.26.9.6.4
Relay Logic Brake control:
The AA (Motor), BK (brake), and P (potential) contactors are verified to be in the deactivated state (control contacts open) before the car is allowed to restart by SP1 and SP2 safety processors. The states of these contactors are monitored through the following inputs STOPSP1, BKiSP1 and PinSP1 and STOPSP2, BKiSP2, and PinSP2. Refer to page 4 of the controller prints for detail of the wiring of the contactor monitoring contacts.

Electronic Brake Control (Using the P-brake electronic brake control board)
The AA (motor), P (potential) contactors are verified to be in the deactivated state (control contacts open) before the car is allowed to restart by SP1 and SP2 safety processors. The states of these contactors are monitored through the following inputs STOPSP1 and PinSP1 and STOPSP2, and PinSP2. Refer to page 4 of the controller prints for detail of the wiring of the contactor monitoring contacts and page 2bk for P-Brake to brake interface circuits.

NOTE: The P-MP will not issue a CAN command to the P-Brake to energize the brake unless The AA (Motor), P (potential) contactors are in the deactivated state, and the drive unit reports to be ready to drive the motor

2.26.9.7 The Pixel controller design does not include the application for Motor generator – field control systems.

2.26.9.8 The Pixel controller design complies with these requirements.

2.26.10 Circuits are provided to absorb the power that is regenerated by the hoist motor. Refer to page 1 of the controller prints for regenerated power absorption circuits.

2.26.11 Pixel controller during set up "learns" the fully level position, of each landing, of the cab in the hoistway, such position will be used to center the parameters for Leveling Zone, area where the car will engage leveling, Door Zone, area where the cab door operation is permitted, and Dead Zone, area where the car is considered to be fully leveled with the floor, refer to Fig 1 below.

As the car approaches a landing it will engage level Zone area and it will continue to travel into the area where the Level Zone and the Door Zone overlap, within this area the cab door will be allowed to open if preopening option is enabled, the car will continue to travel into the Dead Zone area, until Level Zone stops. The Dead Zone Area represents the separation between Level Zone Up and Level Zone Down where the car is considered to be fully leveled with the landing. If a fully leveled car position changes, due to rope stretching, the car will be automatically repositioned, Re-Leveled, into the Dead Zone area as soon as the Leveling Zone Up or Down position is engaged.

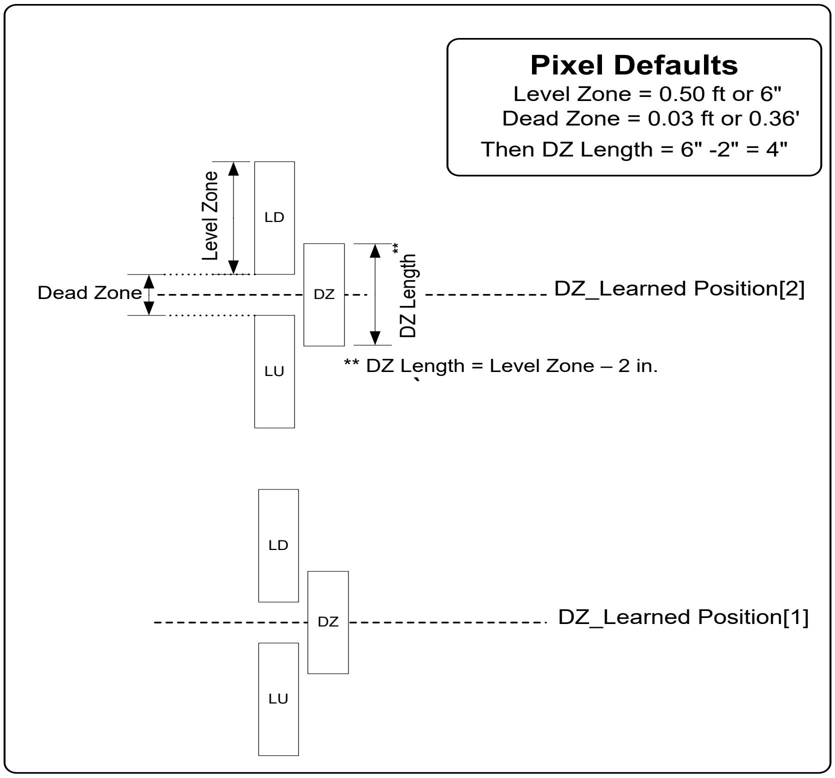

Figure 1. Virtual LU, LD , DZ, and Dead Zone

2.26.12 Provided by others.

2.27 Emergency Operation and Signaling Devices

2.27.1 Provided by others.

2.27.1.2 The Emergency Bell is provided by others; refer to page 6 and 7 of the controllers prints for its wiring interface to the Emergency Stop Switch.

2.27.2 Pixel control behavior complies with Emergency or Standby Power System requirements; refer to Part D2 Test Procedures Item 2301 below for performance verification.

2.27.3 Pixel control behavior complies with Fire Phase 1 and Fire Phase 2 Emergency modes of operation, with exception to Section 2.27.3.5 (Pixel design does not provide for control of multi-compartment elevators); refer to Part D2 Test Procedures Item 2302, 2303, 2304 and 2305 below for performance verification.

2.27.4 Pixel control behavior complies with Firefighters Emergency Operation for Non automatic Elevators.

2.27.5 Pixel control behavior complies with Firefighters Emergency Operation for Automatic Elevators with designated attendant operation. Refer to Section 2.7.11 below for Occupant Evacuation Operation Compliance.

2.27.6 Pixel control behavior complies with Firefighters Emergency, Occupant Evacuation Operation for Inspection Operation. Refer to Section 2.7.11 for Occupant Evacuation Operation Compliance.

2.27.7, 2.27.8, 2.27.9 and 2.27.10 Provided by others.

2.27.11 Pixel design is under development to provide Optional Occupant Evacuation Operation.

4. PART C2 (STATEMENTS OF CONFORMANCE)

In addition to the schematic, provide a written conformance document to explain how compliance with the following requirements is met (where applicable) if it is not possible to demonstrate compliance in the schematic.

