Switcher Locomotive Family Specifications

SWM9 Mid-Cab Series
Switcher, Mid-mount cab 82 ton 900 hp

SWR18 Rear-Cab Series
Switcher, Rear-mount cab 120-180 ton 1850 hp

Images may be shown with Optional Equipment

Rev	Description	Date
1.0	Initial Release	1/6/2025
2.0	Added title page and rev table	1/14/2025
3.0	Added additional CFR 223, 231, & 232 compliance to regulations	3/6/2025
4.0	Updates specification sections, added additional CFR 229 compliance items, title to compliance sections, as well as AAR and ISO Certification documents	3/26/2025

Contents

1.0 Introduction

For 28 years RITALKA and its collective companies have become well known in many equipment markets, including the Railroad Maintenance of Way market. We have touched and influenced over 300,000 self-propelled pieces of equipment, including nearly 300 complex railroad car design & builds. Many of these from a clean sheet of paper, through entire design and analysis, review of all relevant standards, and full vertical manufacturing within our several facilities located in MN, WI, and SD.

In 2023 the Navy was seeking someone to design a clean sheet Switcher Locomotive that matched the 1954 GE80 style and performance. We leaped at this opportunity, and inside 18 months we demonstrated meeting all the AAR-CFR-NEC-ISO-ANSI-AWS related locomotive specifications. We incorporated proven prime movers, generators brand, traction controls, and undercarriage components. Of course, we ultimately built the first units in our AAR certified facility. The following pages will show you the details of each design subsystem.

Since our first order for the Navy, orders for other units have been placed by the Air Force and the Army. From this GEEP Army award, a family was born. Our cab is designed to be mid ship, rear, or front mounted. The generator is sized to match to the 900 Hp to 2100 Hp optional prime mover diesel Tier 4f engines. Propel & Traction controls allow for correct power ratings to the tractive drives, and we place the EMD 77/78 under all of our locomotives. Design the overall weight from 82 tons to 180 tons, 45 feet in Length Overall All (LOA) to 55 feet in LOA, and you have a family of Locomotives.

2.0 Definitions

AAR – Association of American Railroads

ANSI – American National Standards Institute

ASME – American Society of Mechanical Engineers

AWS – American Welding Society

CARB – California Air Resources Board

CFR – Code of Federal Regulations

DOT – Department of Transportation

FEA – Finite Element Analysis

FRA – Federal Railroad Administration

ISO – International Organization for Standardization

MOW – Maintenance of Way

MU – Multiple Unit

NEC – National Electrical Code

NFPA – National Fire Protection Association

SAE – Society of Automotive Engineers

3.0 General Configurations/Performance

The Integral family of locomotives allows for selection of a cab location (Mid, Rear, Front), and specification of overall weight tonnage from 82 tons dry weight up to 180 tons dry weight. Dry weight does not include diesel, sand, or human occupants.

a. AAR C-Plate Clearance
b. Standard SWM9 Mid Mount Cab, 82 Ton, 900 Hp Locomotive
    a. Maximum Length over, coupler to coupler: 45 ft
    b. Maximum Width: 10 ft 6 in
    c. Maximum Height: 14 ft 11 in
    d. Chassis Dry Weight: 164,000 lb
    e. Starting Tractive Effort @ 25% Adhesion: 41,000 lb
    f. Standard 400 gallon diesel fuel tank center slung under frame
c. Standard SWR10 or SWF10 Rear or Front Mount Cab, 120-180 Ton, 1000 Hp Locomotive
    a. Maximum Length over coupler to coupler: 55 ft 8 in
    b. Maximum Width: 10 ft 6 in
    c. Maximum Height: 14 ft 11 in
    d. Chassis Dry Weight: 240,000 – 360,000 lb
    e. Starting Tractive Effort @ 25% Adhesion: 60,000 – 84,000 lb
    f. Standard 600 gallon diesel fuel tank center slung under frame, optional sizes available

