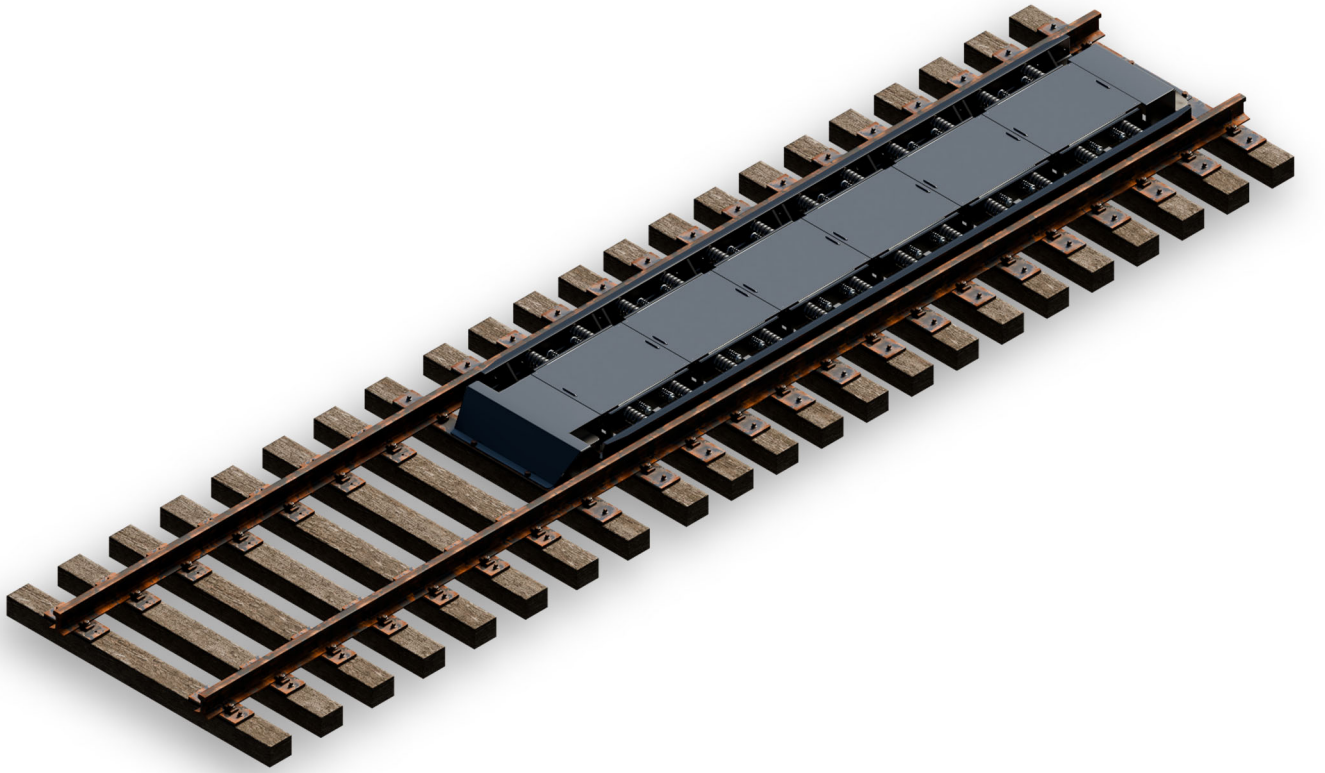
Model ASR-23
Skate Retarder

480VAC POWER / 24VDC CONTROL



Basic Operation Manual

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The recipient shall use it solely for the purposes of design evaluation, performance of a contract, inspection, installation, or maintenance of the equipment and shall not be disclosed or used by the recipient for any purposes other than what is stated here.

The information in this manual is specific to this equipment and should not be used for any other application.

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REVISION	DATE	DESCRIPTION	BY
0	March 2025	Original issue.	AJD

SAFETY SYMBOLS IN THIS MANUAL

In accordance with ANSI Z535 Safety Alerting Standards, safety precautions are located throughout this manual to highlight unsafe practices or possible hazards that could result in death, severe personal injury and/or equipment damage. The following symbols are used to direct attention to specific hazards and precautions. Use the product only after carefully reading and fully understanding this manual in its entirety.

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Used to address practices not related to physical injury (e.g., messages relating to equipment/property damage).

Ref. ANSI Z535 Safety Alerting Standards

NOTICE

This manual provides information for the ARS Model ASR-23 Skate Retarder. The information in this manual should not be used for any other equipment or application.

The information in this manual is arranged into sections as described below:

SECTION 1 – INTRODUCTION

Provides general information on the ASR-23 skate retarder components and safety considerations.

SECTION 2 – OPERATION

Provides general information regarding skate retarder operation and safety precautions.

SECTION 3 – PREVENTATIVE MAINTENANCE

Describes preventative maintenance procedures, functional tests and recommended frequency and interval of inspections.

SECTION 4 – PARTS LISTS

Lists all the skate retarder parts and components.

SECTION 5 – AUXILIARY DRAWINGS

Provides basic electrical schematic drawings.

SECTION 6 – INSTALLATION GUIDANCE

Provides basic diagram detailing ideal installation and recommended practices.

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TERMS AND ABBREVIATIONS

A	Retarder ‘A’
A+B	Retarder ‘A’ & ‘B’
AC	Alternating Current – Electric
AREMA	American Railway Engineering and Maintenance-of-Way Association
ARMMI	Advanced Rail Machine-to-Machine Interface
ASR	Advanced Skate Retarder
B	Retarder ‘B’
CCW	Counter-clockwise
CW	Clockwise
DC	Direct Current – Electric
EMI	Electromagnetic Interference – Electronic
EMC	Electromagnetic Compatibility – Electronic
FRA	Federal Railroad Administration
GCOR	General Code of Operation Rules
LED	Light Emitting Diode – Electronic
NORAC	Northeast Operating Rules Advisory Committee
PNP	Semiconductor device in which an n-type region is sandwiched between two p-type regions.
M.O.W	Maintenance of Way – Field maintenance activities
PPE	Personal Protective Equipment – Safety related
V	Voltage – Electric & Electronic

SECTION 1 - INTRODUCTION

1.1 General Safety Precautions

⚠ WARNING

The ASR-23 is intended to be controlled by an external control unit & supplied voltage or an integrated control unit, both of which must be programmed according to the manufacturer's specification to correctly address all the safe operating features and failure modes. Contact the manufacturer (ARS) to obtain instructions on how to properly control the skate retarder.

⚠ WARNING

Proper installation adjustments, regular inspections, and preventative maintenance of the skate retarder will reduce the occurrence of failures, and any potential for severe personal injury or death.

NOTICE

It is expected that all installation, operation, and maintenance personnel will adhere to all applicable Federal Railroad Administration (FRA), General Code of Operating Rules (GCOR), and / or Northeast Operating Rules Advisory Committee (NORAC) rules governing the rail yard where the ASR-23 skate retarder is to be installed.

1.2 ASR-23 Overview

The ASR-23 is an electrically controlled skate retarder (4’ - 8 1/2” standard gauge), to be used for the control and stopping of rail cars at the end of a classification or hump yard. The ASR-23 incorporates a unique mechanical actuation and spring return design for a smooth operation.

The ASR-23 can be used as a direct replacement of any powered skate retarder for yard applications. It is intended to be installed and used in tandem with a second retarder panel to ensure both trucks (combination wheelsets) of any rail car are captured with a braking force applied.

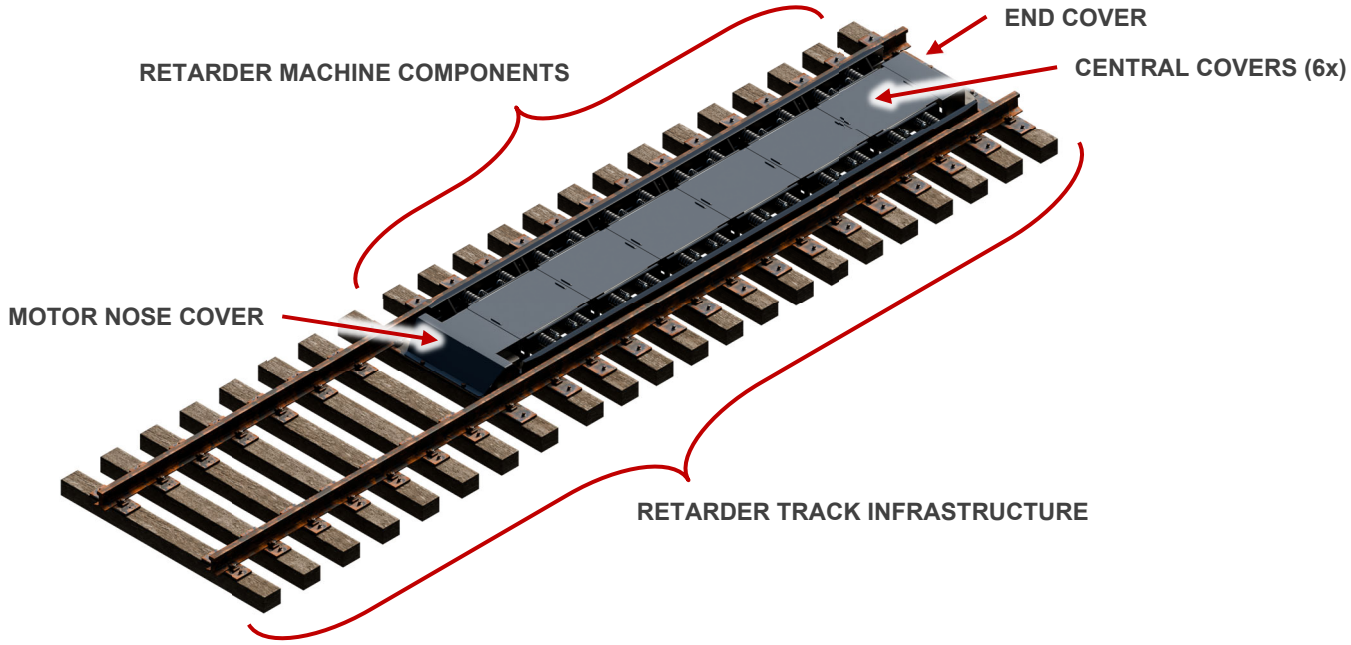

Figure 1.1 *Retarder Overview Diagram*

⚠ WARNING

Careful planning should be considered to ensure that both retarders in a yard track will adequately span the entire wheelbase of a typical rail car. Failure to do so could result in a collision or derailment, causing property damage and severe personal injury or death. Refer to Section 6 for installation guidance.

The skate retarder consists of two reciprocating brake channels with serviceable brake pads. The brake channels are mounted to a series of large damping springs, to absorb any shock load during the braking action. In the center of the gauge, there are six low-profile gear box modules, each of which contain a rotating cam gear box and two spring-actuated cam follower arms. The gear boxes are interconnected by a common driveline and secured between the brake channels. The cam gear boxes are driven by a three-phase AC gear motor, while three proximity sensors are used to indicate the retarder position status. As the cam gear boxes rotate, the brake channels slide in or out to open and close the retarder.

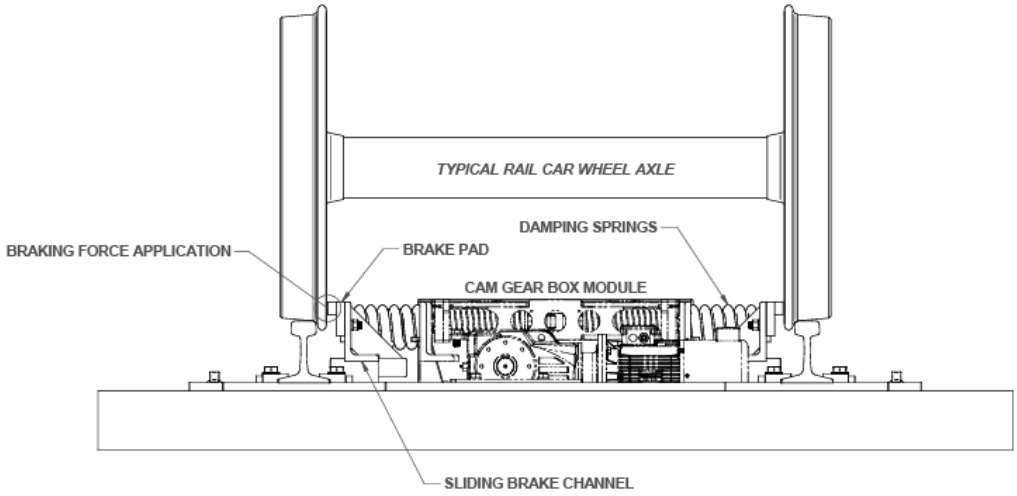

Figure 1.2 *Retarder Functionality Diagram*

During typical rail yard operations, the retarder is kept in the 'Closed' position. This will apply braking force to any rail car wheels as they enter the retarder. To pull a train through the retarder, it is cycled to the 'Open' position, thus removing any braking force that is acting on the rail car wheels. As the brake pads wear over time, wear shims can easily be installed on the ASR-23 by setting it to the 'Shim' position.