Item 2001

2.12.7.3.2 (2.12.7.3.3 for 2019): Independent Speed Control on Access

All modes of Inspection operation share the Inspection Speed, limited to 150 ft/ min and the Inspection Trip Speed Parameter, limited to a maximum value of 20% over Inspection Speed parameter, the Inspection Speed is monitored by two independent means, SP1 and SP2 (along with the Auxiliary and Main Readers, respectively). If either SP1 or SP2 determine that the speed of the car exceeds the speed allowed by this subsection, it removes power from the driving machine motor and brake by deactivating the AA and P contactors. Refer to page 4 of the controller prints to see the AA and P contactor control circuits. Refer to page 2, for relay logic brake control, or 2bk, for electronic brake control, of the controller prints to view the application of contacts of the P contactor in the main machine brake control circuit. Refer to page 1 of the controller prints to see the application of the AA contactor in the driving machine motor circuit, and the application of contacts of the AA and P contactors in the motor drive enable and base block circuits.

Item 2002

2.19.1.2: Ascending Car Overspeed Protection

Refer to section 2.19.1 above "Ascending Car Overspeed Protection" above for conformance explanation.

Item 2003

2.19.2.2: Protection against Unintended Car Movement

Refer to section 2.19.2 above "Protection against Unintended Car Movement" above for conformance explanation.

Item 2004

2.25.4.1: ETSL is Independent of NTS

The **Emergency Terminal Speed-Limiting Devices** (ETSL) are implemented in a dually independent and redundant manner. The first implementation of the Emergency Terminal Speed-Limiting Device is comprised of:

- Landa Main Car Position Reader (Main Reader)
- Pixel Safety Processor 2 (SP2) and SP2 Learned Terminal landings Speed Profile

The redundant implementation is comprised of:

- Landa Auxiliary Car Position Reader (Auxiliary Reader)
- Pixel Safety Processor 1 (SP1) and SP1 learned Terminal landings Speed Profile

The Normal Terminal Stopping Means is implemented in a dually independent and redundant manner.

The first implementation is comprised of:

- Landa Auxiliary Car Position Reader (Auxiliary Reader)
- Pixel Safety Processor 1 (SP1) and SP1 Learned Terminal Landings Speed Profile and learned normal limits

The redundant implementation is comprised of:

- Landa Main Car Position Reader (Main Reader)
- Pixel Safety Processor 2 (SP2) and SP2 Learned Terminal Landings Speed Profile and learned normal limits

Item 2005

2.25.4.2: ETSD is Independent of NTS

An Emergency Terminal Stopping Device is not required because of the existence of the Emergency Terminal Speed-Limiting Devices as specified in section 2.25.4.1. Section does not apply to Pixel design.

Item 2006

2.26.1.4.1(d)(1): Independent Speed Control on Inspection

All modes of Inspection operation share the Inspection Speed, limited to 150 ft/ min and the Inspection Trip Speed Parameter, limited to a maximum value of 20% over Inspection Speed parameter, the Inspection Speed is monitored by two independent means, SP1 and SP2 (along with the Auxiliary and Main Readers, respectively). If either SP1 or SP2 determine that the speed of the car exceeds the speed allowed by this subsection, it removes power from the driving machine motor and brake by deactivating the AA and P contactors. Refer to page 4 of the controller prints to see the AA and P contactor control circuits. Refer to page 2, for relay logic brake control, or 2bk, for electronic brake control, of the controller prints to view the application of contacts of the P contactor in the main machine brake control circuit. Refer to page 1 of the controller prints to see the application of the AA contactor in the driving machine motor circuit, and the application of contacts of the AA and P contactors in the motor drive enable and base block circuits.

Item 2007

2.26.4.3.2: SIL Certification (Includes Conditions of Certification)

Pixel submittal does not include any SIL Certifications.

Item 2008

2.26.7: Installation of Capacitors or Other Devices

The Pixel controller design does not include the application of capacitors or other devices that would make Electrical Protective Devices ineffective.

Item 2009

2.26.8.2: Release and Application of Driving Machine Brakes

The P contactor is used in conjunction with the BK contactor for relay Logic interface or the P-Brake, electronic brake control board, for electronic brake control interface to remove power from the brake coil. Refer to section 2.26.2 above for compliance.

Item 2010

2.26.9.3: Single Ground / Single Failure

Pixel design does not contain any magnetically Operated switches to limit the truck zone and because of its redundant and independent safety processors and their respective input circuits, the failure of a single solid state device will not render the detection means inoperative, and because one of the safety processors, SP2, is not a software system, the failure of a software system will not render the detection means inoperative.

Item 2011

2.26.9.4: Redundancy and Checking

Refer to sections 2.26.9.4 above for compliance and to page 6B of the controller prints for Landa Main Reader and Auxiliary sensor heads wiring utilizing two independent communication channels to convey its position information.

Item 2012

2.26.9.5 / 2.26.9.6: Two Means to Remove Power

Refer to sections 2.26.9.6 and 2.26.9.6 above for compliance and to page 1 of the controller prints for hoist motor wiring in series with AA contactor and the motor drive unit.
Note: The drive unit transistor logic is enabled through the Drive Enable input

Item 2013

3.26.6.3 / 3.26.6.4: Two Means to Remove Power

Not applicable to this submittal.

5. PART D2 TEST PROCEDURES

Provide a written test procedure for the items listed below. Provide a written procedure for the tests of 8.10.2 and 8.10.3 that cannot be easily demonstrated in the field or for those tests which require specific test instructions to demonstrate compliance. The procedure should follow the same sequence of the tests in 8.10.

Items Section D2: 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309.

In addition, written test procedures are required for the following items from following Sections:
C2: 2010, 2011, 2012.
D1: 2202, 2210, 2213, 2219, 2220, 2224, 2227, 2228, 2232, 2233, 2236, 2237, 2238, 2240, 2242.

Item 2301
2.27.2 Emergency or Standby Power System

Comment: This series of tests should be skipped for installations that do not utilize an emergency power generator that can run one (or more) elevator(s).

To prepare for testing the logical operation of the control system (testing the system without actually invoking the emergency power generator), refer to the control system prints to locate the connection terminal to which the emergency power status contact is wired (the contact of the emergency power generator that is used to reflect whether power is being supplied by the commercial source or from the generator). This terminal is labeled "EPI". Determine the polarity of this contact (i.e., open or closed when on emergency power). Emergency power conditions will need to be simulated by either shunting the status contact or by disconnecting the field wire at the EPI terminal, depending upon this polarity.

