



CHALLENGER

4-6-6-4



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HISTORY

The Challenger 4-6-6-4 simple articulated locomotive was born into an era of contradictions. The railroad industry was suffering through the massive economic downturns of the early 1930s, with most railroads barely remaining solvent. Yet, a movement arose that resulted in the development of the pinnacle of steam locomotive design.

New locomotive orders with the major erection shops of Alco, Baldwin and Lima were almost non-existent in the years between 1930 and 1933. Most railroads opted to rebuild and refurbish existing equipment in their own shops. In addition, motive power rendered obsolete or surplus by the downturn in traffic found its way to the scrap line. In an effort to capture what little business existed, experimentation reached a fever pitch. These efforts manifested themselves in the introduction of streamlining, the development of diesel-powered, dedicated consist passenger trains and super-power steam locomotives. Super-power steam was the evolution in steam locomotion brought about by a marriage of high tractive effort with high-speed performance. Previously, railroads had either greyhound swift locomotives with limited pulling power or massive, complex locomotives capable of high tractive effort at speeds of around 20 miles per hour. By combining the latest technology with improved understanding of the dynamics of steam power, new classes of locomotives reached the rails. These machines featured large fireboxes supported by either four or six wheel trailing trucks, massive boiler girths that pressed clearance limits, higher boiler operating pressures and the latest in appliances that improved the roadworthiness and thermal efficiencies of the power plant.

The Union Pacific Railroad had a unique operational dilemma: The majority of its traffic was moved over long distances between the West Coast and the Midwest through daunting terrain. Almost at the midpoint of the system is Cheyenne, Wyoming and the Sherman Hill grade. Geographically, Cheyenne is located at the juncture between the plains of the Midwest and the foothills of the Rocky Mountain ranges. While not as dramatic as the Allegheny or Sierra grades, the line west of Cheyenne had long runs of 1.2% or better grades. The Union Pacific sought to operate long high-speed service through this challenging geography. For this reason, their best and most modern motive power was allocated to this division. Beginning with double-headed 2-8-0 Consolidations in the early twentieth century, heavier and more powerful locomotives were used, culminating with the signature Union Pacific three-cylinder 4-12-2. While they provided stellar service on the Sherman Hill route, these twelve-coupled locomotives

had reached the maximum size for a rigid wheelbase locomotive and required the Union Pacific to look for additional horsepower to increase over-the-road speed.

Arthur M. Fetters, general mechanical engineer for the UP, suggested redesigning the successful wheel arrangement of the 4-12-2 as a simple articulated. By splitting the wheelbase between two smaller frames, an advantage would be gained by the ability to add larger drivers to a shorter rigid wheelbase. This resulted in more speed with the added benefit of lighter side rods. These lighter side rods would minimize track damage at higher speeds since the entire mechanism would be easier to balance dynamically. The final complement to this concept would be the ability to add a larger firebox supported by a four wheel trailing truck, further enhancing steaming capabilities. Mr. Fetters and the designers from American Locomotive Company (Alco) finalized the design of what was to become one of the most widely recog-



| Challenger Locomotive Weights and Dimensions | |
|--|----------------------|
| Tractive force | 97,350 Lbs. |
| Cylinders, diameter and stroke (4) | 21 in. x 32 in. |
| Drivers, diameter | 69 in. |
| Total weight of engine | 634,500 Lbs. |
| Weight of tender (2/3 loaded) | 348,000 Lbs |
| Boiler diameter, first ring inside | 94-11/16 in. |
| Length over tube sheets | 20 ft. 0 in. |
| Driving wheel base, each | 12 ft. 0 in. |
| Total engine wheel base | 60 ft. 4 in. |
| Fuel | Soft coal/Oil |
| Grate area | 132.2 sq. ft. |
| Steam pressure | 280 Lbs. |
| Evaporative heating surface, firebox total | 554 sq. ft. |
| Evaporative heating surface, tubes and flues | 4,038 sq. ft. |
| Superheating surface, type A | 1,741 sq. ft. |
| Tender Capacity, centipede | 25,000 gal., 28 tons |



nized locomotives in the world. In 1936, the first group of locomotives with the 4-6-6-4 wheel arrangement was delivered to the Union Pacific Railroad. They were an immediate success and their roster grew to number 105 locomotives on the Union Pacific alone. This new wheel arrangement was given the name **“CHALLENGER”**. While the origin of the name is unclear, it proved to be an apt moniker.