Figure 1.3 *Retarder Closed vs. Open Positions*

The ASR-23 can reduce the speed or stop a rail car travelling at up to 6 MPH. It can also maintain control of a stopped car when coupled into from behind by other cars travelling at up to 6 MPH. The whole system features an operating time of less than half a minute (cycled from close to open). In the event of motor failure or loss of power, the ASR-23 allows for rail cars to be pulled through in the closed state at up to 4 MPH.

1.3 Specifications

1.3.1 Physical Characteristics

Table 1.1 *ASR-23 Skate Retarder Physical Characteristics*
(See also Figures 1.3 and 1.4)

Parameter	**Specification**
Track Gauge	Standard, 4’ - 8 1/2” (1435 mm)
Rail Size	136RE (136 lbs/yd)
Length	39’ - 0” (1188.7 cm)*
Width	9’ - 0” (274.3 cm)*
Height	1’ - 6 1/4” (46.4 cm)
Estimated Shipping Weight	25,000 lbs (11,340 kgs)

**Typical dimensions; can vary depending on supplied track material.*

1.3.2 Operating Characteristics

Table 1.2 *ASR-23 Skate Retarder Operating Characteristics*

Parameter	**Specification**
Average cycle time (‘closed’ to ‘open’ position)	20 seconds (40 seconds to ‘shim’ position)
Temperature range	-40°F + 185°F (-40°C + 85°C)
Retarder position state detection	(3) inductive proximity sensors 9-30VDC 3-wire operation, PNP Normally open (NO)
Control methods	Remote (call from external control system) Local (push button at retarder)

1.3.3 Electrical Characteristics

Table 1.3 *ASR-23 Skate Retarder Electrical Characteristics*

Parameter	**Specification**
Drive Motor	469 VAC (3-phase) ***Minimum rated supply circuit:*** 480 VAC, 4.5 Amps (+/-2%)
Control Voltage	24 VDC (+/- 5%)

NOTICE

The expected service life of the IFM IFS240 proximity sensor is twenty (20) years. It is recommended that the sensor be replaced, before reaching the end of its expected service life, to maintain operational reliability.

To ensure reliable operation, any faulty or damaged proximity sensors should be replaced with the same model IFM IFS240.

See Section 5 for replacement parts information.

1.4 Skate Retarder Dimensions

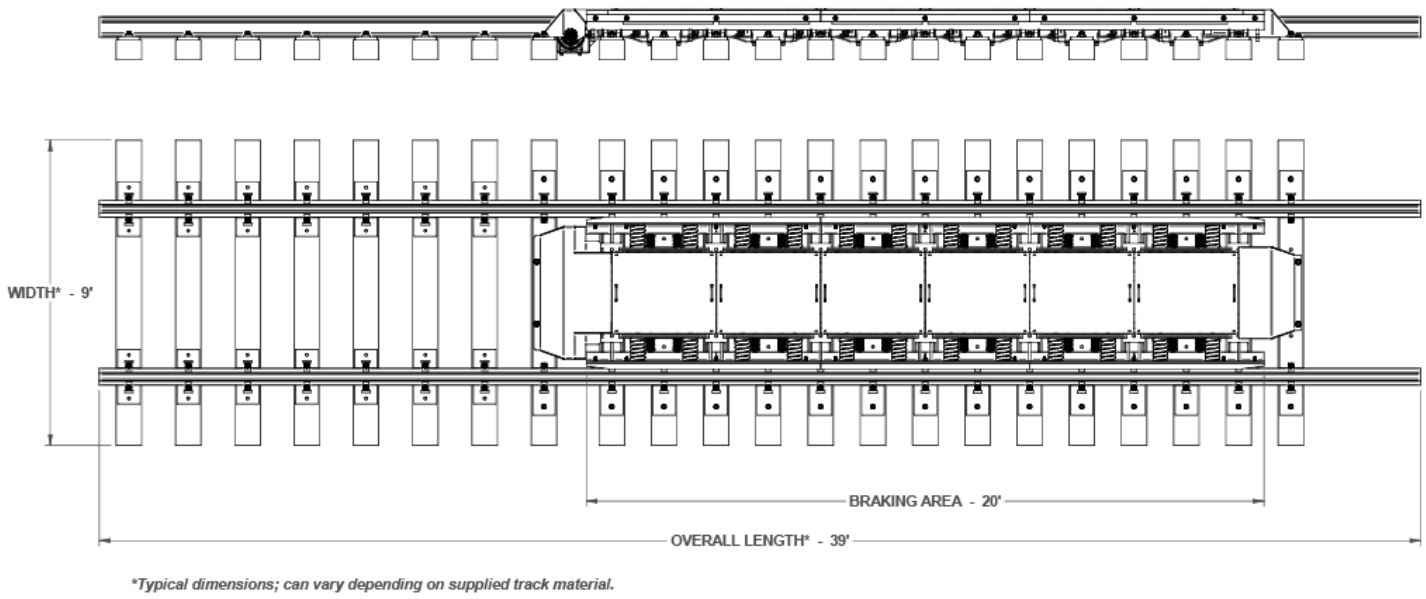

Figure 1.4 *Skate Retarder Top & Side View*

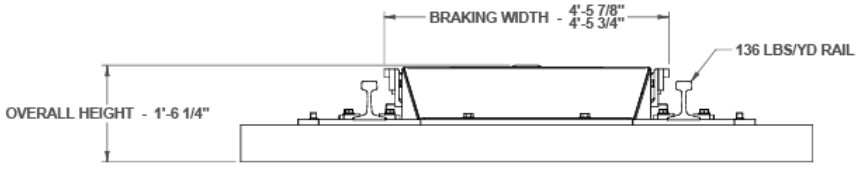

Figure 1.5 *Skate Retarder Front View*

1.5 Skate Retarder Components

The ASR-23 skate retarder consists of six cam gear box modules, connected by a common drive line, and secured between two brake channels. This components overview section will focus on one single cam gear box module, brake channel, as well as the position detection system and motor/electrical control systems.

1.5.1 Cam Gear Box Module

The cam gear box module is responsible for the movement of the retarder brake channels. The following details are how it operates to form a dual acting mechanical system.

The cam gear box module is comprised of a rotating cam gear box, two cam follower arms, and four operating springs. As the cam rotates, the cam follower arms are forced outward, causing the operating springs to compress and maintain contact of the follower with the cam. All six cam gear box modules are driven by a 3-phase, 469V AC gear motor.

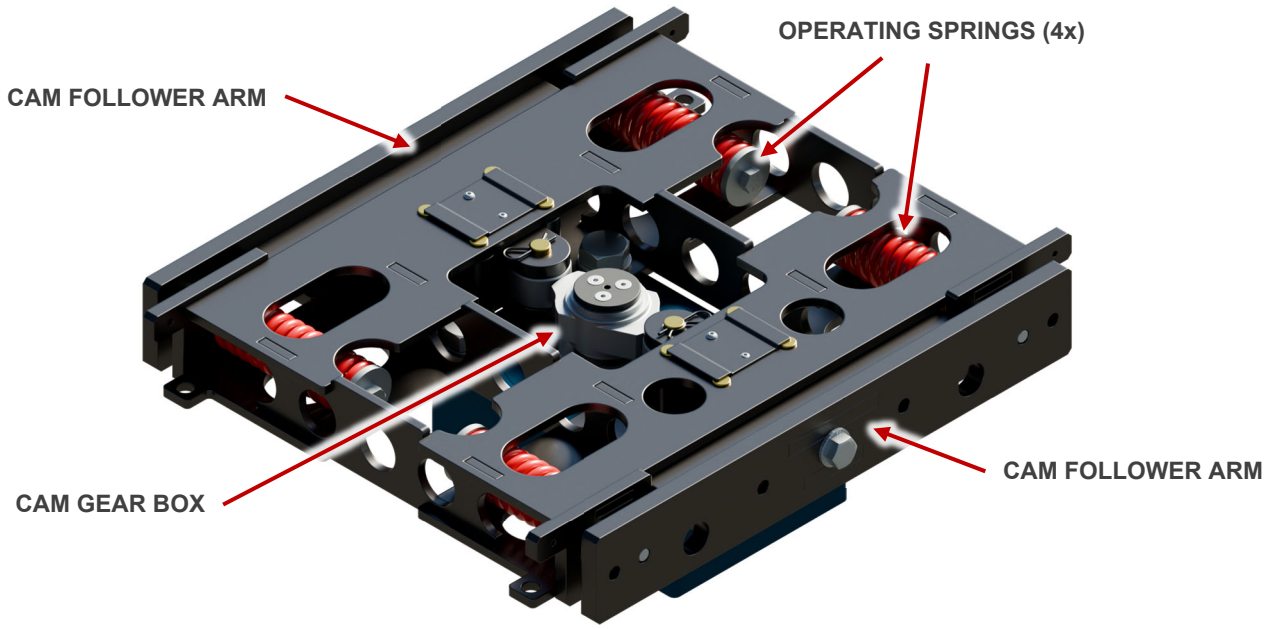

Figure 1.6 *Skate Retarder Cam Gear Box Module*

NOTICE

The cam gear box module subsystem: cam gear box, cam follower arms, and operating springs, should be periodically inspected, as recommended in this manual, for reliable operation.

See Section 3 for skate retarder inspection procedure and recommended frequency.

1.5.1.1 Cam Gear Box

The cam gear box (See **Figure 1.7**) is a compact worm gear reducer unit that features a dual input drive shaft and a cam shaft output. The gear drive box is sealed to prevent dust and moisture contamination.

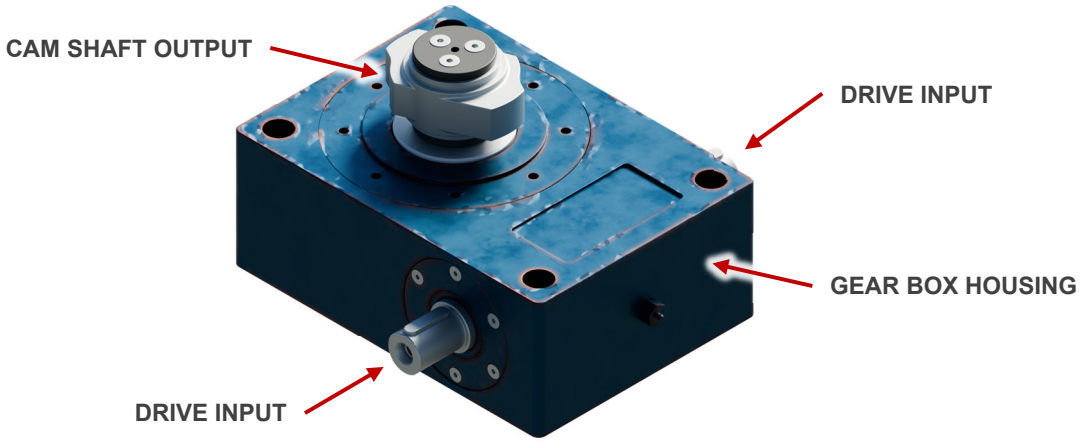

***Figure 1.7** Cam Gear Box*

1.5.1.2 Cam Follower Arm Assembly

The cam follower arm assembly is a steel weldment with a roller follower bearing, as shown in **Figure 1.8**. The assembly is used to convert the rotating motion of the cam gear box into an output force to move the brake channels as required. As the cam shaft on the cam gear box rotates, it acts upon the cam follower arm assembly and exhibits one inch of total linear displacement.