Also, refer to the control system prints to locate the connection terminal to which an emergency power pre-transfer contact is wired (a contact of the emergency power system that indicates that a transfer back to commercial power is imminent). This terminal is labeled "EPPT". Determine the polarity of this contact (i.e., open or closed when a transfer back to commercial power is imminent). This pre-transfer condition will need to be simulated (in Test Procedure 2301.4) by either shunting the status contact or by disconnecting the field wire at the EPPT terminal, depending upon this polarity.

Test Procedure 2301.1 (sequential lowering):

1. Remove power from all controllers (including the group supervisor, if applicable).
2. Simulate the activation of the emergency power status contact from the emergency power generation system, as discussed in the Comment section above.

3. Simultaneously restore power to all controllers.
4. Verify that the “ELEVATOR EMERGENCY POWER” indicator at the designated level lobby is illuminated.
5. Verify that the cars return sequentially to the emergency power recall floor, as required by Section 2.27.2.4.4(a) through Section 2.27.2.4.4(d).
6. As each car performs its recall process, verify that the visual indicator associated with each car (if required by Section 2.27.2.4.3) illuminates once the car has completed its recall operation, as required by Section 2.27.2.4.3.
7. Stringent and complete testing will require that steps 1 through 6 above are repeated with one or more cars placed on Designated Attendant Operation (if applicable), Inspection Operation, and Firefighter’s Emergency Operation.

Test Procedure 2301.2 (automatic car selection, multi-car system with selection switch):

1. Place the selection switch labeled “ELEVATOR EMERGENCY POWER” in the “AUTO” position.
2. Carry out Test Procedure 2301.1. Once the sequential recall process has completed for all cars, move on to Step 3 of this test procedure.
3. Once the cars have completed the sequential recall process, verify that a car (or cars, up to the rated capacity of the emergency power generator) is selected to run on generator power, per the requirements of section 2.27.2.4.5.
4. Verify that the proper visual indicator (adjacent to the manual selection switch(es), as referenced in Section 2.27.2.4.6) is illuminated when a car is selected to run.

Test Procedure 2301.3 (manual car selection, multi-car system with selection switch):

1. Place the selection switch labeled “ELEVATOR EMERGENCY POWER” in a position that is associated with one of the elevators.
2. Carry out Test Procedure 2301.1. Once the sequential recall process has completed for all cars, move on to Step 3 of this test procedure.
3. Once the cars have completed the sequential recall process, verify that the car that is selected to run via the manual selection switch(es) is selected to run on generator power, per the requirements of section 2.27.2.4.5.
4. Verify that the proper visual indicator (adjacent to the manual selection switch(es), as referenced in Section 2.27.2.4.6) is illuminated when a car is selected to run.
5. Move the position of the manual selection switch to select a different car to run. Verify that the car that was previously selected is allowed (if moving) to continue running until it stops (at which point it is deselected). Once the previously selected car has been deselected, verify that the newly selected car is allowed to operate.
6. Verify that the proper visual indicator (adjacent to the manual selection switch(es), as referenced in Section 2.27.2.4.6) is illuminated when the new car is selected to run, and verify that all other indicators of that type are turned off.
7. Repeat the manual selection process for all cars.

Test Procedure 2301.4 (transition from Emergency Power to commercial power):

1. This test should be performed once the system has been placed in emergency power operation (by following the steps in Test Procedure 2301.1 above).
2. Simulate the activation of the emergency power pre-transfer contact as discussed in the Comment section above (if one is available).
3. Verify that a running car will stop at the next available floor and open its doors.
4. Simulate transfer of power back to commercial power by first removing power from all controllers.
5. Simulate the return to commercial power by reversing the action taken in Step 2 of Test Procedure 2301.1.
6. Reverse the action taken in Step 2 of this test procedure.
7. Restore power to all controllers.
8. Verify that all cars return to normal operation.

Item 2302
2.27.3.1.6(m) Phase I Emergency Recall Operation

Comment: This test should be skipped for installations that do not utilize a load weighing device.

Test Procedure 2302:

1. Place a full load in the elevator.
2. Place the car on Fire Recall Operation by moving the Fire Recall Switch to the ON position.
3. verify that the car responds to Fire Recall Operation as required by section 2.27.3.1.6.

Item 2303
2.27.3.3.1(l) Phase II Emergency In-Car Operation

Comment: This test should be skipped for installations that do not utilize a load weighing device.

Test Procedure 2303:

1. Place a full load in the elevator.
2. Place the car on Fire Recall Operation by moving the Fire Recall Switch to the ON position.
3. Once the car has completed its recall to the Fire Recall floor, place the car on Fire Phase II operation by moving the in-car “Fire Operation” switch to the ON position.
4. Verify that the car operates as required by section 2.27.3.3.

Item 2304
2.27.3.3.6 Phase II Emergency In-Car Operation

Note: During this test one or more fuses will blow (F50). Refer to the controller prints and make sure that appropriate replacement fuses are readily available.

Test Procedure 2304:

1. Place the car on Fire Service Phase II operation.
2. Board the elevator and travel to the bottom landing (if necessary).
3. Open the elevator door and exit the elevator.
4. Open the hall call push button station at the bottom landing.
5. Using a wire jumper, simulate an accidental ground on the "landing side of the hoistway enclosure" by momentarily shorting the hall buttons voltage bus terminal V+ on the hall node boards to the hall button fixture enclosure.
6. Verify that the operation of the car remains in accordance with section 2.27.3.3.
7. Turn off power to the controller and replace fuses F50 and F50F as required.

Item 2305
2.27.3.4 Interruption of Power

Test Procedure 2305.1 (retention of Fire Phase 1 status through power loss):

1. This test is most efficiently performed with an assistant in the elevator who can register car calls and operate the Door Open Button.
2. Move car to a floor other than the designated Fire Recall floor by registering a car call.
3. Once the car arrives at the floor hold the door open using the Door Open Button.
4. Initiate Fire Phase 1 recall by moving the Fire Recall switch to the ON position (keep holding the door open using the Door Open Button).
5. Remove power from the controller.
6. With power OFF, turn the Fire Recall switch to the OFF position.
7. Restore power to the controller.
8. Allow the door to close (release the Door Open Button).
9. Verify that the system remains on Fire Phase 1 operation, and that the car operates as required under Fire Phase I operation.