d. Standard SWR16 or SWF16 Rear or Front Mount Cab, 120-180 Ton, 1600 Hp Locomotive
    a. Maximum Length over coupler to coupler: 55 ft 8 in
    b. Maximum Width: 10 ft 6 in
    c. Maximum Height: 14 ft 11 in
    d. Chassis Dry Weight: 240,000 – 360,000 lb
    e. Starting Tractive Effort @ 25% Adhesion: 60,000 – 84,000 lb
    f. Standard 600 gallon diesel fuel tank center slung under frame, optional sizes available
e. Standard SWR18 or SWF18 Rear or Front Mount Cab, 120-180 Ton, 1800 Hp Locomotive
    a. Maximum Length over coupler to coupler: 55 ft 8 in
    b. Maximum Width: 10 ft 6 in
    c. Maximum Height: 14 ft 11 in
    d. Chassis Dry Weight: 240,000 – 360,000 lb
    e. Starting Tractive Effort @ 25% Adhesion: 60,000 – 84,000 lb
    f. Standard 800 gallon diesel fuel tank center slung under frame, optional sizes available
f. Standard SWR21 or SWF21 Rear or Front Mount Cab, 120-180 Ton, 2100 Hp Locomotive
    a. Maximum Length over coupler to coupler: 55 ft 8 in
    b. Maximum Width: 10 ft 6 in
    c. Maximum Height: 14 ft 11 in
    d. Chassis Dry Weight: 240,000 – 360,000 lb
    e. Starting Tractive Effort @ 25% Adhesion: 60,000 – 84,000 lb
    f. Standard 800 gallon diesel fuel tank center slung under frame, optional sizes available
g. North American railway track gauge: 56.5 in
h. Remanufactured EMD 4 wheel switcher trucks utilizing D77/D78 rebuilt traction motors
i. New Fat 40 in (Actually measure out nearly 41 in) steel wheels meeting AAR MSRP Section G and CFR49 229.73 & 229.75
j. Automatic wheel flange lubrication on all wheels
k. AAR E or F-Type shelf coupler per AAR MSRP Section B and S
l. Coupler Height: 34.5 in
m. Maximum Operating Altitude: 7,300 ft
n. Minimum Operating Temperature: -20°F
o. Maximum Operating Temperature: 120°F
p. Maximum speed up to 60 mph
q. MU Multiple Unit Capable per AAR S-512 & RP-5595

4.0 Frame/Shrouds

New fabricated and AWS D1.1-D1.2 welded manufactured frame, deck, and shrouds, utilizing high strength steel and FEA analyzed.

a. Robust collision posts fully integrated to the locomotive frame constructed of T1 steel to provide occupancy safety per AAR S-580 and CFR49 229.141 & 229.205
b. New mono-weld frame design to meet AAR S-580 and CFR 49 229.123, 229.141 & 229.205
c. Four (4) frame integrated lifting slings/jack post on 82 ton unit
d. Eight (8) frame integrated lifting slings/jacking post on 120, 130, &180 ton units
e. Integrated traction motor cooling ducts
f. ANSI J185 & ISO 2867 compliant steps and railings
g. Anti-Slip non-skid decks integral to all walkways
h. Sloped engine hoods for increased visibility
i. Engine shrouds constructed of 10ga steel sheet
j. Engine shrouds can be fully removed in stages for major service/repairs
k. Engine shroud doors can be opened 180° or completely removed via lift off hinges for engine/generator access
l. LED walkway lighting
m. LED engine bay lighting
n. 4 corner sanding boxes approx. 45 ft^3 per corner (180 ft^3 total) future unit sand capacity and box configuration may differ
o. Under frame mounted fuel tank (400, 600, or 800 gal) constructed of grade 50 plate steel per AAR S-5506 & 49CFR 229.95, 229.97, & 229.217
p. Snyder fuel fill fittings and fill level sight gauge on both sides of locomotive

5.0 Cab

New fabricated and AWS D1.1-D1.2 welded manufactured cab, utilizing high strength steel and FEA analyzed. Cab design and layout places an emphasis on operator comfort with a high back swivel captain's chair and robust HVAC. A modern glass cockpit gives modern feel and amenities to the traditional AAR control stand layout operators are accustomed to.

a. Center, Rear, or Front mounted steel cab structure
b. Cab frame structure constructed with grade 50 steel tubing and plate to provide occupancy safety per AAR S-580 and CFR49 229.205 crashworthiness
c. Steel fabricated cab skin
d. Modern clean cab to abide by AAR RP-5107, RP-5115, RP-5117, RP-5120, RP-5122, RP-5124, RP-5126, RP-5127, RP-5128, & RP-5136 (cab door cushion, door pull bar, flexible hinge guard, operator sun visor, rounded corners, etc…)
e. Traditional cab layout with modern components integrated
f. Enclosed cab with FRA type I & II glass meeting AAR S-5101 & CFR49 223
g. Side sliding windows with FRA Type II glass
h. Electric wipers with wash down on operator station windows, & door behind operator station
    - Three (3) wipers on mid cab units
    - Four (4) wipers on forward and rear cab units
i. Cab HVAC maintains 68°F to 72°F internal temp in 0°F to 100°F ambient
j. Fully insulated walls, floors, & ceiling utilizing open and closed cell foam as well as an acoustic barrier to provide thermal and acoustic insulation
k. CFR49 229.121 cab noise compliant
l. Non-skid flooring with foam backing laser cut to profile. Sheets are easily removable for cleaning and under cab access
m. AAR S-5520 cab securement on all three (3) doors
n. Exterior deadbolt per AAR S-5520 on rear two doors
o. Modern AAR RP-5132 compliant control stand with new throttle and brake controls
p. Standard 8 notch propel setting
    - At commissioning notch performance can be configured to provide end user with desired set point and ramp rate
    - Allows end user to obtain ideal speed and acceleration for a silky smooth pull away from a stop or to obtain maximum pulling force
q. Modern Electronic Brake Valve
r. Modern "glass cockpit" touch screen controls for auxiliary components
s. Captains operator chair with swivel mounted per CFR49 229.119
t. Fold down jump seat
u. Railway optimized radio compliant with AAR RP-5128, S-5702, & AAR standard radio channels
v. LED white and red lighting
w. Easy access to fire extinguisher and first aid kit
x. One (1) 12v power plug and one (1) 110v outlet
y. Electric cab heater for cab preheating when connected to wayside power
z. No toilet