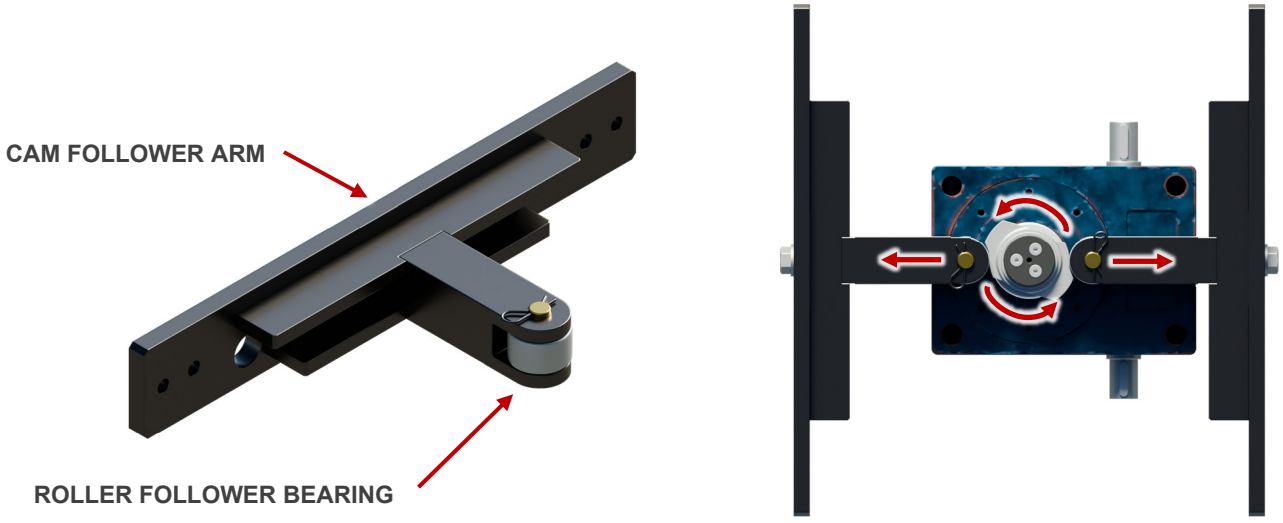

***Figure 1.8** Cam Follower Arm Assembly*

1.5.2 Brake Channel Assembly

The ASR-23 skate retarder consists of two reciprocating brake channels with serviceable brake pads. The brake channels feature a series of large damping springs mounted to several internal spring plates. These large damping springs absorb any shock load during the braking action. During a freight car run-through, the large springs on the brake channels are compressed against the internal spring plate, which is kept stationary by the cam follower arm. This transfers force to the brake pad, resulting in braking force applied to the inside flange of the freight car wheels.

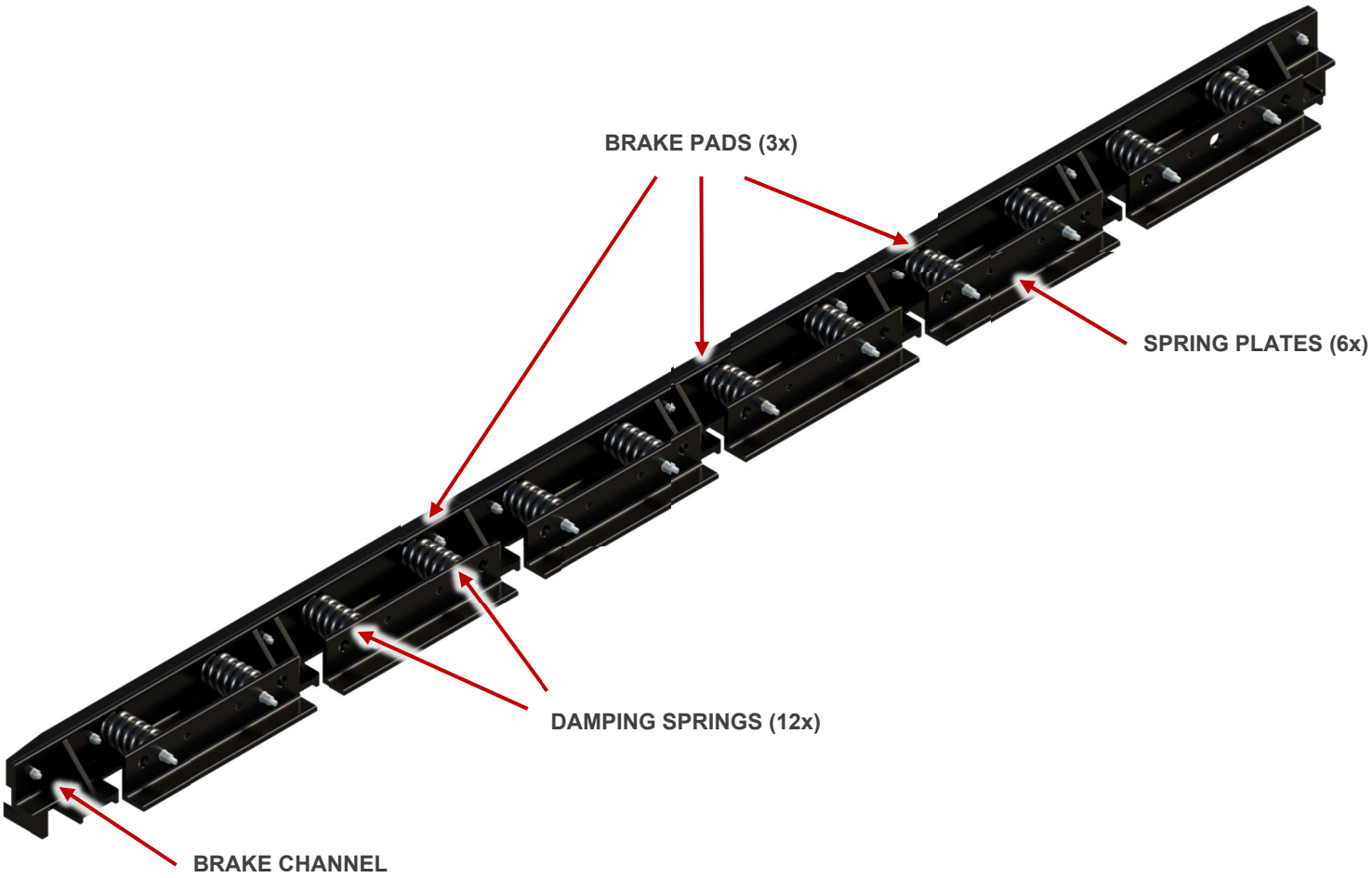

Figure 1.9 *Brake Channel Assembly*

⚠ WARNING

The skate retarder brake channel assembly should be periodically inspected, as recommended in this manual, for safe operation.

See Section 3 for skate retarder inspection procedure and recommended frequency.

The internal spring plates are connected to the cam gear box modules through the cam follower arms, coupled together by four small holding springs. These small holding springs also act to keep shims in place between the spring plate and cam follower arm (see **Figure 1.10**).

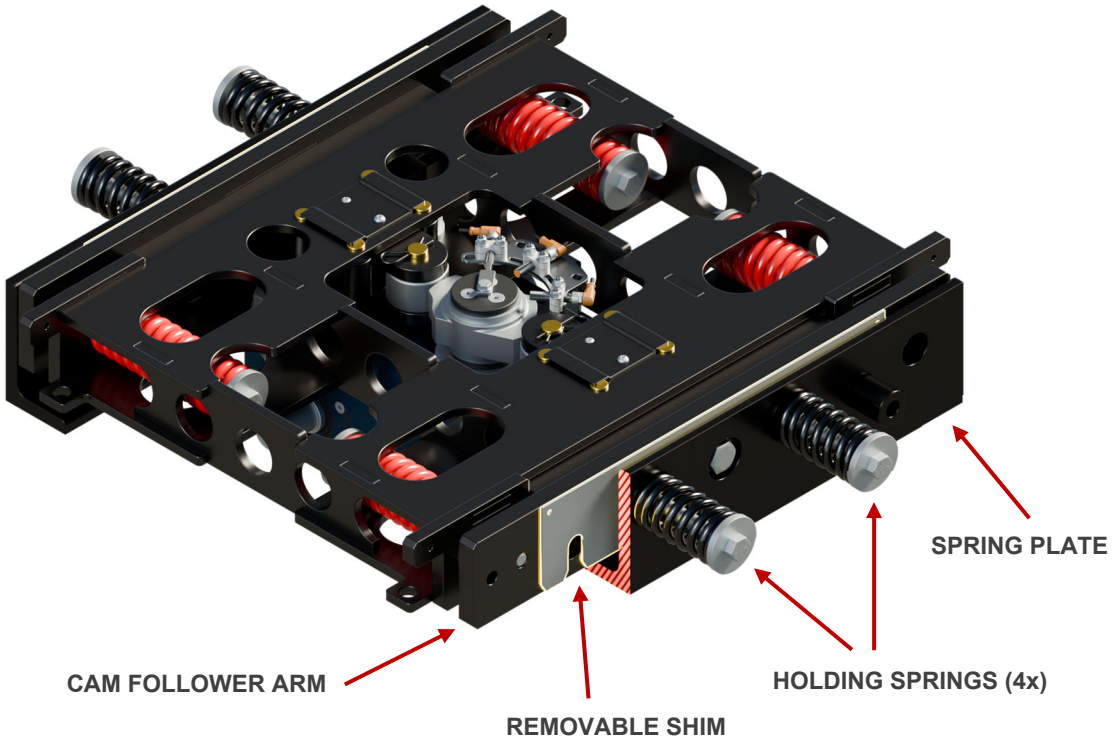

Figure 1.10 *Cam Follower Arm to Spring Plate Connection*

The retarder spring plates can be shimmed up to one inch overall (1/2" each side). The recommended brake surface measurement is between 4'-5 3/4" and 4'-5 7/8" (see Figure 1.5). If the brake surface measurement is outside of this range, a shim or combination of shims should be applied so that the braking surface distance is maintained within the recommended operating range. If shims can no longer be added, the brake pads must be replaced (see Section 4 for replacement part information).

⚠ WARNING

The braking surface measurement must not be allowed below the recommended minimum 4'-5 3/4". If so, the retarder may fail to stop a moving railcar, resulting in a derailment or collision, causing property damage and severe personal injury or death.

NOTICE

The braking surface measurement must not exceed the recommended maximum 4'-5 7/8". If so, the retarder will become overloaded during operation, resulting in possible damage to the retarder and components.

1.5.3 Retarder Position Detection

Three inductive proximity sensors are used to indicate the retarder position, by detecting the position of the cam gear box. One sensor is used for each of the 'Closed', 'Open', and 'Shim' positions. See **Figure 1.11** and **Figure 1.12**. As failsafe, the sensors are mounted on the last cam gear box in the driveline. This will detect any failure of the driveline during operation and result in a control system fault (See Section 2.2).

The sensors are designed to work in the railroad environment under extreme temperature variations and high vibration. The sensors are normally open induction sensors, PNP, three-wire configuration. Each sensor is inserted in a support designed to isolate it from severe vibration. Each sensor support can easily move inside the sensors bracket slot to the position where it will detect the target best.