The Challenger type of locomotive would serve until the end of mainline steam service. They were

assigned to railroads across the nation and under all operating conditions gave a good accounting of themselves. Two examples escaped dismantling. UP 3985 has been restored and joins UP 4-8-4 844 as the only two steam locomotives operated by a class 1 railroad today. The other, UP 3977, has been on display in North Platte, Nebraska since 1968 and has recently been refurbished by a group of dedicated railfan volunteers.

In 1936, the Union Pacific Railroad and Alco met the needs of increased speeds and tractive effort with the design of the Challenger. Today, the Athearn N-Scale 4-6-6-4 Challenger meets the needs of modelers and collectors by providing an N scale model that captures all nuances of the prototype, taking model steam realism to the next level.



THE MODELS

UNION PACIFIC



Union Pacific received its fourth order of Challengers in 1943, and its fifth order in 1944. These were improved from the earlier design based upon experience gained from the Big Boy 4-8-8-4 locomotive received in 1941. These locomotives featured double smoke stacks, centipede tenders and many parts common to the Big Boys. In 1952 engines from both orders were converted to burn oil and were renumbered in the 3700 series. They were commonly assigned to both passenger and freight movements on the system. Two examples survived the replacement of steam by diesels, with 3985 receiving a restoration by volunteer UP employees following years on display adjacent to the Cheyenne depot. The 3985 returned to special service during the early 1980s, with an oil conversion for the tender occurring in 1990.

Road Specific Features:

- 11802 CHALLENGER UP #3985 (FAN TRIP VERSION)
- 11805 CHALLENGER UP #3943 COAL & SMOKE DEFLECTORS
- 11806 CHALLENGER UP #3977 TWO TONE GRAY W/OIL TENDER
- 11808 CHALLENGER UNDECORATED UNION PACIFIC LATE
- 11810 CHALLENGER UP #3964 ALL BLACK, COAL
- 11811 CHALLENGER UP #3975 TWO TONE GRAY W/OIL TENDER
- 11812 CHALLENGER UP #3958 ALL BLACK, COAL
- 11813 CHALLENGER UP #3983 TWO TONE GRAY W/OIL TENDER

Rio Grande

In 1943, to meet the demands of increased war-time traffic, Rio Grande requested more Baldwin 4-6-6-4s similar to those previously received from this builder. Instead, the War Production Board diverted six Alco locomotives from an order then in production for the Union Pacific. These locomotives were in turn leased from the Defense Plant Corporation by the D&RGW. Classified as L-97 locomotives, and assigned numbers 3800 through 3805, these engines spent the duration of World War II lifting heavy ferrying freight trains over the Rocky Mountains. When the war ended in 1945 and rail traffic levels returned to normal, the half-dozen L-97s were deemed surplus and, in 1946, returned to the War Assets Administration. The following year, these workhorses were sold to the Clinchfield Railroad.

Road Specific Features:

- 11801 CHALLENGER UNDECORATED UP/RIO GRANDE VERSION
- 11803 CHALLENGER DENVER & RIO GRANDE WESTERN #3802
- 11809 CHALLENGER DENVER & RIO GRANDE WESTERN #3804



CLINCHFIELD



The Carolina, Clinchfield & Ohio was a latecomer to the railroad scene. Completed in 1909, it was built for the purpose of hauling Kentucky and West Virginia coal. As a coal hauler it would at first appear that the high stepping 4-6-6-4s would be out of place in this environment. However, in 1942, the Clinchfield received an order of eight Alco Challengers to handle increased wartime traffic. This first order proved very successful so, in 1947 when six more locomotives became available through the War Assets Administration, Clinchfield acquired them. Originally assigned to the Rio Grande, these engines were numbered 670-675. They are unique in that, shortly after delivery, their double smoke stacks were replaced by large single stacks .