6.0 Coupling/Trucks

The proven EMD 4 wheel switcher truck is used across the Integral family of locomotives due to its proven reliability and spare parts availability. Remanufactured truck assemblies are sourced from AAR M-1003 certified rebuild facilities where the truck assemblies are reconditioned per EMD M.I. 1501 rev B. EMD D77/78 traction motors are reconditioned/rebuilt and installed in the remanufactured truck assemblies.

a. Remanufactured AAR E or F-Type shelf coupler per AAR MSRP Section B and S
b. Type 390/391 draft gear
c. Top pin operable from both sides of locomotive
d. 34.5 in top of rail to middle of pulling face height
e. Remanufactured EMD 4 wheel switcher truck per EMD M.I. 1501 rev B rebuilt by an AAR M-1003 facility
    - Optional Blomberg B Trucks with EMD D77/78 Traction Motors available on most units
f. New Fat 40 in (Actually measure out nearly 41 in) steel wheels meeting AAR MSRP Section G and CFR49 229.73 & 229.75
g. New brake shoes and twin clasp rigging per CFR49 229.65
h. New steel pins, bushings and wear plates
i. Rebuilt D77/D78 motor combos with standard 62/15 gearing
j. Peak traction motor torque: 6,000 Ft-lbs
k. Continuous motor torque: 4,400 Ft-lbs
l. Optional 65/12 gearing available
m. New F mount wheel bearings
n. New heavy spring kit
    - Optional light spring kit available
o. Sanding nozzle on first and last axles, sands in direction of movement only, except in emergency braking mode which operates all sander nozzles.
p. Optional automatic wheel flange lubrication on all wheels via spring loaded lubrication stick

7.0 Powertrain

Locomotives are powered via a dual engine configuration, allowing for built in single engine power if engine or generator failure, or if the power need is much less than full Hp designed into the locomotive. Single engine operation would not be possible had we not designed electric motor power of the air compressor, air brake system, and the HVAC system. All of the engines selected are EPA Tier 4 Final (Tier 4F), and California Air Resources Board (CARB) certified via CARB Executive Order.

a. CAT engines are standard, with Cummins options available
    a. 900 Hp: Dual C9.3B 456 Hp
    b. 1000 Hp: Dual C13B 500 Hp
    c. 1600 Hp: Dual C18 800 Hp
    d. 1800 Hp: Dual C27 925 Hp
    e. 2100 Hp: Dual C27 1050 Hp
b. Single engine operation can be completely controlled by the operator by simply electing to operate one engine or two
c. Engine integrated cooling CAT certified package means direct fan drive off the engine crank, providing for simplified cooling fan power
d. Marathon 574RDL (900 and 1000 Hp), 741RSL (1600 Hp), 743RSL (1800 Hp), or 744RSL (2100 Hp) generators
e. Marathon's custom rail specific generators have been selected for their reliable performance and ability to deliver high idle voltage
f. TMV excitation control for load balancing across both generators
g. Generators feature a digital voltage regulator providing unprecedented voltage regulation in the presence of harmonic distortion caused by non-linear loads
h. Generators incorporates single piece rotor laminations, a die cast rotor core and damper windings into an integrated rotor assembly
i. The field winding is wet layer wound to the rotor assembly with thermo setting epoxy for high mechanical and electrical integrity
j. Engine and generators coupled via Reich rubber disc flange coupler
k. The couplers disc shaped rubber element is highly flexible and enables the coupler to absorb high torsional vibrations to provide virtually backlash free coupling and compensate for misalignment
l. Engine bay or undercarriage mounted DEF tanks pending configuration
m. Cold weather engine heater powered via wayside (shore) power