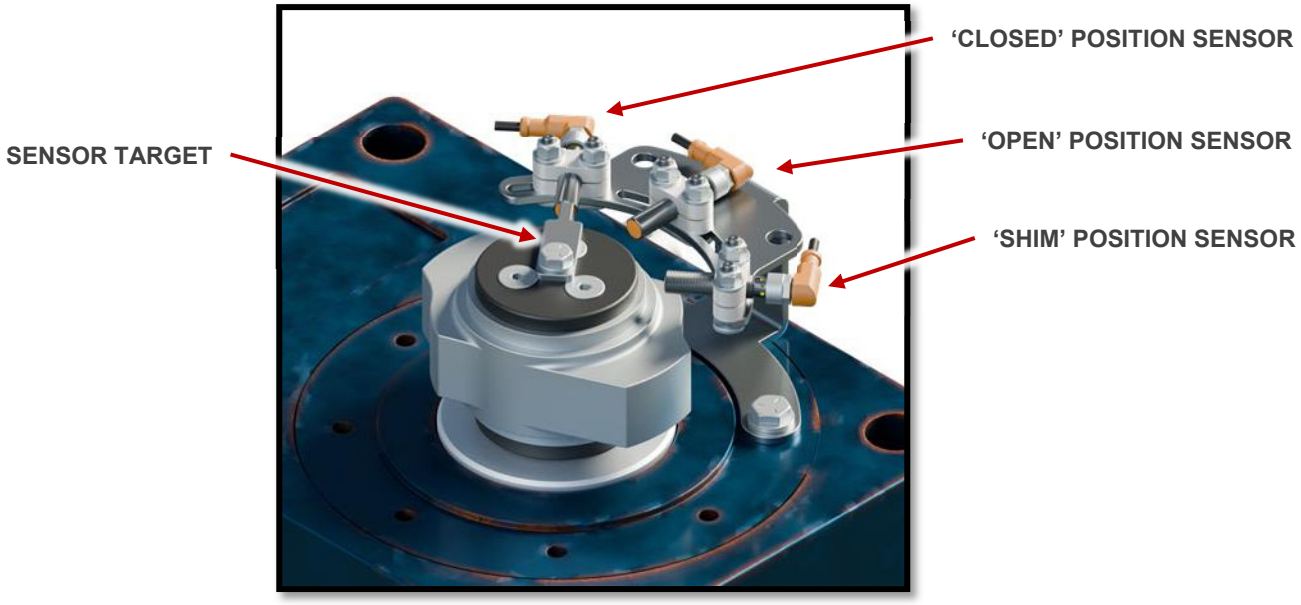

Figure 1.11 *Proximity Sensors Bracket*

NOTICE

The expected service life of the IFM IFS240 proximity sensor is twenty (20) years. It is recommended that the sensor be replaced, before reaching the end of its expected service life, to maintain operational reliability.

To ensure reliable operation, the position sensor mounting hardware and sensor target mounting hardware should be periodically inspected, as recommended in this manual. Any faulty or damaged proximity sensors should be replaced with the same model IFM IFS240.

See Section 5 for replacement parts information.

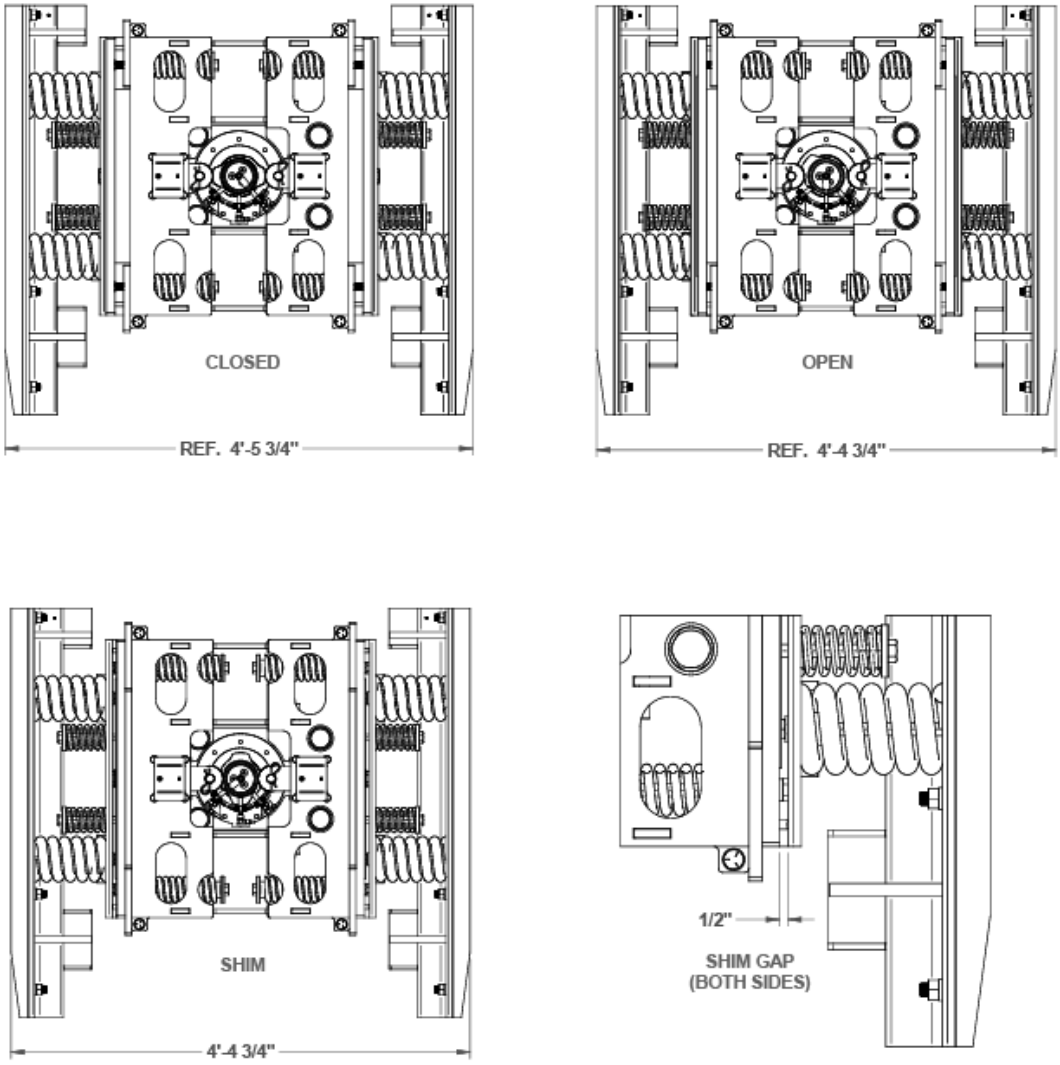

Figure 1.12 *ASR-23 Cam Gear Box Positions*

1.5.4 ASR-23 Motor & Electrical Control Systems

1.5.4.1 Retarder Gear Motor (3-phase 469 VAC)

The ASR-23 motive power source is a 3-phase 469 VAC gear motor that features a right-angle gear box. The gear box is sealed to prevent any contamination from dust or moisture. The gear motor supplies mechanical power to turn the driveline that is connected to the six cam gear box modules. The integrated electrical control system is configured to power the gear motor, thus cycling the ASR-23 through the 'Closed', 'Open', or 'Shim' positions.

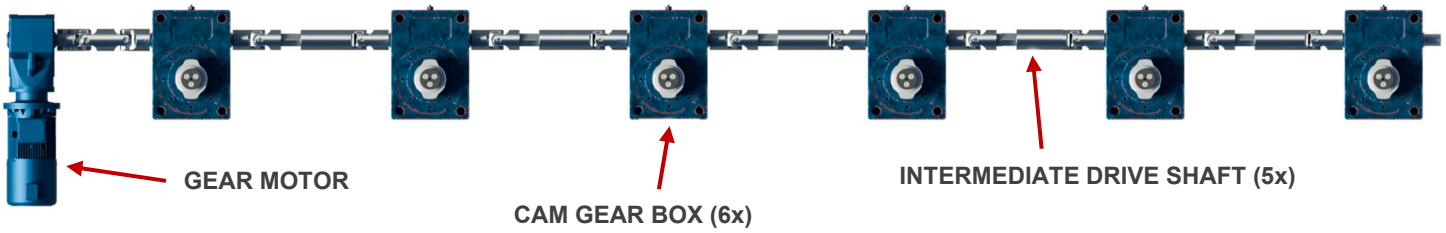

Figure 1.13 *Motor & Cam Gear Box Driveline*

Motor Specifications:
Part Number: 953-001
Approximate Weight: 185 lbs. or 83.9 kg

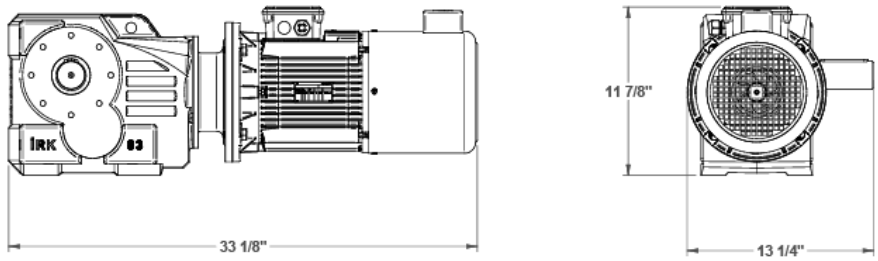

Figure 1.14 *Motor Dimensions*

NOTICE

The skate retarder motor should be periodically inspected, as recommended in this manual, for reliable operation. Only use a compatible power supply circuit, as specified in this manual.

See Section 3 for skate retarder inspection procedure and recommended frequency.

1.5.4.2 ASR-23 Electrical Control System

Depending on the customer application, the ASR-23 can be supplied with an integrated electrical control system. The control system features a heavy-duty aluminum enclosure, with intrinsic functionality to control two retarders in tandem.

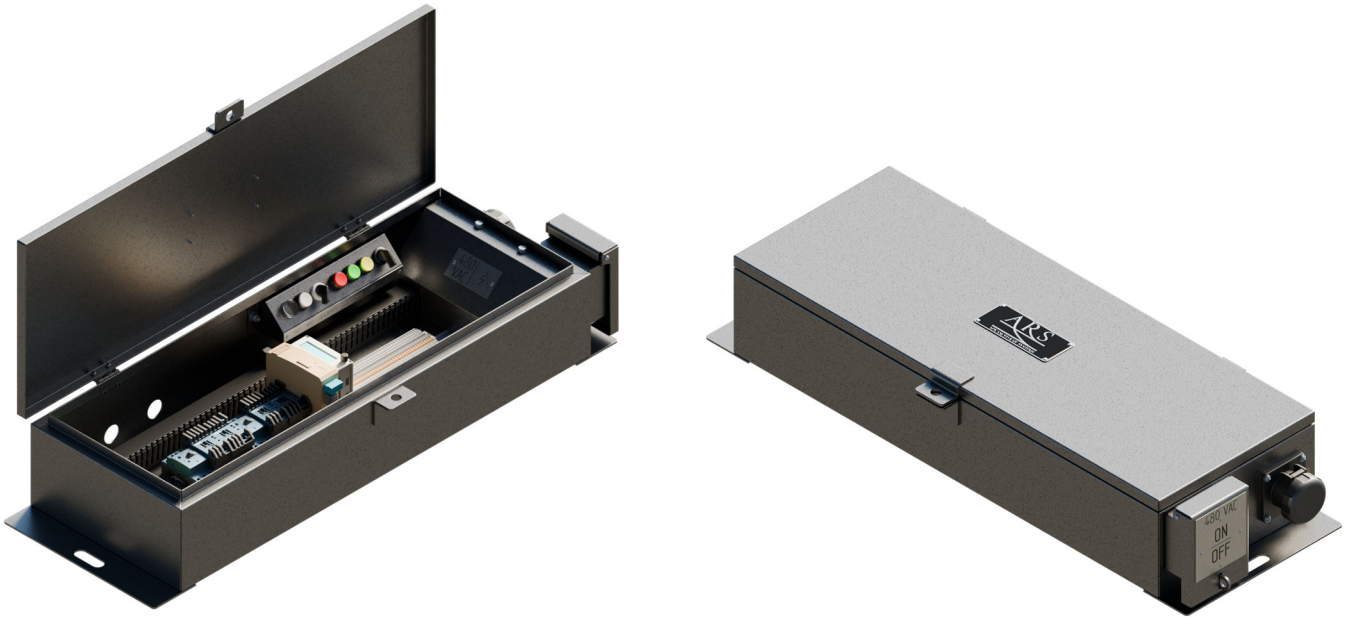

Figure 1.15 *ASR-23 Control Enclosure*

The control system consists of:

- ✓ 480VAC 3-phase power connections
- ✓ Main power disconnect switch
- ✓ External power test receptacle
- ✓ 24V DC power supply
- ✓ ARS ARMMI™ Controller
- ✓ Overload protection relay (2x)
- ✓ Motor power contactor (2x)
- ✓ Local control panel
- ✓ Terminal rail & all necessary wiring

⚠ DANGER

The ASR-23 electrical circuitry (3-phase 480VAC) presents an electrocution hazard leading to death or severe injury. Use caution when accessing the electrical control enclosure or servicing motor control and supply circuits.

Inside the control system enclosure, a local control panel allows operators at the site to control the ASR-23 and request positions locally. Selector switches are provided to disable remote command input and to toggle control of the two retarders independently or at the same time. Lighted push button switches are used to send a position command, which then illuminate to provide confirmation of the requested position. A system fault indication light and reset button is also included at the local control panel.