Test Procedure 2305.2 (retention of Fire Phase 1 status through power loss):

1. Move car to a floor other than the designated Fire Recall floor by registering a car call.
2. Initiate Fire Phase 1 Recall by moving the Fire Recall switch to the ON position.
3. Allow the car to move away from the floor (it should move toward the Fire Recall floor).
4. Remove power from the controller (with the car in between floors).

5. With power OFF, turn the Fire Recall switch to the OFF position.
6. Restore power to the controller.
7. Verify that the car moves toward the Fire Recall floor.
8. Once it reaches a floor, verify that the car completes the recall to the Fire Recall floor as required under Fire Phase I operation.

Test Procedure 2305.3 (retention of Fire Phase 2 status through power loss):

1. This test is most efficiently performed with an assistant in the elevator who can register car calls and manipulate the Fire Phase 2 switch.
2. Place the elevator on Fire Phase 2 Operation and move it to an upper floor by registering a car call.
3. Leave the Fire Phase 2 switch in the ON position.
4. Leave the doors closed.
5. Remove power from the elevator controller.
6. Restore power to the elevator controller.
7. Verify that the car will not move (except for releveling operation as required).
8. Verify (by observing the car's position indicator) that the floor position is re-established immediately.
9. Verify that the car will then respond to car calls as appropriate under Fire Phase 2 operational requirements.

Test Procedure 2305.4 (retention of Fire Phase 2 status through power loss):

1. This test is most efficiently performed with an assistant in the elevator who can register car calls and operate the Door Open Button and Door Close Button.
2. Place the elevator on Fire Phase 2 Operation and move it to a floor other than the fire recall floor.
3. Leave the Fire Phase 2 switch in the ON position.
4. Open the elevator doors fully using constant pressure on the door open button.
5. Remove power from the elevator controller.
6. Restore power to the elevator controller.
7. Verify that the doors do not close automatically. The closing of the doors must remain "constant pressure operation" as required by Fire Phase 2 operation.
8. Verify (by observing the car's position indicator) that the floor position is re-established immediately.
9. Verify that the car will then respond to car calls as appropriate under Fire Phase 2 operational requirements.

Test Procedure 2305.5 (retention of Fire Phase 2 status through power loss):

1. This test is most efficiently performed with an assistant in the elevator who can register car calls and manipulate the Fire Phase 2 switch.
2. Place the elevator on Fire Phase 2 Operation and move it to a floor other than the fire recall floor.

3. Open the door fully using the Door Open Button and then place the Fire Phase 2 key switch in the HOLD position.
4. Remove power from the controller.
5. Restore power to the controller.
6. Verify that the car will not move (except for releveling operation as required).
7. Verify (by observing the car's position indicator) that the floor position is re-established immediately.
8. Verify that the doors will remain open as required by Fire Phase 2 HOLD operation.

Item 2306
3.19.4.7.6 Sealing of the Overspeed Valve
Test procedure: Not applicable to this controller type (electric elevator)

Item 2307
3.17.3.2.2(a) Plunger Gripper - Inspection and Test Means
Test procedure: Not applicable to this controller type (electric elevator)

Item 2308
3.27.1 Phase I Emergency Recall Operation After Device Actuation
3.27.2 Phase I Emergency Recall Operation Prior to Device Actuation
3.27.3 Device Actuation at Recall Level
Test procedures: Not applicable to this controller type (electric elevator)

Item 2309
3.27.4 Device Actuation with Phase II Emergency In-Car Operation in Effect
Test procedure: Not applicable to this controller type (electric elevator)

6. PART C2 TEST PROCEDURES

Test procedures for double boxed items in Part C2, as indicated in Part 2 for items 2010, 2011, 2012

Item 2010

2.26.9.3 Protection Against Failures

Single Ground

Critical Component: N/A

Redundant Component: F4A Fuse

Monitored Component: N/A

Test Verification of Single Ground:

a. Place the car on Machine Room Inspection.

NOTE: The Single Ground Test can be performed on either automatic or inspection operation.

NOTE: The system logic is driven by a source of 110 Volts AC, and has one side already connected to ground, the 3 bus, the other side to the 4A bus protected by a fuse feeding the logic power. Any accidental grounding will result in a blown fuse F4A, which will remove controller power to the safety string and logic circuits.

b. Short terminal SAFH to ground. Verify that fuse F4A blows, and the Pixel screen displays **Safety String Open Fault**.
c. Turn main power to the controller off.
d. Replace fuse F4A.
e. Turn main power to controller on.
f. Confirm that the Pixel screen displays **No Faults**.
g. Remove the car from Machine Room Inspection.

Test Verification Landa™ Redundant Position System

Critical Component:	**Landa**™ Main and Auxiliary Position Sensor Heads
Redundant Component:	**Landa**™ Main and Auxiliary Position Sensor Heads
Monitored Component:	Car Speed, and Position

NOTE: The following tests verify that Pixel can safely position the cab using either of the two independent sensor heads that comprise the Landa™ positioning system.

The Pixel control uses a dual head positioning system – Landa™– incorporating a positional encoded tape that runs the entire length of the hoistway. This system enables each sensor head to provide absolute position information independent of the other. Refer to page 6 of the prints for Landa™ interface circuits.

The Main Positioning head communicates its absolute position to the main processor via dedicated RS485 serial port while the Auxiliary Positioning head communicates its absolute position to the main processor via CAN.

The Landa™ positioning system verifies absolute cab position to 0.032" (0.8mm) accuracy throughout the entire length of the hoistway.

The Pixel computer network, MPU, will "learn" and then build a positional image of the entire hoistway including:

- Door Zone or Trucking Zone, one per landing
- Top and Bottom Access Limits
- Mid hoistway position
- Physical open position for the top and bottom normal limit switches
- A speed profile deceleration ramp for the top and bottom landings

NOTE: The landing zones are limited to a maximum of six inches plus or minus learned position and are set at a factory default of three inches.

The learn process – once performed and verified during elevator installation – will be transferred and permanently stored by the three microprocessors that make up the Pixel controller's main processing unit (MP, SP1, SP2). The learning process must be accomplished and transferred before the car can be run on any passenger automatic mode of operation.