8.0 Traction/Electrical

Electrical power is generated through the diesel engine driven generators as well as the engine mounted alternators. Multiple electrical circuits are used to power a multitude of components on the locomotive. All circuits are sized and protected per NEC guidelines. Additional circuits have been added to utilize wayside (shore) power for battery charging, engine block heaters, and electric cab heat.

a. Marathon 574RDL (900 and 1000 Hp), 741RSL (1600 Hp), 743RSL (1800 Hp), or 744RSL (2100 Hp) generators
b. 480 VAC, 240VAC, 110VAC, 750VDC, 75VDC, 24VDC, & 12VDC circuits used across the machine
    a. 480VAC: Air compressor
    b. 240VAC: High voltage cooling circuit, traction motor cooling & wayside power circuit
    c. 110VAC: Cab outlets, high voltage enclosure safety lockout, and electrical cabinet cooling fans
    d. 750VDC: Traction circuit
    e. 75VDC: Headlight/ditch light, interior and walkway lighting, electro pneumatic brake system, traction engine control unit, multiple unit systems, & excitation panels
    f. 24VDC: Engines, locomotive master power, controls system and displays, HVAC system, wipers, air compressor controls, traction choppers and inverters, high voltage cooling fans, cab lights, work lights, strobe light, horn control, & most other miscellaneous circuits
    g. 12VDC: Crossing bell, spot light, radio, power plug, & optional camera system
c. Machine critical systems are isolated on dedicated circuits such as the air compressor & traction circuits
d. Engines/generators supply power to a common DC bus. This allows system to remain fully functional with only 1 engine running.
e. All circuits protected via circuit breakers per NEC section 240
f. Circuits can be isolated by breakers for troubleshooting and maintenance
g. Generator cutoff isolation handles
h. New electrical enclosures housing traction and controls components abiding by NEC 312.11 A-D component spacing
i. AC-Rectified DC traction system with independent automatic wheel slip control on all axles
j. American Traction Systems (ATS) with DLL components
k. ATS Traction Rectifiers independently convert 480 VAC to 650VDC nominal for each generator circuit
l. ATS Multi-Function Inverter mounted in our high voltage cabinet utilizes the common DC bus to provide 3 phase AC power to the air compressor and traction motor blower circuits
m. ATS DC Traction Chopper Modules, which utilize solid state IGBTs, provide individual motor control to the EMD D77/78 traction motors. The modules also include ramping functions for power output to the traction system resulting in smoother acceleration.
n. ATS and TMV systems work together to control traction motor over torque and stall out, preventing the operator from stalling the traction motors for any length of time outside of motor design limits

o. ATS capacitor banks are installed in the high voltage cabinet used in conjunction with the traction and power modules
p. Integrated TMV Traction Engine Control Unit (TECU) all in one system with event recording, locomotive monitoring, wheel slip and slide control
q. TMV crash hardened memory per AAR S-5512 & CFR49 229.135
r. TMV reversers and crossover bars work with the ATS traction system to provide travel in both directions
s. TMV cutout contactors are integrated into the traction system and controlled through the TECU to allow electronic motor cutout allowing locomotive to remain operable with one traction motor offline
t. TMV ground fault detection circuit with industry standard 750mA trip and automatic reset
u. D77/D78 traction motors
v. A multitude of sensors and components are used to monitor locomotive telematics, system faults, & alarms. These are sent to the PLC controller and displayed on the operator display screen. This ensures the operator has access to all important engine parameters and alarms to ensure safe reliable operation
w. Modern wiring and cable per AAR RP-585, RP-586, RP587, RP-588
x. Modern AGM house batteries
    a. Two (2) parallel sets of batteries wired in series for 24V house circuit
y. Lifeline AGM engine starting batteries
z. Oversized alternator installed on both CAT engines, 24V 250A
aa. On board house and starting battery maintainer
bb. In cab 12v and 110v outlet
cc. 110v outlet in each engine bay
dd. 27 pin MU connector per AAR S-512
ee. Full LED lighting (Headlights, in cab lighting, walkway and step lights, shroud/cabinet lighting, amber strobe light, and spotlight) meeting AAR S-5515, S-5516, CFR49 229.125, CFR49 229.127, & CFR49 229.133
ff. Dual LED headlights and ditch lights meeting AAR S-5516, CFR49229.125, & CFR49 229.133. Ditch light flash can be turned on or off based on customer preference
gg. IFM Touch screen displays provide operator with all necessary information and faults as well as control over a variety of auxiliary systems (Lighting, HVAC, wipers etc…)
hh. Two (2) forced air cooling fans for traction motor cooling 3,400 cfm each (6,800 cfm total)
ii. Integrated ducting directs air to traction motors 1,700 cfm per traction motor

9.0 Braking

A modern 26L compatible Electro-Pneumatic brake unit is used to provide air brakes to the locomotive. The modern brake components give an updated version of the traditional components seen on many older locomotive. These updated components give the same traditional operation but with modern reliability and ease of maintenance.