Road Specific Features:

- 11800 CHALLENGER UNDECORATED CLINCHFIELD VERSION
- 11804 CHALLENGER CLINCHFIELD #670 WITH SINGLE STACK
- 11807 CHALLENGER CLINCHFIELD #672 WITH SINGLE STACK



Model Features

The Athearn N-Scale 4-6-6-4 Challenger is the culmination of the art of design and tooling integrating the latest innovations in electronic technology. The Challenger model has been developed from its inception as the finest three dimensional operating miniature representation of the prototype available.

Enclosed in the premium quality box are the following items:

1. History and Instruction Book that includes a warranty and instruction card
2. N scale 4-6-6-4 Challenger Locomotive
3. N scale tender with full electronics package installed
4. Hand Held Wireless DC Controller

Upon inspecting the locomotive and tender note the many details that have been incorporated in its construction.

Locomotive and tender features

- Boiler backhead with full details
- Individually applied detail parts such as piping, valves, generators, etc.
- Blackened metal wheels.
- Eccentric cranks operating on both sides in correct direction.
- Minimal compromise on wheel diameter (about 1" only).
- Front and rear engines (cylinders and coupled drive wheel sets) both pivot in order to manage 11" radius curves. Although the locomotive runs on 11" (279.4 mm) radius curves, we strongly recommend to operate your Challenger on at least 15" (381 mm) radius track.
- Pilot has open/closed positions. Coupler pocket can be inserted to mount coupler.
- Headlights and tender lights have directional light change.
- Five-pole, skewed armature motor with two fly-wheels with very smooth-running features.

- Each undecorated version includes all parts for that specific version.
- 5-pin connector plug between loco and tender.
- Current pick-up on all 12 driver wheels and 8 tender wheels.
- Drawings for spare part replacement are shown on pages, 12, 13 and 15. Disassembly of this locomotive is not very easy and great care should be taken if you attempt this.
- Detailed instruction sheets with exploded view drawings and history booklet.

Prototype Specific Features

- Single or twin smoke stacks.
- Coal load or oil bunkers.
- Wood tender deck.
- Smoke deflectors.
- Closed or open cab.



Sound and DCC Features

The installation of sound in a locomotive adds a new dimension to operation. Sound makes a technically perfect static model come alive and enhances the experience of operation. You will find that you will no longer 'run' the engine but, rather, operate it in the context of your layout. Whether you are using conventional DC control or a DCC system, the incorporation of advanced electronic technology will provide the ultimate railroading experience.

The Athearn N-Scale Challenger Locomotive includes a factory installed DCC and sound board with speakers. The board is mounted in the tender. The DCC decoder automatically senses the power supply type (either DC or NMRA compliant DCC system) that is being used and will operate without intervention from the user.

Hand-Held Wireless Controller

Included with the Challenger locomotive is a hand-held wireless controller. When operating on conventional DC, this control unit is designed specifically to allow control of the speed and direction of the locomotive as well as these six individual sound functions:

- Bell
- Whistle
- Water Injector
- Air Release
- Blower Hiss
- Fire Box Door

These are more sound features than have been previously available to the conventional DC sound user in any format. The Athearn N-Scale Challenger Locomotive will operate on DC without the use of this hand held, however, only the steam chuff sounds will be available in this operational mode.



The 12-volt transmitter battery # A23-12, is available at any electronics or office supply store.

DCC Features:

The decoder provided with the Athearn N-Scale Challenger Locomotive will operate with any NMRA compatible DCC system. The default setting is address 3. The decoder is rated at 1.5 amps and will support either 2 or 4 digit addresses. The decoder functions are fully programmable by the adjustment of CVs. A CV table is included in the operating instructions. Either 14 speed steps or 28/128 speed steps are supported by this system. Available accessory and sound functions are as follows:

- Directional Lighting
- Whistle
- Coupling
- Conductor's Voice
- Sound On/Off
- Water Injector
- Cylinder Cock/Flange squeal
- Bell
- Air Release
- Brake Squeal
- Fire Box Door
- Sand Release
- Blower Hiss

In addition to Function 0 (Directional lighting) there are 28 additional sound functions to allow the operator to capture the full range of unique sounds found on an operating steam locomotive. You can now fully immerse yourself in the complexities of prototype operation and add a new level of realism to your railroading experience.

Dual-Function decoder is made by Model Rectifier Corporation for Athearn, Inc.

OPERATION

Caution: This locomotive is a very delicate model. Please be careful when handling it and placing it on the track.