NOTE: Pixel always "knows" the car position by reading it from the encoded tape and validating it through comparison to the learned/stored positional image.

Verification of Landa™ Main Sensor Head:

a. Set CAPTURE switch, located on the MP board, to CAPTURE which will prevent the car from responding to hall call demand.

b. Set TEST switch, located on the MP board, to TEST which will enable Test Mode operation and disable door operation.

c. Enter a car call to a floor several floors away from current car position (for a two stop elevator place a call to the other floor).

d. While car is running, unplug the Main Selector RJ45 cable labeled “SELECTOR” from Pixel MP, and observe that Pixel displays a **Main Selector Fault**, makes an emergency slowdown, and positions the elevator cab at the next available landing.

e. Pixel will remove the car from service until proper Landa™ Main sensor head communication~~s~~ is re-established.

f. Verify that the car will not respond to car calls.

g. Reconnect the RJ45 cable to the Pixel MP. Confirm that Pixel clears the **Main Selector Fault**, and that the car responds to car call demand.

h. Return the CAPTURE and TEST switches to their off positions, which will enable the car to return to Automatic Mode of operation and serve hall call demand.

Verification of Landa™ Auxiliary Sensor Head:

a. Set the CAPTURE switch, located on the MP board, to CAPTURE, which will prevent the car from responding to hall call demand.

b. Set the TEST switch, located on the MP board, to TEST which will enable Test Mode operation and disable door operation.

c. Enter a car call to a floor several floors away from current car position (for a two stop elevator place a call to the other floor).

d. While car is running, unplug the cable labeled “CAB CAN” from the Pixel MP, and observe that Pixel displays briefly **SP1 Aux. Selector Comm. Fault**, before being overwritten by a higher priority **CAB Comm. Fault**, makes an emergency slowdown, and positions the elevator cab at the next available landing.

e. Pixel will remove the car from service until proper Landa™ Auxiliary sensor head communication and CAB communications are re-established.

f. Verify that the car will not respond to car calls.

g. Reconnect the RJ45 cable to the Pixel MP. Confirm that Pixel clears the **CAB Comm. Fault and SP1 Aux. Selector Comm. Fault,** and that the car to respond to car call demand.

h. Return the CAPTURE and TEST switches to their off positions, which will enable the car to return to Automatic Mode of operation and serve hall call demand.

Item 2011
2.26.9.4 Methods to Satisfy 2.26.9.3
The car position data values read from the Main Reader and Auxiliary Reader are continuously compared against each other, while the car is running or at rest, independently by the P-MP, SP1, and SP2, to validate that each reader is operating in accordance with the other. Each reader is self-diagnosing in that each is designed to detect when it can no longer reliably read the encoded hoistway tape due to internal failures, inadequate installation, or installation failures.
Verification of operation is included as part of test procedure for **2.26.9.3 Protection Against Failures** above.

The following safety inputs are verified against failures by cycle testing after each run before allowing the car to start another:

List of components verified against failures prior to allowing the car to start an automatic run:

1. Landa Positioning System
2. EB1-EB2, EBX1-EBX2, emergency brake relays
3. AA, Motor Contactor, used as Delta or Solid State Starter output
4. P, potential Contactor, used as Y for Y-Delta design only
5. BK, Contactor, used as auxiliary motor protection contactor for Delta and Y-Delta designs only.
6. ESCO Emergency Slowdown command contactor
7. SP1 Learned terminal speed profiles, landing positions and virtual limit positions Flash memory contents Integrity.
8. SP2 Learned terminal speed profiles, landing positions and virtual limit positions Flash memory contents Integrity.
9. P-MP Learned terminal speed profiles, landing positions and virtual limit positions Flash memory contents Integrity.
10. $AAo1_{SP1}$ and $AAo2_{SP2}$ AA Contactor control outputs
11. $Po1_{SP1}$ and $Po2_{SP2}$ P Contactor control outputs
12. Safety Inputs:
    a. GOV_{SP1} and GOV_{SP2} Governor
    b. $SAFH_{SP1}$ and $SAFH_{SP2}$ Safety String Hoistway
    c. $SAFC_{SP1}$ and $SAFC_{SP2}$ Safety String Cab
    d. ICT_{SP1} and ICT_{SP2} Car top Inspection
    e. $ICTE_{SP1}$ and $ICTE_{SP2}$ Car top Inspection Enable
    f. IIC_{SP1} and IIC_{SP2} In Car Inspection
    g. IIC_{SP1} and IIC_{SP2} In Car Inspection Enable
    h. IA_{SP1} and IA_{SP2} Hoistway Access
    i. $ESTP_{SP1}$ and $ESTP_{SP2}$ COP Emergency Stop
    j. IMR_{SP1} and IMR_{SP2} Machine Room Inspection
    k. $IMRE_{SP1}$ and $IMRE_{SP2}$ Machine Room Inspection Enable

l. CDB_{SP1} and CDB_{SP2} Car Door Bypass
m. HDB_{SP1} and HDB_{SP2} Hoistway Door Bypass
n. $DLAT_{SP1}$ and $DLAT_{SP2}$ Door Lock Access Top
o. $DLAB_{SP1}$ and $DLAB_{SP2}$ Door Lock Access Bottom
p. $DLSF_{SP1}$ and $DLSF_{SP2}$ Front Door Lock String
q. $DLSR_{SP1}$ and $DLSR_{SP2}$ Rear Door Lock String
r. $DCAT_{SP1}$ and $DCAT_{SP2}$ Door Closed Access Top
s. $DCAB_{SP1}$ and $DCAB_{SP2}$ Door Closed Access Bottom
t. $DCSF_{SP1}$ and $DCSF_{SP2}$ Front Door Closed String
u. $DCSR_{SP1}$ and $DCSR_{SP2}$ Rear Door Closed String
v. CGF_{SP1} and CGF_{SP2} Car Gate Front
w. CGR_{SP1} and CGR_{SP2} Car Gate Rear

To verify integrity of monitoring inputs a cycle test operation is automatically performed prior to each automatic run. To verify cycle test functional operation, follow steps below that use the GOV input for a failed cycle test verification:

1. Place the car on Test and Capture
2. Turn power to controller off
3. Remove and insulate the field wire from terminal GOV.
4. Jump terminal GOV to terminal 4A to simulate a latched cycle test input.
5. Turn controller power on
6. Place a car call and allow the car to travel to the commanded landing.
7. Pixel will automatically perform a Cycle test at the destination landing, verify display shows a Cycle test fault and that the car cannot be commanded to move by entering car calls
8. Turn power off
9. Remove jumper from GOV to 4A
10. Connect the field wire from step 3 above to GOV terminal.
11. Turn Power on
12. Verify the fault remains through power lost
13. Press the System Fault Reset push button in the P-MP board to clear fault and return car to service
14. Place Test and Capture switches to off position.