a. New York Airbrake CCB-26 Electro-Pneumatic Control Unit (EPCU)
    - Optional NYAB CCBII (computer controlled brake) ideal for passenger trains
b. The EPCU controls normal brake operation via delivering main reservoir pressure to the brake cylinders, train lined brake pipe, and brake cylinder equalizing pipe
c. Operation of these functions is controlled through the EPCU computer
d. A modern electronic brake valve mounted in AAR RP-5132 control stand functions like the tradition brake valve seen in old locomotives
e. Pressure is directed to the correct pipes and lines from the relevant control valves
f. Traditionally seen valves in the 26L brake schedule are grouped and modularized into line replaceable units (LRUs)
g. LRUs allow for easy replacement of individual modules for easier troubleshooting and repair
h. The LRUs are as follows; Brake Pipe Control Portion (BPCP), Equalizing Reservoir Control Portion (ERCP), 13 Control Portion (13CP), 16 Control Portion (16CP), & 20 Control Portion (20CP)
i. Additional components included in the EPCU are; Brake Cylinder Control Portion (BCCP), DB Triple Valve (DBTV), & Power Supply Junction Box (PSJB)
j. The EPCU unit also includes a Dead Engine Regulator (DER) which allows the locomotives main reservoirs to be charged when acting as a dead locomotive in train
k. Integrated filters protect the EPCU and its components from contaminants from the main reservoirs
l. Twin shoe brake clasp utilizing low friction brake shoes
m. High friction brake shoes can be optioned when necessary or desired
n. Manual handbrake crank mounted behind operator seat in cab
o. EPCU mounted below cab and can be easily accessed for maintenance and troubleshooting

10.0 Air System

The Integral line of switchers uses a modern air system utilizing electrically powered air compressors and new main reservoirs. The system is setup and plumbed per relevant AAR and CFR sections using modern components and commonly seen valves and cutouts.

a. New electric powered air compressor with air dryer
    - Atlas Copco GAR 30 or 37
    - New York Air Brake VV270-T or VV1000-T
    - Gardner Denver 170 CFM to 213 CFM
b. New angle cocks and cutouts used where able, else all remanufactured valves sourced from AAR M-1003 facilities
c. System plumbed and vented to abide by AAR RP-505, RP-546, & CFR49 229.49
d. Plumbed using pipe and fittings that comply with ANSI B16.3, SAE J844 Type 3B, J527, and/or ASTM A254
e. All plumbing is securely fastened via hangers and straps to underside of frame
f. Large radius bends utilized whenever possible to prevent air flow restriction
g. New 120 gal steel constructed air reservoir tanks (total capacity 240 gal)
h. MU coupling hoses per AAR RP-5595, & S-5529
i. Multi directional air horn per CFR49 229.129
j. Leading and trailing axle pneumatic sander valves
k. Traditional analog display gauges implements in new AAR RP-5132 control stand allows operator to observe critical pressures from a familiar interface

11.0 Optional Equipment

a. Track and Coupler Cameras can be optioned to provide operator a clear unobstructed view of the coupling process and the track
b. Camera display screen can be customized to provide operator with their desired layout and views
c. Optional sliding coupler controlled via hydraulic cylinder powered by a hydraulic power pack
d. Sliding coupler allows operator to move coupler back and forth to assist in can coupling alignment
e. When coupled coupler is free to float back and forth to allow transit around tighter radius curves
f. Sliding coupler controlled from operator station and side of locomotive near uncoupling lever