Your new Athearn N-Scale Challenger Locomotive comes factory equipped with a state-of-the-art Dual Function decoder. This means your locomotive will run on any NMRA compatible DCC system or on any regular DC Train Control (HO power pack).

ATTENTION D.C. POWERPACK USERS

To avoid damaging the decoder in this locomotive, we recommend that once bringing the locomotive to it's idle setting, [approx. 50% throttle], wait at least 3 seconds before running the loco at it's maximum recommended voltage level. Older power packs can exhibit a "no-load" voltage spike for a few seconds which can damage the circuitry in the decoder.

Caution: Do not run your new Athearn N-Scale Challenger Locomotive on any G scale or high power HO power pack. You may damage the locomotive circuitry.

When running on a DC power pack, this locomotive features a wireless radio control. This makes accessing the sound functions and running the locomotive more convenient when following your train around the layout. The transmitter (battery not included) that comes with your locomotive has the following functions:

1. Button 1 will start or stop the bell sounds.
2. Button 2 will operate the steam whistle.
3. Button STP will bring the locomotive to a gradual stop. This is a built in safety feature. Press Button STP while the locomotive is stopped and you will hear the water injector sound.
4. Button 4 will accelerate the locomotive. When the locomotive has reached its maximum speed, pressing

Button 4 will activate the sound of the fire box door opening and closing.

5. Button 3 will decelerate the locomotive. Press Button 3 when the locomotive is stopped and you will hear an air release sound.
6. Button 5 (pressed while the locomotive is moving) will slow the locomotive down, change its direction and speed it up. This is also a built in safety feature. Press Button 5 when the locomotive is in idle (25%–35% throttle setting) to activate the blower hiss sound.

Note: There are two idle settings that enable various sounds to be controlled while the engine is standing still. To activate "Idle #1" set the power pack's throttle setting at the 25%–35% position, being sure to keep the transmitter's speed regulator setting off. In "Idle #1" the following sounds can be activated: bell, whistle, water injector, air release, blower hiss and fire box door. To access the "Idle #2" setting, set the power pack's throttle to 100% (again, keeping the transmitter's speed regulator off). While in "Idle #2" the same sounds can be activated with the transmitter, with the exception of the fire box door.

DC Operation-Analog Mode

To set up your Hand Held Controller and operate your locomotive with a DC power pack, follow these easy directions:

1. Install the battery in the transmitter.
2. Connect the wires from your DC power pack's "variable track terminals" to your track.
3. Place the locomotive on the track making sure all wheels are aligned correctly to avoid short circuits, which can possibly damage your locomotive circuitry and power pack.

4. Turn the switch on the power pack to ON.

5. Slowly adjust the throttle until you hear the locomotive begin to idle. Only during idle can you use the direction switch on the power pack to change the locomotive's direction. Either the headlight or back-up light will illuminate to indicate the locomotive's direction. Once the locomotive begins moving, you cannot use the direction switch on the power pack to change direction. You can only use transmitter to change the locomotive direction while it is moving. This feature allows you to control another analog locomotive on the same track.

6. Your new Athearn N-Scale Challenger Locomotive will always remember its last direction of operation regardless of the position of the direction switch on the power pack.

7. When you use the power pack's throttle to control the locomotive's speed, the top speed will be limited by the transmitter's speed setting.

8. When you use the transmitter to control the locomotive's speed, the top speed will be limited by the power pack's throttle setting.

9. If the locomotive's top speed is too low, do not set the power pack's throttle to maximum. We recommend you set the throttle to 60%-70% and use the transmitter to control the locomotive speed. This will give you the best operation range.

10. Never exceed 18 volts D.C. to the track in analog operation. Excessive track voltage may damage the locomotive's circuitry. Never try to operate the locomotive on A.C. power.

11. If the transmitter's range begins to decrease, the battery needs to be replaced.

12. We recommend you always use the power pack's throttle to control the locomotive speed. Not only will you get a smoother speed control, but the battery life



will be extended.

13. Whenever you feel that the locomotive is not operating properly you should move the throttle to zero or 25%-35% throttle setting (depending on your power pack) and slowly move the throttle up again to control the locomotive.

Programming in Analog Mode

While in analog mode, you can program the chuff rate and the sound volume.