Figure 1.16 *ASR-23 Local Control Panel*

Table 1.4 *ASR-23 Skate Retarder Local Controls & Indications*

Panel Position (Left to Right)	**Name**	**Description**
1	Fault	Indicator light; illuminates if a system fault is present.
2	Reset	Pushbutton switch; to reset or clear system faults.
3	Local Control Switch	Selector switch; to select between Local or Remote control.
4	Close	Pushbutton switch & indicator light; call to operate the retarder to the closed position. Illuminates when the position is achieved.
5	Open	Pushbutton switch & indicator light; call to operate the retarder to the open position. Illuminates when the position is achieved.
6	Shim	Pushbutton switch & indicator light; call to operate the retarder to the shim position. Illuminates when the position is achieved.
7	Retarder Panel Selector	Selector switch; select operation of one specific panel or both.

The control system is readily configured to receive a remote command from a yard tower or office system. One signal output provides control system status (binary 'Remote' or 'Local' operation), and one signal input is used to supply remote retarder position commands (binary 'Open' or 'Closed') to the control unit. See Section 5 for typical control system diagrams.

SECTION 2 - OPERATION

2.1 General Safety Precautions

⚠ DANGER

The ASR-23 electrical circuitry (3-phase 480VAC) presents an electrocution hazard leading to death or severe injury. Use caution when accessing the electrical control enclosure or servicing motor control and supply circuits.

⚠ WARNING

Insufficient protection for maintenance-of-way (MOW) personnel on the track may result in death or injury from a collision with other equipment occupying the track in a work zone.

⚠ WARNING

Proper installation adjustments, regular inspections, and preventative maintenance of the skate retarder will reduce the occurrence of failures, and any potential for severe personal injury or death.

⚠ WARNING

The ASR-23 is intended to be controlled by an external control unit & supplied voltage or an integrated control unit, both of which must be programmed according to the manufacturer's specification to correctly address all the safe operating features and failure modes. Contact the manufacturer (ARS) to obtain instructions on how to properly control the skate retarder.

⚠ CAUTION

In accordance with the applicable safety rules of the operating railroad, installation and maintenance personnel must establish a clearance zone near the retarder and remain clear of all moveable retarder components when working at or near the retarder.

Before operating the retarder, always inform ground personnel to stay clear of the retarder components, or any other moving part of the retarder, as significant personal injury can occur.

⚠ CAUTION

In accordance with the applicable safety rules of the operating railroad, proper personal protective equipment (PPE), such as safety shoes, goggles, hard hats, and gloves must be used while on track.

NOTICE

The external control system, intended for use with the skate retarder, should meet the minimum AREMA requirements for electromagnetic interference (EMI) and electromagnetic compatibility (EMC).

2.2 Skate Retarder Electric Control Theory

The following electric control theory is detailed under the presumption that the integrated electrical control system is to be used. If using a custom programmable logic controller (PLC), always consult the manufacturer for guidance on how to properly control the ASR-23.

For the ASR-23 skate retarder to move from one position to another, a single command to the control unit, requesting the new position, is required. Depending on the application, these requests can either be latched or momentary. In a typical application, the control unit is provisioned with three momentary inputs for local control commands ('Closed', 'Open' or 'Shim') and one latched input for remote control (binary 'Closed' or 'Open' only).

When the new position request is received, the control unit is programmed to evaluate what direction the motor must rotate in order to quickly achieve the new position. Once the control unit has determined the direction of motor rotation, a 24V DC signal output is sent to the respective motor contactor (CW or CCW), to start the motor. At the same time, the control unit also starts a 30-second motor overrun timer (adjustable from 0-120s).

As the motor rotates, the retarder moves toward the requested position until the proximity sensor detects the new position. When the new position is detected by the proximity sensor, a signal input is received by the control unit and the motor contactor is de-energized, thus stopping the movement of the retarder. The control unit provides a 24V DC indication output for a pilot lamp or similar, to confirm to the operator that the new position has been achieved.

If for some reason the proximity sensors do not detect the new requested position and the 30-second motor overrun timer is allowed to expire, the control unit will de-energize the motor contactor, pause the requested move, and relay a fault output.

In the case of a system fault, the control unit will not allow any operation of the retarder until a reset has been prompted at the local control panel. This is to protect the retarder motor and electrical system from damage. The rail yard should cease operation of the ASR-23, until the retarder can be inspected and repaired.

NOTICE

The external control system or control unit, intended for use with the skate retarder, should use the proximity sensor indications in a mutually exclusive strategy to ensure correct retarder position determination and/or failure.

The control unit should not accept any command to move the skate retarder if the overrun timer has been allowed to expire. In this scenario, the controller should enter a fault condition, indicating the skate retarder is 'out of correspondence', and the skate retarder should be inspected and repaired if necessary.

See Section 1.5.3 regarding proximity sensor detection.

2.3 Skate Retarder Operation

2.3.1 Local Operation

The ASR-23 skate retarder can be operated locally at the machine using the supplied local control panel. First, the 'Control Mode Selector' switch must be set to the 'Local' position. This will cause the integrated control unit to prevent any remote commands, as well as disable a 'Remote' mode indication signal to the remote system, alerting any remote operator that the retarder has been placed in the 'Local' control mode.

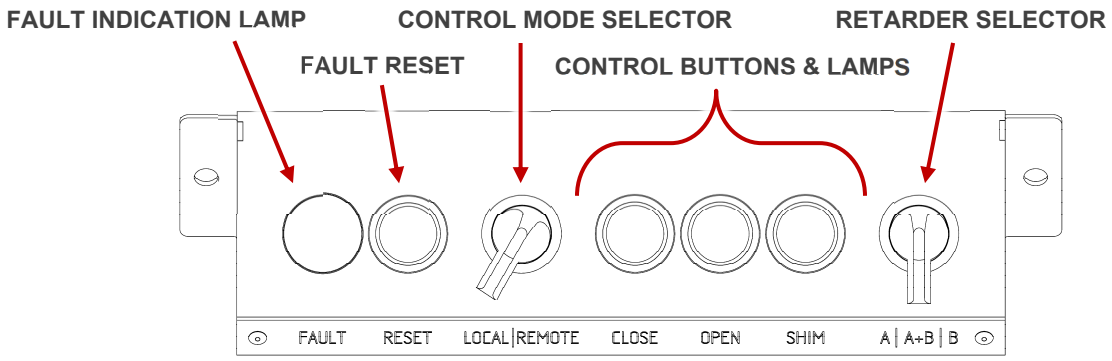

Figure 2.1 *ASR-23 Control Panel*

Next, the 'Retarder Selector' switch can be toggled to select which retarder on the track to control (Retarder 'A', Retarder 'B', or both Retarder 'A+B'). If there is not any system fault present, the new retarder position can be commanded using one of the three momentary control push buttons ('Closed, 'Open', or 'Shim'). Whichever retarder has been selected for control will then begin operating until the new requested position is achieved. Once the retarder has reached the new position, the retarder will cease operation, and the corresponding position pilot lamp will illuminate.

If the retarder does not achieve the new requested position during operation, the command will time-out or expire, the retarder will stop, and the control system will present a fault via the 'Fault Indication' pilot lamp. In this scenario, the retarder should be inspected and repaired if necessary to address any potential failures or position detection issues. Once the retarder has been repaired, the control system fault can be reset by simply pressing the momentary 'Reset' push button at the local control panel.

⚠ CAUTION

To prevent personal injury, ensure all personnel are clear of the retarder moving components before pressing the system fault 'Reset' button.

In a fault scenario, the retarder control unit stores the last requested position. Upon pressing the system fault 'Reset' button, the retarder will immediately resume operation until the new requested position is achieved or the overrun timer expires again.

2.3.2 Remote Operation

The ASR-23 skate retarder can be controlled remotely by utilizing the remote command input that is provisioned with the integrated controller (See Section 5 for basic electrical diagrams). To allow for remote control from a tower or yard office, the 'Control Mode Selector' switch at the local control panel must first be set to the 'Remote' control mode (Figure 2.2).

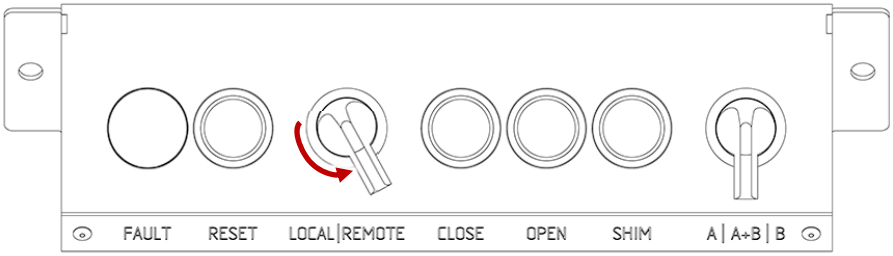

***Figure 2.2** ASR-23 Remote Control Mode Selection*

A single, continuous +24VDC input (+/-5%) to the control unit is required to 'Open' the retarder (Input 14 on the ARS ARMMI™ Controller). In the absence of this voltage, the control unit will keep the retarder in the 'Closed' position as default.

If the remote command is interrupted during a 'Closed' to 'Open' move (wire fault, loss of power, etc.), the integrated control system will automatically reverse operation and return the retarder to the default 'Closed' position.

NOTICE

It is recommended that the +24VDC command for the remote control input utilizes the reference voltage from the integrated control enclosure.

See Section 5 for basic electric diagrams.

The ASR-23 integrated control system also includes a +24VDC signal output back to the remote-control location (Output 10 on the ARS ARMMI™ Controller), to indicate if the retarder has been placed in 'Remote' control mode at the local control panel. If this voltage output is not present, the retarder control system has been placed in 'Local' control mode and will not receive any remote commands.

Depending on the customer application, the ARS ARMMI™ Controller has several additional outputs available, if the remote-control location requires additional retarder status indications. Contact the manufacturer (ARS) to obtain instructions on how to configure the ARMMI™ controller to enable these outputs.

SECTION 3 - PREVENTATIVE MAINTENANCE

The following periodic preventive maintenance procedures are intended to prevent any possible causes of skate retarder failure before it occurs.

Please read and understand all the following safety related information before working on or around the skate retarder.

3.1 Important Safety Precautions

⚠ DANGER

The ASR-23 electrical circuitry (3-phase 480VAC) presents an electrocution hazard leading to death or severe injury. Use caution when accessing the electrical control enclosure or servicing motor control and supply circuits.

⚠ WARNING

Insufficient protection for maintenance-of-way (MOW) personnel on the track may result in death or injury from a collision with other equipment occupying the track in a work zone.

⚠ WARNING

Proper installation adjustments, regular inspections, and preventative maintenance of the skate retarder will reduce the occurrence of failures, and any potential for severe personal injury or death.

⚠ CAUTION

All field maintenance must be performed in accordance with the applicable safety rules of the operating railroad. Prior to any inspection, adjustment, or maintenance of the retarder, obtain proper authorization and confirm the retarder operation is disabled from both local and remote activation, or significant personal injury may occur.

⚠ CAUTION

In accordance with the applicable safety rules of the operating railroad, installation and maintenance personnel must establish a clearance zone near the retarder and remain clear of all moveable retarder components when working at or near the retarder.

Before operating the retarder, always inform ground personnel to stay clear of the retarder components, or any other moving part of the retarder, as significant personal injury can occur.

⚠ CAUTION

In accordance with the applicable safety rules of the operating railroad, proper personal protective equipment (PPE), such as safety shoes, goggles, hard hats, and gloves must be used while on track.

⚠ CAUTION

Components in or around the retarder could have sharp edges. Be aware of sharp edges when inspecting, adjusting, or maintaining the retarder.

NOTICE

Immediately following a flooding or submerging event, it is recommended to replace all cables, wire harnesses, wire sets, connectors, terminal blocks, motors, and relays. Replacing these components after such an event will reduce the occurrence of failure during operation.

3.2 Preventative Maintenance Schedule

Regular inspections and performance tests are recommended to maximize service life and to ensure continued safe operation.

A recommended schedule of preventive maintenance actions is presented in Table 6.1. The actual frequency will depend upon usage, or the customers' own operating rules.

Table 3.1 *Preventive Maintenance Schedule*

Frequency	**Equipment**	**Type of Action**	
		Inspect	**Test Performance**
Every Three Months	Retarder Track Infrastructure	X	
	Retarder Machine		X
Every Six Months	Retarder Machine	X	

Regular lubrication is not required; all internal bearings are greased and sealed for the life of the component.