NOTE: The remaining listed input components can be verified by repeating Procedure above

Item 2012

2.26.9.5 / 2.26.9.6 Two means to remove power from hoist motor

The two means provided to remove power from the motor are the AA Motor Contactor and the Drive Enable Transistor logic, for AC hoist motors, or the Drive Enable Logic for DC hoist motors.

Test Verification AA Motor Contactor Force Guided Relay

Critical Component: AA Relay

Redundant Component: STOP1-STOP2, SP1 and SP2 Computer Monitoring Inputs

Monitored Component: AA Relay Contacts

NOTE: Test confirms that Pixel correctly detects a motor contactor failure to open. Pixel checks for a stuck contact at the end of every run before allowing the next run. Refer to page 1and 4 of prints.

a. Set CAPTURE switch, located on the MP board, to CAPTURE which will prevent the car from responding to hall call demand.

b. Set TEST switch, located on the MP board, to TEST which will enable Test Mode operation and disable door operation.

c. Place Machine Room Inspection switch to INSP.

NOTE: AA Contactor Verification functions identically in both inspection and automatic modes of operation.

d. Manually press and hold the AA contactor movable and verify that the Pixel screen displays **AA Relay Fault**. Then release and confirm that the fault condition has been cleared (screen displays **No Faults**).

e. While holding AA contactor movable, use Controller Inspection to command the car Up or Down.

f. Verify that the car will not accept a run command while the fault is present.

g. Release the AA contactor movable and confirm that the Pixel screen displays **No Faults**.

h. Return the Controller Inspection, TEST and CAPTURE switches to their off positions, which will enable the car to return to Automatic Mode of operation and service call demand

i. Place Machine Room Inspection switch to NORMAL.

Test Verification Drive Enable

NOTE: Test confirms that the drive will not feed current to the hoist motor unless it has been commanded and “Enabled” to do so though the Drive Enable input.

a. Set CAPTURE switch, located on the MP board, to CAPTURE which will prevent the car from responding to hall call demand.

b. Set TEST switch, located on the MP board, to TEST which will enable Test Mode operation and disable door operation.

c. Place Machine Room Inspection switch to INSP.

NOTE: Drive Enable Verification functions identically in both inspection and automatic modes of operation.

d. Turn main line disconnect off.

e. Remove and Isolate the Drive Enable wire from the drive terminal Strip, refer to page 1 of the controller prints for terminal and wire.

f. Turn main line disconnect on.

g. Use Controller Inspection to command the car Up or Down.

h. Verify that the car will not run and the Brake will not engage.

i. Turn main line disconnect off.

j. Rewire the Drive Enable wire to the drive terminal Strip.

k. Turn main line disconnect on.

l. Return the Controller Inspection, TEST and CAPTURE switches to their off positions, which will enable the car to return to Automatic Mode of operation.

7. PART D1 TEST PROCEDURES

Test procedures for double boxed items in Part D1, as indicated in Part 2 for items 2202, 2210, 2213, 2219, 2220, 2224, 2227, 2228, 2232, 2233, 2236, 2237, 2238, 2240 and 2242 for safety and/or EPD devices.

Item 2202
Motor Field Sensing (for Pixel DC motor applications only)
Refer to section C2 entry 2.26.2.4 Motor Field Sensing Means for explanation on detection means and procedure below to verify detection performance.

a. Set CAPTURE switch, located on the MP board, to CAPTURE which will prevent the car from responding to hall call demand.
b. Set TEST switch, located on the MP board, to TEST which will enable Test Mode operation and disable door operation.
c. Place Machine Room Inspection switch to INSP.

ⓘ **NOTE:** Drive Enable Verification functions identically in both inspection and automatic modes of operation.

d. Turn main line disconnect off.
e. Remove and Isolate the Motor Field Wires from the drive terminal Strip, refer to page 1 of the controller prints for terminals and wire.
f. Turn main line disconnect on and observe the drive unit declares a motor field loss fault and removes the drive safe output wired to Pixel's safety processors $DSAF_{SP1}$ and $DSAF_{SP2}$ inputs.
g. Use Controller Inspection to command the car Up or Down.
h. Verify that the car will not run and the Brake will not engage.
i. Turn main line disconnect off.
j. Rewire the Motor Field Wires to the drive terminal Strip.
k. Turn main line disconnect on.

Return the Controller Inspection, TEST and CAPTURE switches to their off positions, which will enable the car to return to Automatic Mode of operation

Item 2210

2.26.2.12 Emergency Speed Limit

The Emergency Terminal Stop test forces the car to execute a run at high speed into the terminal landing (up or down) tests are accomplished using simple menu driven processes and the procedures below:

Down Direction:

a. Set CAPTURE switch, located on the MP board, to CAPTURE which will prevent the car from servicing Hall Calls.

b. Drive the car to the top landing by entering a Car Call.

c. Set TEST switch, located on the MP board, to TEST which will enable Test Mode operation and disable door operation.

d. Navigate to:

Home

Install

Code Compliance Tests

Safeties Speed Tests

Emergency Terminal Stop

NOTE: The Emergency Terminal Stop "Slowdown Position" represents the hoistway position at which the car must start its deceleration into the bottom landing (relative to the virtual down normal limit).

Press the **Run Test** soft key to start the **Emergency Terminal Stop** run or the **Back** soft key to abort test run.

CAUTION: Once the Run Test soft key has been pressed, the car will accelerate to contract speed in the down direction and run past the Slowdown Position.

e. Observe that the Display shows a **Slowdown Overspeed** Trip latching fault, and that the car comes to a halt.

f. Press the System Fault Reset key to clear the fault and allow the car to reposition.