12.0 Compliance

- Association of American Railroads (AAR) Manual of Standards and Recommended Practices Section-M, Locomotives and Locomotive Equipment
  - Plate-C Clearance
  - AAR E-Type Coupler
  - AAR Wheel Tread/Flange
  - AAR Section L (Lettering)
    - Decal/stencil font and sizing
  - RP-505 Typical 26-L Type Brake Equipment Pipe Diagrams for Locomotives
    - Recommended plumbing diagram for type 26L brake system
  - RP-509 Braking Ratios for Locomotives
    - Braking force ratios and testing method
  - RP-514 Designation of Sides and Ends of Locomotives
    - Designates sides and ends of the locomotive
  - RP-518 Brake Shoe Unflanged
    - Describes nominal dimensions of brake shoes
  - RP-546 Minimum Requirements for Main Reservoir System on New and Rebuilt Diesel-Electric, Electric, and Gas Turbine Locomotives of 800-hp Capacity and Greater
    - Minimum requirements for air system
  - RP-585 Wiring and Cable Specifications
    - Wiring/Cable insulation design performance and testing requirements
  - RP-586 Wire and Cable Insulating Material – Moisture-Resisting Jacketed
    - Describes cable for use in locomotive equipment
  - RP-587 Wire and Cable Insulating Material – Silicone Rubber Insulated
    - Describes cable for use in locomotive equipment
  - RP-588 Wire and Cable Insulating Material
    - Describes cable for use in locomotive equipment
  - RP-589 Rating for Specific Fuel Consumption of Diesel Electric Locomotives
    - Uniform method for rating specific fuel consumption of diesel electric locomotives
  - RP-590 Lead-Acid Batteries and Compartments
    - Uniform practices for battery performance under a variety of conditions
  - RP-599 Brake Shoes – High-Friction Composition Type for Locomotives
    - Brake shoe material composition
  - RP-5107 Access Doors to Light Boxes for Road Number, Headlight, or Warning Lights – Outside Cab
    - Limit access to outside light boxes from inside locomotive
  - RP-5115 Cushion Pad – Locomotive Cab Door Frame
    - Cushion pad over doorways
  - RP-5117 Door Closure Bar – Locomotive Cab
    - Door closure bar
  - RP-5120 Flexible Hinge Guard of Locomotive Cab Door
    - Flexible hinge guard for doors

- RP-5122 Locomotive Horn Valve Handle with Soft, Resilient-Type Rubber Cover
  - Soft cover on horn handle
- RP-5124 Padded Sun Visor in Locomotive Cab – Engineer's Side Only
  - Padded sun visor for operator
- RP-5126 Recessed Windshield Wiper Valve, Train-Order Light Switch, and Flush-Mounted Train-Order Light
  - Recessed windshield valve
- RP-5127 Rounded Cab Window Latch in Locomotive Cabs
  - Rounded cab window latch
- RP-5128 Rounding All Possible Exposed Convex Edges and Corners
  - Rounding all possible corners in cab
- RP-5132 Diesel Locomotive Control Stand for New Locomotive
  - Control stand dimensions and component location
- RP-5136 Windshield Wiper Motor Handle with Soft-Rubber-Type Grip
  - Soft rubber covered handle for wiper motor handle
- RP-5209 Basic Brake Design Data for Freight Locomotives
  - High friction brake shoe braking ratio
- RP-5595 Main Reservoir Equalizing End Hose Coupling
  - Main reservoir equalizing end hose coupling
- RP-5596 Brake Shoes – Metal Type
  - Metal brake shoe composition
- S-512 27-Point Control Plug and Receptacle
  - 27 point MU wiring
- S-580 Locomotive Crashworthiness Requirements
  - Crashworthiness
- S-591 Locomotive System Integration Operating Display
  - Display screen layout
- S-5022 Ultra-Low Sulfur Diesel (ULSD) Identification Label/Decal
  - Ultra Low Sulfur Diesel Sticker
- S-5101 Locomotive Cab Window Glazing Material
  - Cab window glazing
- S-5506 Performance Requirements for Diesel Electric Locomotive Fuel Tanks
  - Fuel tank performance requirements
- S-5512 Locomotive Event Recorder Download Standard
  - Event recorder download standard
- S-5513 Locomotive Alerter Requirements
  - Locomotive alerter logic and functionality
- S-5514 Locomotive Operator Control Symbols
  - Operator control symbols
- S-5515 LED Lighting for Locomotives
  - LED lighting performance and requirements
- S-5516 LED Headlight and Auxiliary Lighting for Locomotives
  - LED headlight performance and requirement

- S-5520 Locomotive Cab Securement
    - Cab securement
- S-5529 Multiple Unit Pneumatic Brake Equipment for Locomotives
    - Defines standard equipment for multiple unit pneumatic braking
- S-5530 Locomotive Headlight Control
    - Locomotive headlight control switches/symbols
- S-5597 Air Flow Indicators
    - Functionality, testing, and approval of air flow indicators
- S-5598 Calibration Procedure for AFM-Type Air Flow Indicators
    - Air flow indicator calibration
- The Official Railway Equipment Register
- Code of Federal Regulations (CFR) Title 49, Part 223 Safety Glazing Standards
- Code of Federal Regulations (CFR) Title 49, Part 224 Reflectorization of Rail Freight Rolling Stock
- Code of Federal Regulations (CFR) Title 49, Part 229 Railroad Locomotive Safety Standards
    - 49CFR 229.11 Locomotive Identification
        - Locomotive identification
    - 49CFR 229.13 Control of Locomotives
        - Locomotive controls
    - 49CFR 229.20 Electronic Recordkeeping
        - Electronic recordkeeping
    - 49CFR 229.31 Main Reservoir Tests
        - Main reservoir tests
    - 49CFR 229.41 Protection Against Personal Injury
        - Protection against injury due to exposed fans, gears, pistons, & moving parts
    - 49CFR 229.43 Exhaust and Battery Gases
        - Proper venting of battery gases
    - 49CFR 229.45 General Condition
        - General condition
    - 49CFR 229.47 Emergency Brake Valve
        - Emergency brake valve
    - 49CFR 229.49 Main Reservoir System
        - Main reservoir system performance and configuration
    - 49CFR 229.51 Aluminum Main Reservoir
        - Aluminum main reservoir
    - 49CFR 229.53 Brake Gauges
        - Brake gauges
    - 49CFR 229.59 Leakage
        - Air reservoir leakage
    - 49CFR 229.61 Draft System
        - Couper draft system
    - 49CFR 229.65 Spring Rigging
        - Wheel truck spring rigging
    - 49CFR 229.67 Trucks
        - Wheel truck attachment