3.3 Inspection Procedures

The inspection consists of observing the interior/exterior of the retarder operating equipment and the integrity of the retarder track infrastructure.

If the inspection suggests that any adjustment or replacement parts are required, see Section 4 – List of Parts.

3.3.1 Retarder Track Infrastructure Inspection

1. Inspect the retarder gauge plates and wood ties to ensure they are properly secured and remove any debris that could foul the ballast.

2. Inspect the running rails, tie plates, track fasteners, joints, etc. and ensure that all track bolts, nuts, screw spikes, and other hardware is secure.

3. Inspect the gap between the running rails and retarder brake pads. Ensure the gap is clear of obstructions that could interfere with the retarder operation. Replace the retarder brake pads if necessary.

3.3.2 Retarder Machine Inspection

1. Remove the retarder covers and observe the interior of the retarder, looking for a potential or obvious faulty condition. Inspect the cam gear box modules and internal components. Ensure there are no foreign objects in or around the cam gear box modules that could interfere with the retarder operation.

2. Inspect the cam gear box, cam follower arms, and main operating springs. Ensure there are no signs of abnormal wear or breakage of the components that could inhibit the retarder operation. Replace faulty components if necessary.

3. Inspect the skate retarder brake channel, brake pads, and damping springs. Ensure there are no failed components that could inhibit the retarder operation. Replace faulty components if necessary.

4. Check the brake pads for abnormal wear; replace the brake pads or add shims as necessary (reference Section 1.5.2 for brake pad operating tolerance range).

5. Check to ensure the position sensor & sensor target mounting hardware is tight and not loose.

6. Inspect and test all cables, wire harnesses, wire sets, connectors, and terminal blocks. Ensure there are no faults or degradation of the wire and insulation or terminal connections. Replace any damaged components.

7. Inspect any electrical conduit fittings / connections, repair if necessary.

8. Inspect and test the main power connections. Ensure 480VAC (+/-2%) is present for all three phases.

9. Observe if there are any signs of moisture accumulation in or around the retarder cam gear box modules. Address any potential sources of water ingress or moisture accumulation. This is especially critical before cold weather periods, as freezing water can potentially damage retarder components.

NOTICE

Immediately following a flooding or submerging event, it is recommended to replace all cables, wire harnesses, wire sets, connectors, terminal blocks, motors, and relays. Replacing these components after such an event will reduce the occurrence of failure during operation.

3.4 Retarder Performance Test

A performance test of the retarder should be done according to the customer operating rules.

The retarder should be periodically cycled while observing for erratic or faulty operation.

1. Using the local control panel, cycle the retarder through all three positions ('Closed', 'Open', and 'Shim') as necessary and check for smooth operation without undue drag or vibration.

2. Ensure that the main drive motor shuts off completely at the end of each cycle.

3. Ensure that the yellow LED light of each proximity sensor is on when the retarder is placed in each of the three positions.

4. Verify that the position indications are being shown by each of the illuminated pushbuttons inside the local control enclosure.

SECTION 4 - LIST OF PARTS

4.1 Cam Gear Box Module

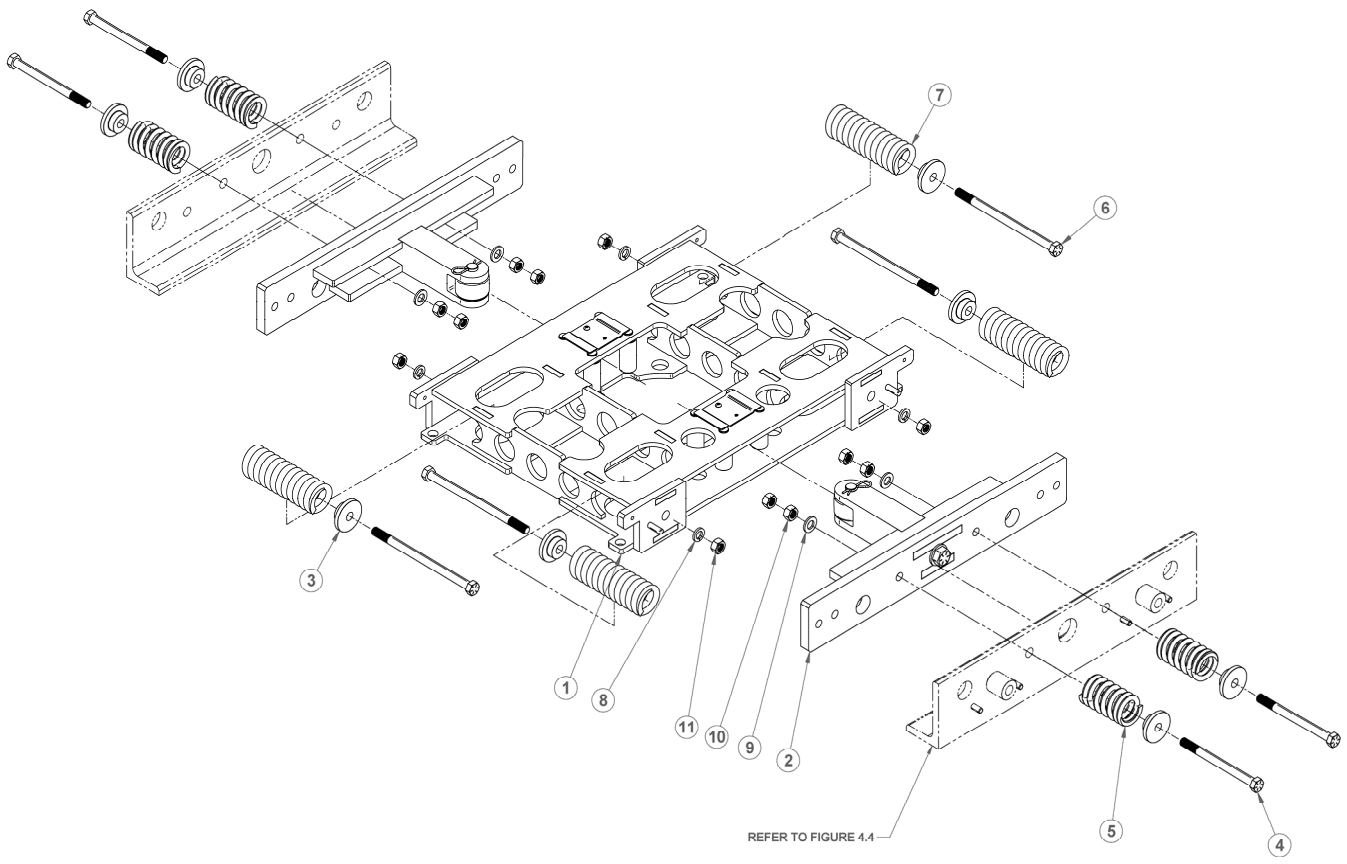

Figure 4.1: *Cam Gear Box Module*

Table 4.1: *Cam Gear Box Module Parts list*

ITEM #	PART #	DESCRIPTION	QTY.
1	1-200-005	SKATE RETARDER BASE FRAME	1
2	1-220-014	CAM ARM ASSEMBLY	2
3	220-047	SPRING HOLDER	8
4	901-069-P8Y	3/4"-10 X 9" ZHHCS-8	4
5	935-009	RETARDER HOLDING SPRINGS	4
6	901-066-P8Y	3/4"-10 x 12" LONG ZHHCS-8	4
7	935-004	LOCK SPRING	4
8	910-019-H5Z	3/4" SCREW SIZE ZP SPLIT LOCK WASHER FOR HHCS	8
9	908-003-G5Z	3/4" SCREW SIZE ZP FLAT WASHER GR.5	4
10	914-023-H8Z	3/4"-10 ZP HEX NUT G8	8
11	914-023-S5Z	3/4"-10 ZP HEX NUT G5	4

4.2 Gear Box Sub Assembly

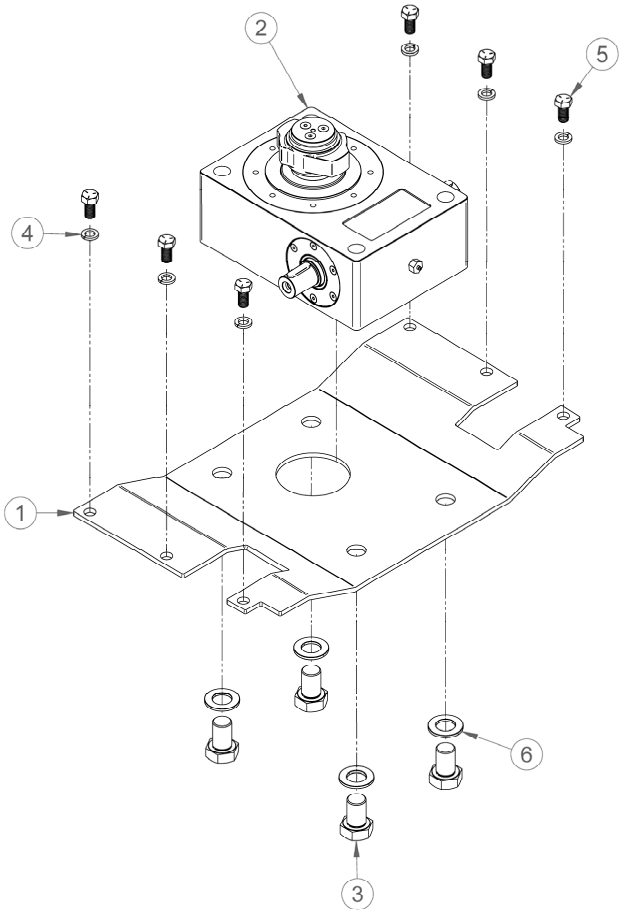

Figure 4.2: *Gear Box Sub Assembly*

Table 4.2: *Gear Box Sub Assembly Parts List*

ITEM #	PART #	DESCRIPTION	QTY.
1	220-073	GEAR BOX BASE PLATE	1
2	953-002	WORM GEAR REDUCER WITH SHAFT AND CAM	1
3	901-068-F5Z	M36-4 x 55mm LONG ZHHCS-8	4
4	910-019-H5Z	3/4" SCREW SIZE ZP SPLIT LOCK WASHER FOR HHCS	6
5	901-023-F5Z	3/4"-10 X 1-1/2" LONG ZHCS-5	6
6	908-028-G5Z	M36 SCREW SIZE ZP WASHER	4

4.3 Skate Retarder Cover

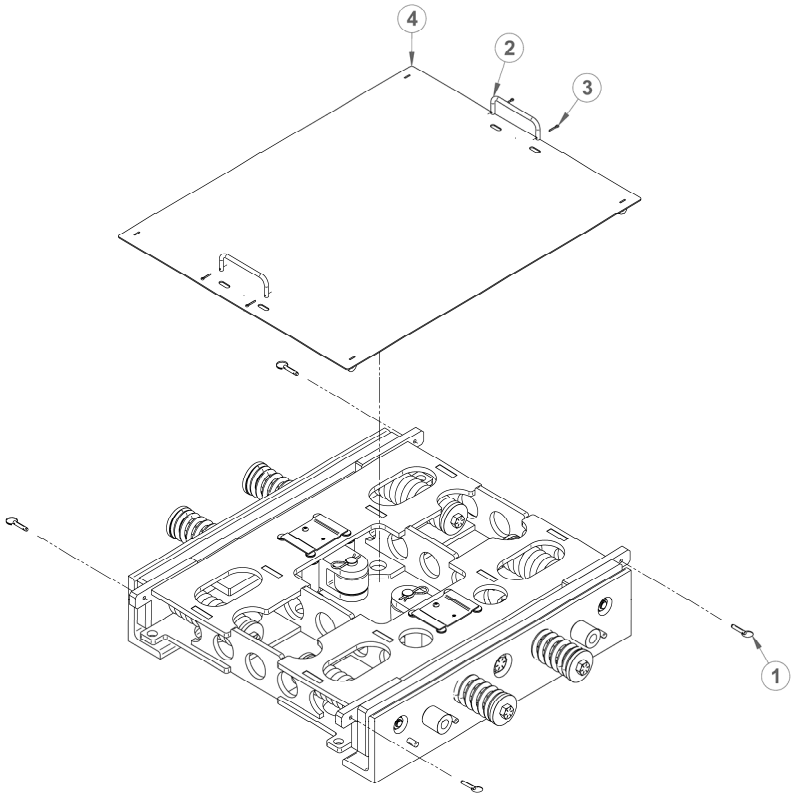

***Figure 4.3**: Skate Retarder Cover*

***Table 4.3:** Skate Retarder Cover Parts List*

ITEM #	PART #	DESCRIPTION	QTY.
1	927-406	Quick Release Pin	4
2	220-044	RETARDER LID HANDLE	2
3	927-302	1/8" x 3/4" COTTER PIN	4
4	220-045	PROTECTION LID	1