Up Direction:

a. Set CAPTURE switch, located on the MP board, to CAPTURE which will prevent the car from servicing Hall Calls.

b. Drive the car to the bottom landing by entering a Car Call.

c. Set TEST switch, located on the MP board, to TEST which will enable Test Mode operation and disable door operation.

d. Navigate to:

Home

Install

Code Compliance Tests

Safeties Speed Tests

Emergency Terminal Stop

NOTE: The Emergency Terminal Stop "Slowdown Position" represents the hoistway position at which the car must start its deceleration into the top landing (relative to the virtual up normal limit).

Press the **Run Test** soft key to start the **Emergency Terminal Stop** run or the **Back** soft key to abort test run.

CAUTION: Once the Run Test soft key has been pressed, the car will accelerate to contract speed in the up direction and run past the Slowdown Position.

e. Observe that the Display shows a **Slowdown Speed** Trip latching fault, and that the car comes to a halt.

f. Press the System Fault Reset key to clear the fault and allow the car to reposition.

Item 2213
2.26.2.16 Emergency Terminal Stopping
Pixel elevator controllers comply with section 2.25.4.2 and are exempt from complying with section 2.26.2.16

Item 2219

2.26.2.29 Ascending Car Overspeed

The Pixel Ascending Car Overspeed test is accomplished using a simple menu driven process and the procedure below

NOTE: Test verifies operation and deployment of the emergency brake by Pixel, if electrical overspeed contact of the governor activates from empty car overspeed detection in the up direction.

a. Set CAPTURE switch, located on the MP board, to CAPTURE which will prevent the car from servicing Hall Calls.

b. Set TEST switch, located on the MP board, to TEST which will enable Test Mode operation and disable door operation.

c. Drive the car below the counterweight position to allow enough distance from the top landing for the car to accelerate and overspeed due to gravity.

d. On Pixel control navigate to:

   Home

   Install

   Code Compliance

   Overspeed Tests

   Ascending Car Overspeed

Press the **Back** soft key to abort test or **Page Up** to enter test.

e. Follow Ascending Car Overspeed test directions on Pixel LCD.

f. Once ready to perform test Press the Page Up soft key, to enter Ascending Car Overspeed test mode.

g. The LCD will display instructions prior to Ascending Car Overspeed test, follow directions on the Screen to enable Pixel to lift the main brake without commanding the motor drive unit, and observe the car to travel, by gravity, in the up direction until the electrical contact from the governor activates deploying the emergency brakes to stop the car.

NOTE: The main brake will remain lifted for as long as the Enable and Up Machine Room Inspection push button are held push in, allowing verification of auxiliary brake capacity to stop the car upon failure of main brake.

h. Cycle power on control unit and verify **Governor Latching Fault** remains after power cycle.

i. Reset the drive Run Enable to Brake in the motor control in the drive unit.

j. Press the System Fault Reset push button to clear **Governor Latching Fault**.

k. Set Machine Room Inspection switch to Normal and observe Pixel repositioning the cab to its closest landing zone.

l. Set CAPTURE, TEST switches to OFF position to return car to service.

Item 2220
2.26.2.30 Unintended Movement

Critical Component:	**Car** Gate and Hoistway Door Locks
Redundant Component:	SP1 and SP2 safety microprocessors, Landa™ Landa™ Position System
Monitored Inputs:	**Front Doors:** CGF1-CGF2, DLAT1-DLAT2, DLSF1-DLSF2, DLAB1-DLAB2 Additional inputs for front and rear doors **Rear Doors:** CGR1-CGR2, DLSR1-DLSR2

NOTE: Test verifies operation and deployment of the emergency brake by Pixel if the cab travels outside a landing zone with both car and the hoistway doors open.

a. On Pixel control Verify **Unintended Movement Bypass option is set to No,** navigate to:

Home

Install

Code Compliance

Unintended Movement

Unintended Movement Bypass

No

Press the Save soft key, to disable bypass.

b. Enable **Unintended Movement Test,** UIM test, navigate to:

Home

Install

Code Compliance

Unintended Movement

Unintended Movement Test

c. Follow UIM test directions on Pixel LCD.

WARNING: Place approved barricade across elevator door opening. Station qualified supervision at opening. PREVENT ACCIDENTAL INGRESS ATTEMPT DURING TEST.

d. Once ready to perform test Press the Page Up soft key, to enter UIM test mode.

e. The LCD will display instructions and current distance information prior to UIM test, follow directions on the Screen to enable Pixel to lift the main brake without commanding the motor drive unit and observe the car to travel by gravity out of the door zone area triggering an Unintended Movement latching Fault deploying the emergency brakes to stop the car.

NOTE: The main brake will remain lifted for as long as the Enable and Up Machine Room Inspection push button are held push in, allowing verification of auxiliary brake capacity to stop the car upon failure of main brake.

f. Verify on Pixel Screen that the Distance Moved by car is less than or equal to 48 inches, if Distance Moved is more than 48 inches, auxiliary brake adjustment must be performed to comply with the code maximum stopping distance allowed for Unintended Movement, please refer to the auxiliary brake manufacturer for instructions on brake adjustment, and repeat UIM test.

g. Cycle power on control unit and verify Unintended Movement Fault remains after power cycle.

h. Reset the drive Run Enable to Brake in the motor control in the drive unit.

i. Press the System Fault Reset push button to clear Unintended Movement Fault.

j. Set Machine Room Inspection switch to Normal and observe Pixel to close the cab doors and reposition the cab to its closest landing zone.

k. Remove barricades, set Capture switch to off, to conclude UIM test.

Item 2224
2.25.2 Normal Terminal Stopping Devices
The NTS Slowdown test forces the car to execute an emergency slowdown into the terminal landing (up and down) utilizing the Landa Auxiliary sensor head Only to verify that the failure of the primary terminal slowdown device, the Main Land Sensor head, does not prevent the car from landing into terminal landing position, the NTS Slowdown tests are accomplished using simple menu driven process and the procedures below:

Down Direction:

a. Set CAPTURE switch, located on the MP board, to CAPTURE which will prevent the car from servicing Hall Calls.

b. Drive the car to the top landing by entering a Car Call.

c. Set TEST switch, located on the MP board, to TEST which will enable Test Mode operation and disable door operation.

d. Navigate to:

Home

Install

Code Compliance Tests

Safeties Speed Tests

NTS Slowdown Test

NOTE: The **NTS Slowdown Test** parameter "Slowdown Position" represents the hoistway position at which the car must start its deceleration into the bottom landing.