- 49CFR 229.71 Clearance Above Top of Rail
  - Clearance above top of rail
- 49CFR 229.73 Wheel Sets
  - Wheel set uniformity
- 49CFR 229.75 Wheel and Tire Defects
  - Wheel and tire defects
- 49CFR 229.83 Insulation of Grounding of Metal Parts
  - Metal part grounding/insulation
- 49CFR 229.85 High Voltage Markings; Doors, Cover Plates, or Barriers
  - High voltage markings
- 49CFR 229.87 Hand-Operated Switches
  - High voltage hand switch covers
- 49CFR 229.93 Safety Cut-Off Device
  - Fuel cut-off
- 49CFR 229.95 Venting
  - Fuel tank venting
- 49CFR 229.97 Grounding Fuel Tanks
  - Fuel tank grounding
- 49CFR 229.115 Slip/Slide Alarms
  - Wheel Slip Alarm
- 49CFR 229.117 Speed Indicators
  - Speed Indicator
- 49CFR 229.119 Cabs, Floors, and Passageways
  - Cab, floors, and passageway requirements
- 49CFR 229.121 Locomotive Cab Noise
  - Cab noise requirements
- 49CFR 229.123 Pilots, Snowplows, End Plates
  - Frame end plates top of rail height
- 49CFR 229.125 Headlights and Auxiliary Lights
  - Headlight and aux lighting requirements
- 49 CFR 229.127 Cab Lights
  - Cab lighting requirements
- 49CFR 229.129 Locomotive Horn
  - Locomotive horn performance
- 49CFR 229.133 Interim Locomotive Conspicuity Measures – Auxiliary External Lights
  - Auxiliary lighting performance and logic
- 49CFR 229.135 Event Recorders
  - Event recorder
- 49CFR 229.140 Alerters
  - Alerter logic
- 49CFR 229.141 Body Structure, MU Locomotives
  - Body structure crashworthiness
- 49CFR 229.205 General Requirements
  - General crashworthiness

- 49CFR 229.206 Design Requirements
  - Crashworthiness design requirements
- 49CFR 229.213 Locomotive Manufacturing Information
  - Data/builder tag information
- 49CFR 229.215 Retention and Inspection of Designs
  - Retention and inspection of designs
- 49CFR 229.217 Fuel Tank
  - Fuel tank performance

- Code of Federal Regulations (CFR) Title 49, Part 231 Railroad Safety Appliance Standards
  - 49CFR 231.29 Road Locomotives with Corner Stairways
    - Corner stair accessible uncoupling lever
  - 49CFR 231.30 Locomotives Used in Switching Service
    - Switching steps and handrail requirements
- Code of Federal Regulations (CFR) Title 49, Part 232 Brake System Safety Standards for Freight and Other Non-Passenger rains and Equipment; End-of-Train Devices
  - 49CFR 232.103 General requirements for all train brake systems
    - 232.103.a
      - Brakes sufficient to stop locomotive
  - 49CFR 232.105 General Requirements for Locomotives
    - General requirements locomotives
  - 49CFR 232.603 Design, Inoperability, and Configuration Management Requirements
    - Electronically controlled pneumatic brake systems design, interoperability, and configuration requirements
- American Society of Mechanical Engineers, Boiler and Pressure Code Section IX, Welding Qualifications
- American Welding Society D15.1 - Railroad Welding Specification
- American Iron and Steel Institute Standards
- FRA Type I & II Glass
- National Electrical Code (NEC)
  - 220.10B
    - Load evenly proportionated among branch circuits
  - 240
    - Overcurrent protection
  - 250
    - Grounding and bonding
  - 250.34
    - Portable and vehicle mounted generators
  - 250.122
    - Size of equipment grounding conductors
  - 310
    - Conductors for general wiring
  - 310.15
    - Ampacities for conductors rated 0-2000 volts