4.4 Cam Follower Arm Assembly

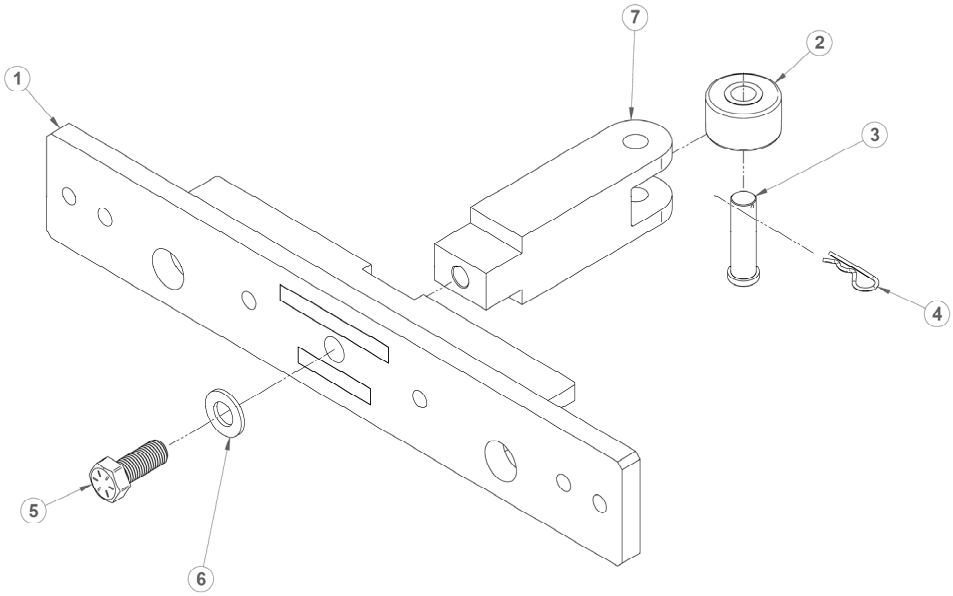

Figure 4.4: *Cam Follower Arm Assembly*

Table 4.4: *Cam Follower Arm Assembly Parts List*

ITEM #	PART #	DESCRIPTION	QTY.
1	220-070	CAM ARM BASE PLATE	1
2	954-002	DYR-3 CAM FOLLOWER ROLLER	1
3	100-207	CLEVIS PIN	1
4	927-353	9/64" x 2-15/16" HITCH PIN FOR 1" SHAFT	1
5	901-074-F8Y	1"-8 X 2-1/2" ZHHCS-8	1
6	908-009-G5Z	1" SCREW SIZE ZP FLAT WASHER	1
7	220-071	CAM ARM	1

4.5 Brake Channel Assembly

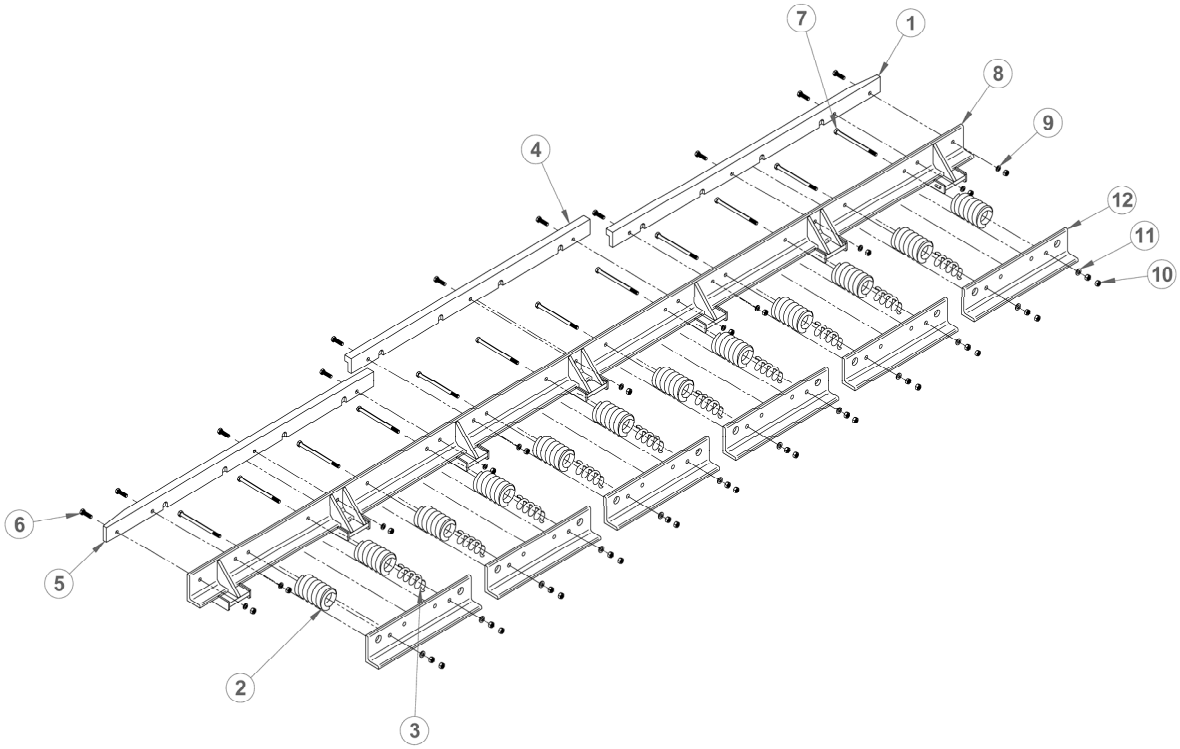

Figure 4.5: *Brake Channel Assembly*

Table 4.5: *Brake Channel Assembly Parts List*

ITEM #	PART #	DESCRIPTION	QTY.
1	220-089	LEFT BRAKE SHOE PAD	1
2	935-013	LOCK SPRING	12
3	935-014	INNER LOCK SPRING	10
4	220-079	CENTRAL BRAKE SHOW PAD	1
5	220-081	RIGHT BRAKE SHOE PAD	1
6	901-067-F8Y	3/4"-10 X 2-1/2" LONG ZHHCS-8	11
7	901-066-P8Y	3/4"-10 x 12" LONG ZHHCS-8	12
8	220-082	BRAKE SHOE CHANNEL	1
9	910-019-H5Z	3/4" SCREW SIZE ZP SPLIT LOCK WASHER FOR HHCS	11
10	914-023-H8Z	3/4"-10 ZP HEX NUT G8	35
11	908-003-G5Z	3/4" SCREW SIZE ZP FLAT WASHER GR.5	12
12	220-227	SPRING CHANNEL	6

4.6 Cam Proximity Sensor Bracket

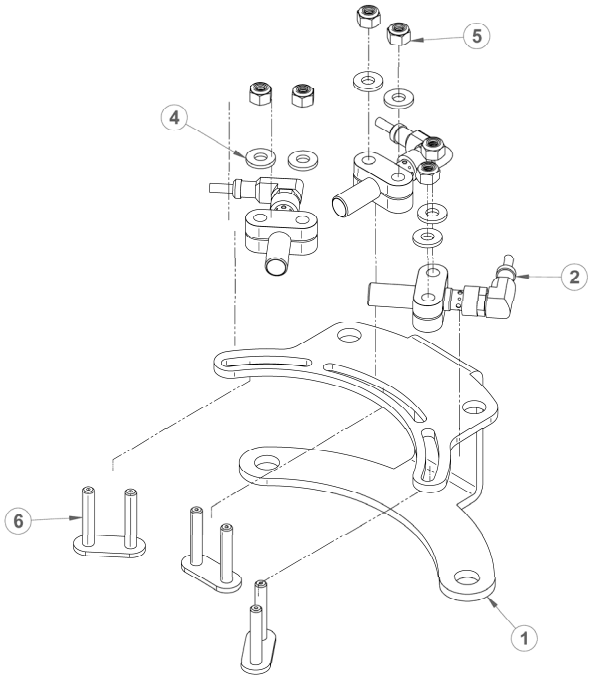

Figure 4.6 *Cam Proximity Sensor Bracket*

Table 4.6: *Cam Proximity Sensor Bracket Parts List*

ITEM #	PART #	DESCRIPTION	QTY.
1	220-106	POSITION SENSOR BRACKET	1
2	1-220-018	POSITION SENSOR ASSEMBLY	3
3	220-102	PROXIMITY SENSOR	3
4	908-015-G5Z	1/4" SCREW SIZE ZP FLAT WASHER	6
5	913-018-S5Z	1/4"-20 ZP NYLOCK HEX NUT GR. 5	6
6	220-102	SENSOR CLAMP PLATE	3