Press the **Run Test** soft key to start the **NTS Slowdown Test** run or the **Back** soft key to abort test run.

CAUTION: Once the Run Test soft key has been pressed, the car will accelerate to contract speed in the down direction and run past the Slowdown Position.

e. Observe that the Display shows a **Slowdown Overspeed** Trip latching fault, and that the car comes Level to the bottom landing.

f. Press the System Fault Reset key to clear the fault and enable the car to re-level into the closest landing.

Up Direction:

a. Set CAPTURE switch, located on the MP board, to CAPTURE which will prevent the car from servicing Hall Calls.

b. Drive the car to the bottom landing by entering a Car Call.

c. Set TEST switch, located on the MP board, to TEST which will enable Test Mode operation and disable door operation.

d. Navigate to:

Home

Install

Code Compliance Tests

Safeties Speed Tests

NTS Slowdown Test

NOTE: The **NTS Slowdown Test** parameter "Slowdown Position" represents the hoistway position at which the car must start its deceleration into the top landing.

Press the **Run Test** soft key to start the **NTS Slowdown Test** run or the **Back** soft key to abort test run.

CAUTION: Once the Run Test soft key has been pressed, the car will accelerate to contract speed in the up direction and run past the Slowdown Position.

e. Observe that the Display shows a **Slowdown Overspeed** Trip latching fault, and that the car comes Level to the top landing.

f. Press the System Fault Reset key to clear the fault and enable the car to re-level into the closest landing.

Item 2227
2.26.1.6.6 Independent Speed Control
Leveling Overspeed monitors cab speed while the car is running within the door zone or trucking zone and is in the process of leveling into a landing. Use the following process for verification:

NOTE: Leveling Trip Speed does not monitor the target final programmed leveling speed. Pixel's car landing zone approach is normally greater than the final programmed leveling speed, the code permits speeds of up to 150 ft/min within the leveling zone.

a. Set CAPTURE switch, located on the MP board, to CAPTURE which will prevent the car from servicing Hall Calls.

b. Set TEST switch, located on the MP board, to TEST which will enable Test Mode operation and disable door operation.

c. Navigate to:

Home

Install

Code Compliance Tests

Overspeed Tests

Leveling Overspeed

NOTE: The Leveling Overspeed display shows the programmed Leveling speed parameter, overspeed tripping speed setting, and prompts for entry of the leveling tripping speed parameter to be used when running a leveling trip detection test. Enter a speed below the current leveling speed parameter setting before running test.

Press the **Run Test** soft key to enable – for the next leveling run only – to detect **Leveling Overspeed** condition using the **Test Leveling Overspeed** parameter or the **Back** soft key to abort test run.

d. Enter a Car Call to run the car.

e. Observe that the Fault Display entry for the safety processors shows a Leveling Overspeed latching fault as the car slows down into the target landing's door zone, and that the car comes to a halt.

f. Verify the car will not accept a command to run while the latched fault is present.

g. Press the System Fault Reset key to clear the fault and enable the enable the car to accept a command to move.

h. Verify that the car re-levels into the closest landing

i. Set place the TEST and CAPTURE switches to off, which will enable the car to accept hall calls and return to Automatic Mode operation.

Item 2228
2.26.1.6.7 Inner landing Zone if static control

a. Set CAPTURE switch, located on the MP board, to CAPTURE which will prevent the car from servicing Hall Calls.

b. Drive the car to a terminal landing.

c. Place the car on Independent Service and barricade the doors.

WARNING: Place approved barricade across elevator door opening. Station qualified supervision at opening. PREVENT ACCIDENTAL INGRESS ATTEMPT DURING TEST.

d. Place the car on Hoistway Access operation.

e. Drive the car on Access Operation 3 inches above or below the landing.

f. Remove from Access operation and observe that the car will not start repositioning into a landing until after doors have closed.

g. Remove the car from Independent Service

h. Set Capture switch, located on the MP board, to OFF to return car to automatic mode of operation.

8. ADDITIONAL TEST PROCEDURES

NOTE: Refer to Pixel controller manual "Pixel Traction Installation and Adjustment V02.pdf" Section 6, CODE COMPLIANCE VERIFICATION, for additional compliance verification test procedures.

1. ASME A17.1 Entry 2.27.3.1.6 (c), Emergency Stop Switch functionality during Fire Phase 1 recall operation.

"**2.7.3.1.6** *(c)* When provided, the in-car stop switch (see 2.26.2.21) or the emergency stop switch in the car (see 2.26.2.5) shall not be made ineffective."

a. Drive the car to a landing away from the main fire recall landing
b. When the car is stopped, place the Emergency Stop Switch to Stop position.
c. Activate the main fire recall switch or Main Fire Recall FRS input.
d. Verify that the car will not move towards the fire recall landing, even do main fire recall mode has been initiated.
e. Place the Emergency Stop Switch to Run position and observe that the car initiates its fire recall operation.
f. Once the car starts to move place the Emergency Stop Switch to Stop position and observe the car stopping.
g. Place the Emergency Stop Switch to Run position and allow the car to complete its fire recall operation.
h. Reset the main fire recall operation.

NOTE: To verify behavior for the alternate fire recall operation, change main fire recall for alternate fire recall on steps a through h above.

2. Executable Software, USI, Verification

The executable software version for the elevator logic and safety 1 microprocessors can be viewed navigating to:

Home

Install

About

Software version: Parameter displays Elevator Microprocessor Logic Version

SP1 Software version: Parameter displays Safety Microprocessor Version

The executable software version for the safety 2 processor, the FPGA, can be viewed using the following procedure:

a. Set the CAPTURE switch, located on the MP board, to CAPTURE which will prevent the car from servicing Hall Calls.

b. Set TEST switch, located on the MP board, to TEST which will enable Test Mode operation and disable door operation.

c. Place the controller on Machine Room Inspection, then navigate to:

Home

Install

File Transfer

Remote CRC Check

SP2

Firmware version: Parameter displays the FPGA firmware version.

[end document]