- 310.16
    - Ampacities for insulated conductors
- 312.11 A-D
    - Component spacing within cabinets and cutout boxes
- 408
    - Switchboard, switchgear, and panel boards
- 408.56
    - Minimum component spacing
- 430
    - Motors, motor circuits, and controllers
- 445.18
    - Disconnecting/shutdown of prime mover

- National Fire Protection Association (NFPA)
    - 130
        - Standard for fixed guideway transit and passenger rail systems
- European Standard (EN)
    - EN 50155
        - Power supply design for railway applications
    - EN 60077
        - General service conditions and rules for rolling stock
    - EN 61373
        - Shock and vibration tests for railway electrical components
- ISO
    - 2867
        - Access to equipment
- ANSI
    - J185
        - Access for off road machines
- EPA
    - Tier 4 Final Emissions
- CARB
    - CARB Certified via CARB Executive Order

ASSOCIATION OF AMERICAN RAILROADS

QUALITY ASSURANCE PROGRAM CERTIFICATION

THIS CONFIRMS THAT

SpecSys Inc.

HAS MET THE REQUIREMENTS OF THE ASSOCIATION OF AMERICAN RAILROADS QUALITY ASSURANCE PROGRAM AS SPECIFIED IN M-1003

CERTIFICATE NUMBER: SPEM **LOCATION:** Granite Falls , Minnesota

PRODUCT/SERVICE: A21 - Manufacturer of Locomotives

CERTIFICATION DATE: Tuesday, January 30, 2024 **EXPIRATION DATE:** Saturday, January 30, 2027

APPROVED: _____ (Executive Director Rules and Standards)

APPROVED: _____ (Chairman, Quality Assurance Committee)

DNV

MANAGEMENT SYSTEM CERTIFICATE

Certificate no.:
CERT-07148-2006-AQ-HOU-ANAB

Initial certification date:
19 September, 2007

Valid:
02 November, 2022 – 10 September, 2025

This is to certify that the management system of

RVI, Inc. / SpecSys/ Integral DX Inc.

121 North First Street, Montevideo, MN, 56265, USA

and the sites as mentioned in the appendix accompanying this certificate

has been found to conform to the Quality Management System standard:

ISO 9001:2015

This certificate is valid for the following scope:

Provide Services to Clients that include: Contract Manufacturing, Design Engineering, Fabrication, Machining, Welding, Assembly, Painting, Repair & Renewal of Electronic Products, Test development & testing of Electronic Products, Battery Management, Wire Harness & Control Box manufacturing & Assembly as well as Intelligent Inventory Management

Place and date:
Katy, TX, 02 November, 2022

For the issuing office:
DNV - Business Assurance
1400 Ravello Drive, Katy, TX, 77449-5164, USA

Sherif Mekkawy
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.
ACCREDITED UNIT: DNV Business Assurance USA Inc., 1400 Ravello Drive, Katy, TX, 77449, USA - TEL: +1 281-396-1000. www.dnv.com

Certificate no.: CERT-07148-2006-AQ-HOU-ANAB
Place and date: Katy, TX, 02 November, 2022

Appendix to Certificate

RVI, Inc. / SpecSys/ Integral DX Inc.

Locations included in the certification are as follows:

Site Name	Site Address	Site Scope
RVI, Inc. / SpecSys/ Integral DX Inc.	121 North First Street, Montevideo, MN, 56265, USA	Design, Engineering, Management, Sales Product/Project Planning
RVI, Inc. / SpecSys/ Integral DX Inc.	304 Industrial Drive, Redwood Falls, MN, 56283, USA	Repair, Renewal, Test of Electronic Products, Process Development , Production Planning, Procurement, Battery Management & Harness assembly
RVI, Inc. / SpecSys/ Integral DX Inc.	1123 Highway 212 West, Granite Falls, MN, 56241, USA	Contract Manufacturing, Fabrication, Machining, Welding, Assembly, Painting, Shipping & Receiving, Project Management
RVI, Inc. / SpecSys/ Integral DX Inc.	2120 North Broadway, New Ulm, MN, 56073, USA	Contract Manufacturing, Design Engineering, Fabrication, Machining, Welding, Assembly, Painting, Procurement, Shipping & Receiving
RVI, Inc. / SpecSys/ Integral DX Inc.	600 Quadee Drive, Watertown, SD, 57201, USA	Contract Manufacturing, Fabrication, Machining, Welding, Assembly, Painting, Repair, Renewal, Test of electronic products, Intelligent Inventory Management services, Shipping, Receiving, Battery Management & Harness Assembly
RVI, Inc. / SpecSys/ Integral DX Inc.	474 Birch Street, Prentice, WI, 54556-1106, USA	Contract Manufacturing, Fabrication, Machining, Welding, Assembly and Painting.