SECTION 5 - ELECTRICAL DIAGRAMS

5.1 ASR-23 Electrical Overview Diagram

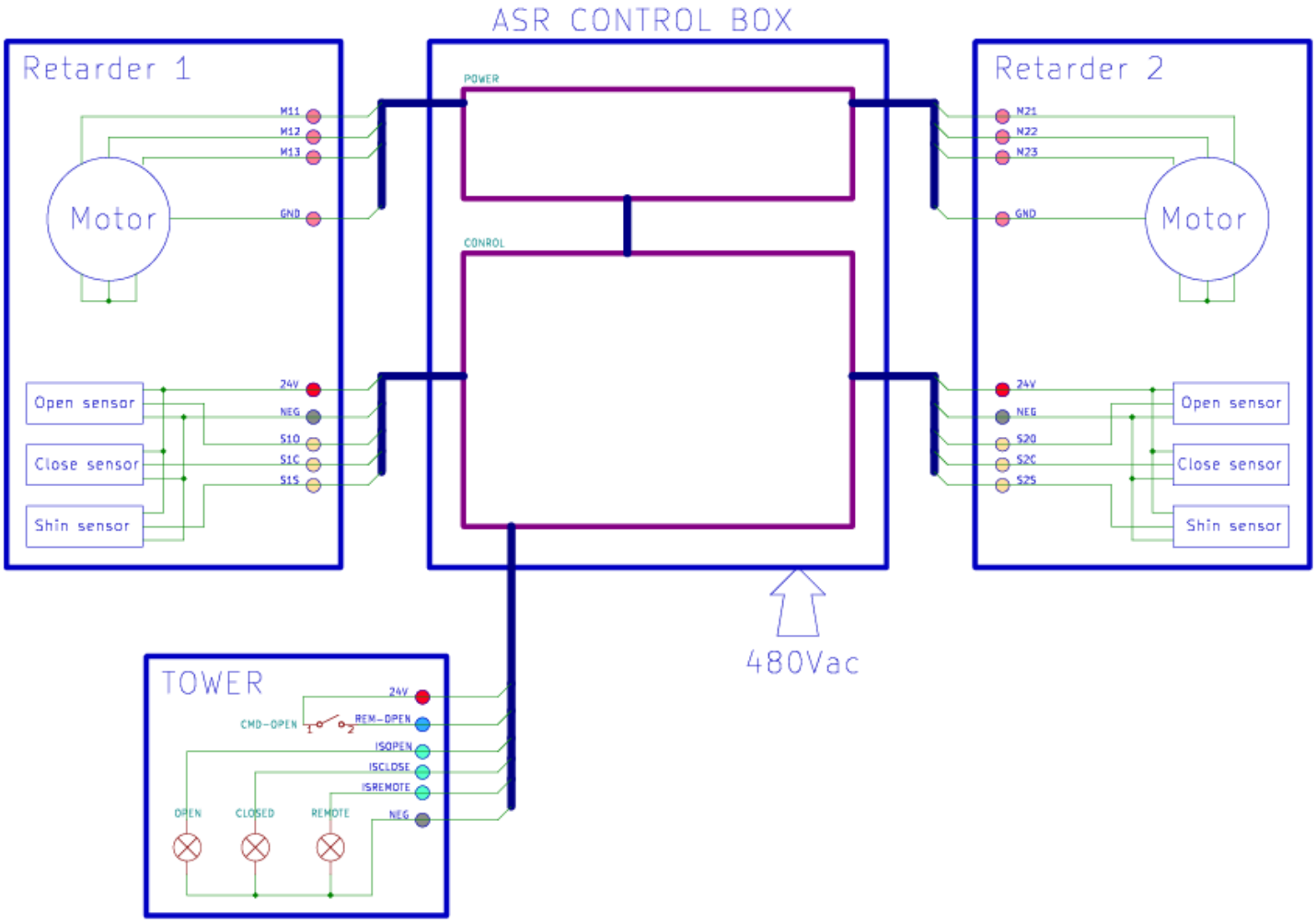

Figure 5.1 *ASR-23 Electrical Overview Diagram*

5.2 ASR-23 Motor Power Contactor Electrical Diagram

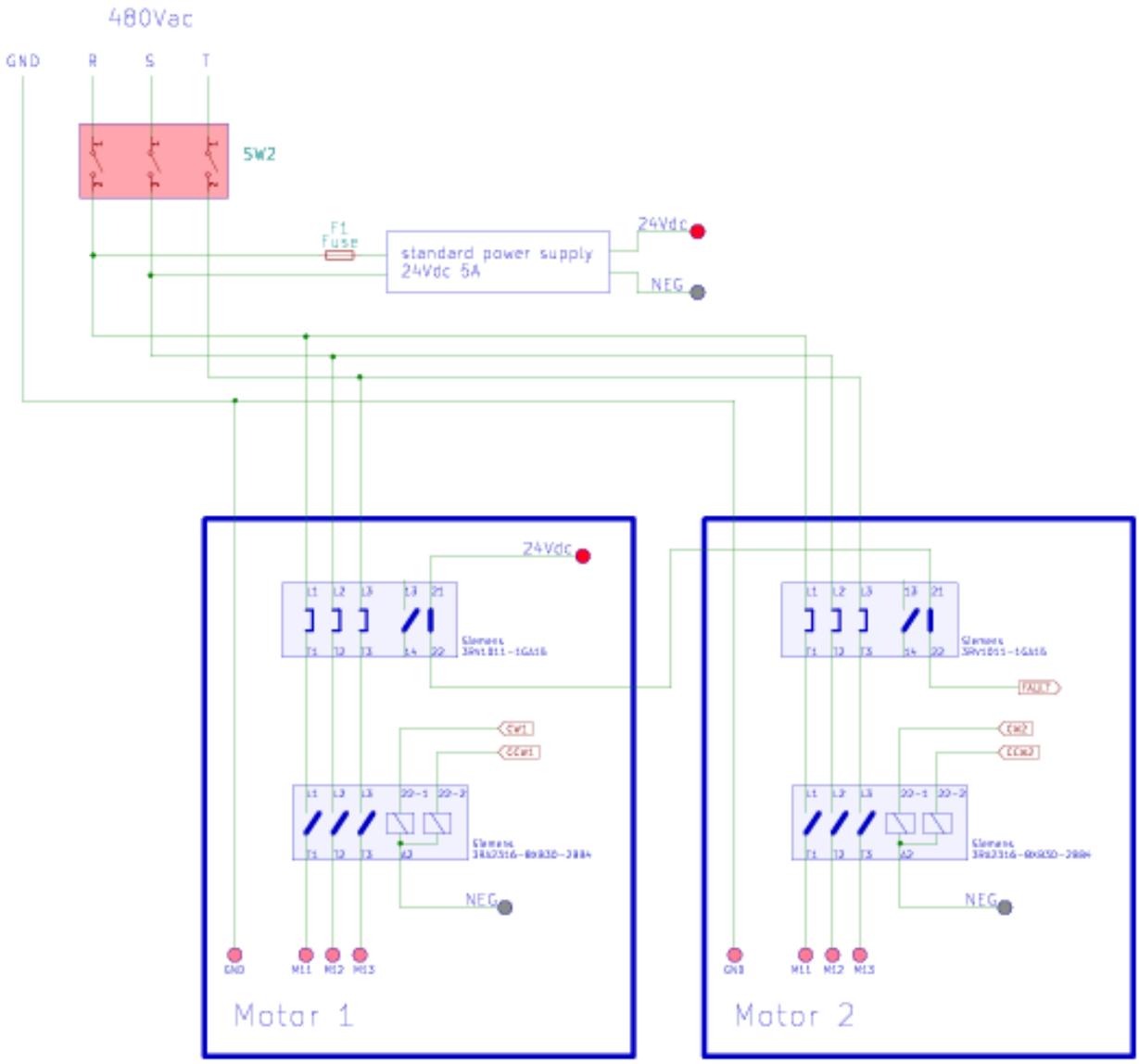

Figure 5.2 *ASR-23 Motor Power Contactor Electrical Diagram*

5.3 ASR-23 Control Unit Electrical Diagram

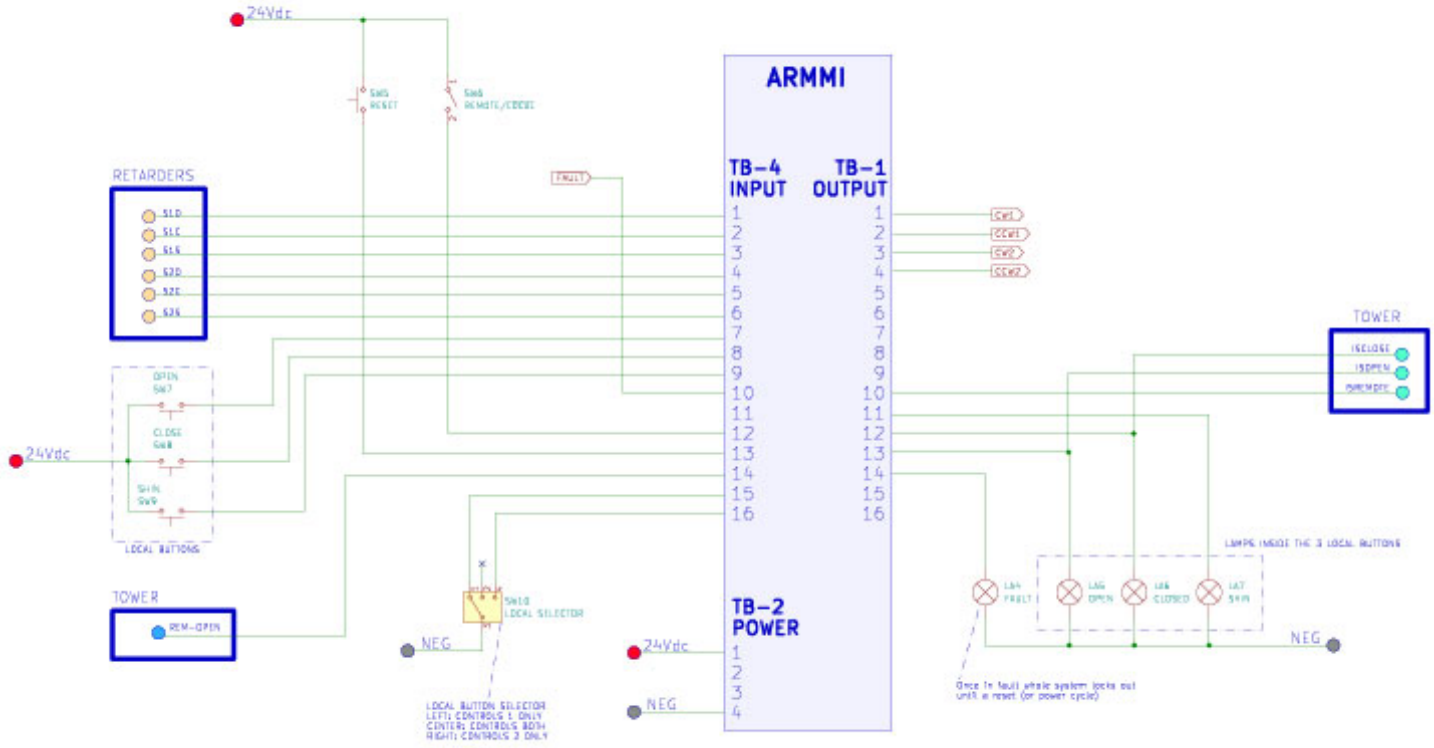

Figure 5.3 *ASR-23 Motor Power Contactor Electrical Diagram*

SECTION 6 - INSTALLATION GUIDANCE

6.1 ASR-23 Installation Guidance Diagram

SEE DIAGRAM ON FOLLOWING PAGE

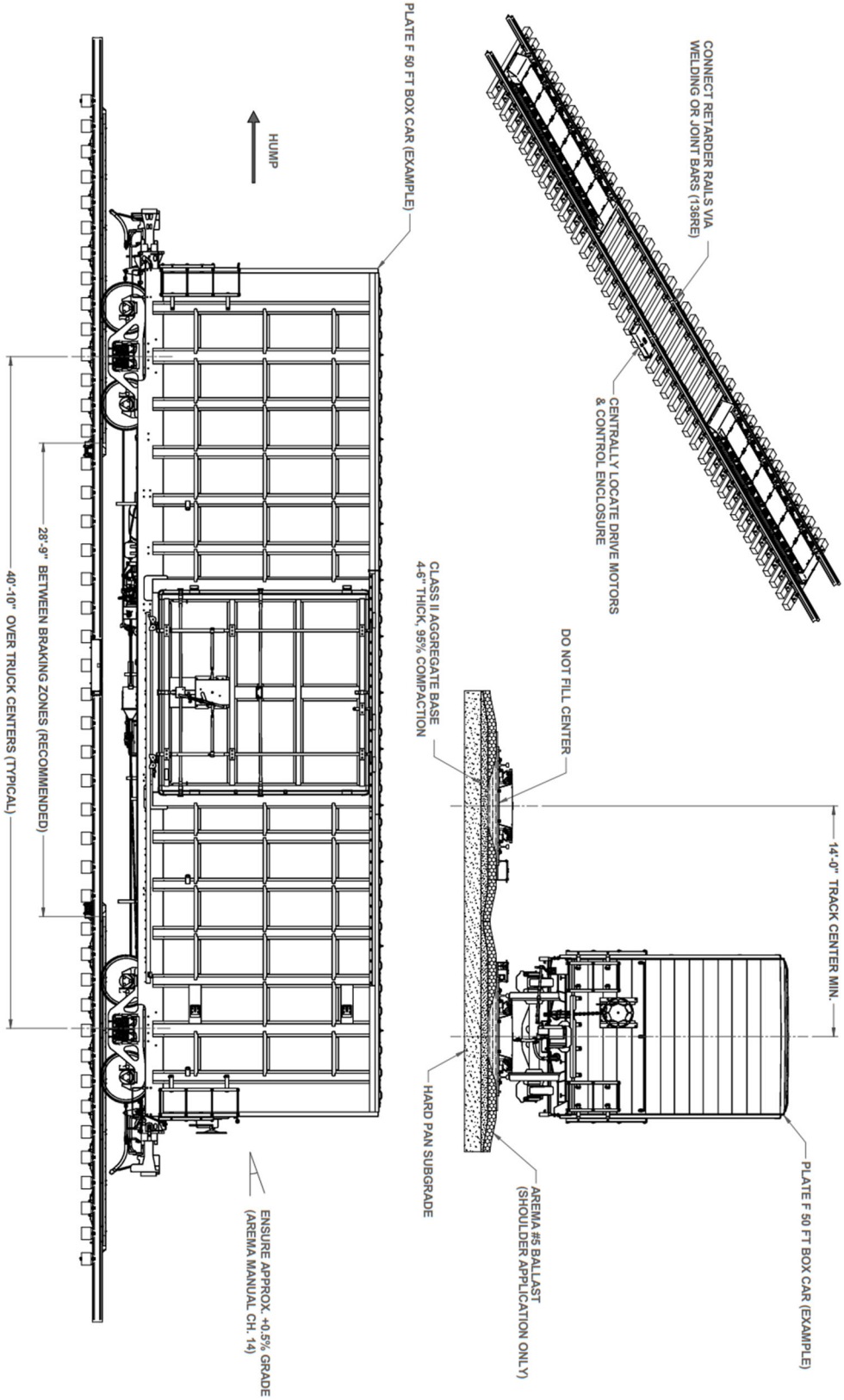

Figure 6.1 *ASR-23 Installation Guidance Diagram*

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