1. Place the locomotive on track.
2. Turn the power switch on the power pack to ON.
3. Slowly turn throttle until sounds come on.
4. Leaving the throttle where it is, shut off the power switch on the power pack.
5. Hold down the STP button while turning the power switch back on. Locomotive will say "Program." You are now in the analog programming mode.
6. Press Button 4 or Button 3 to speed up or reduce the chuff rate, respectively. Each press of the button

adjusts the chuff rate up or down by one unit. Each time you will hear the locomotive say "program."

7. Press Button 5 to toggle between volume settings. You will hear the locomotive say "program" with the new volume settings.
8. To reset the locomotive back to its factory defaults: Press the STP button five (5) times. Wait at least 2 seconds between presses. After each press the locomotive will say "program." After the 5th press, you will hear "program" followed by steam hiss. This confirms that the reset process is completed.
9. Once finished programming, turn the power switch on the power pack to OFF. This will reset the locomotive and lock in your programming. To resume operation, follow the steps under "DC Operation".

TIPS for Analog Operation

1. Turn up the throttle until sounds start and locomotive idles.
2. Select the locomotive's direction either by the direction switch on the power pack or by the transmitter.

3. Slowly start your locomotive moving by using the power pack's throttle to set desired top voltage setting.
4. Once underway, use the transmitter Button 4 to speed up or Button 3 to slow down. Hold down the button until you reach the desired speed.
5. If the top voltage setting at maximum speed is too low, use the power packs throttle to adjust the top voltage setting.
6. To conserve battery, use the throttle to control locomotive speed and use the transmitter to activate sounds.
7. The locomotive can be operated with either the power pack's throttle or with the radio transmitter (included with your model) -- or both. If, while operating with the transmitter, you wish to resume running with the power pack while the locomotive is moving, flip the direction switch on the power pack once (this will re-acquire the locomotive to the power pack's throttle). To resume running with the transmitter, just start using the transmitter's speed, stop, or direction buttons.

8. When finished running your locomotive, turn your power pack throttle to OFF and turn off the power pack's power switch. Any programming changes made in DC analog mode will affect any prior DCC mode settings.

DCC Operation- Digital Mode

Your new Athearn N-Scale Challenger Locomotive will operate on any NMRA compatible DCC system. The dual-function decoder has the following features:

- Synchronized steam chuff with random sounds
- 1.5 amp capacity
- Programmable for either 2 digit, (1-127) or 4 digit, (1-9,999) addresses
- Programmable start voltage
- Programmable acceleration rate
- Programmable deceleration rate
- Programmable top voltage
- Programmable chuff rate
- Programmable volume
- Programmable 14-28/128 speed steps
- Directional lighting (FØ)
- 28 accessory sound functions, (F1-F28)
- Advanced consisting (CV19)
- OPS mode programming
- Compatible with NMRA DCC. standard
- Complies with Part 15 of F.C.C.Rules

Operation

The Athearn N-Scale Challenger Locomotive can be operated with the steam sounds on or off. Double clicking your headlight button (FØ) will turn the steam sounds on or off. When the steam sounds are turned off, all associated sounds are also turned off.

Programming for DCC Operation - Digital Mode

This decoder supports all program methods including register mode, paged mode, CV programming, direct mode and programming on the main (OPS mode programming).

Program the locomotive the same way you would program any other NMRA compatible decoder with your DCC system.

Additional Information

The dual-function decoder installed in this locomotive should perform well when used with any NMRA compatible DCC system. See your DCC manual on how to program and operate the decoder. For more information about Register/CV's and their functions, please refer to the NMRA DCC standards and recommended practices, RP-9.2.2. This is available directly from NMRA or on their website at www.nmra.org.

Note: Due to the higher track voltages associated with DCC systems made for HO and larger scales (16 volts vs. 12 volts for N-scale), the best slow speed performance for any decoder equipped N scale loco can be achieved by either using a lower voltage input power supply or by purchasing an Model Rectifier Corporation "Universal Voltage Reducer" (part # AT880). This product lowers the track voltage by approximately 4 volts, and will give you full throttle control without exceeding the models 12 volt voltage limit.

FCC Compliance

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions; 1) This device may not cause harmful interference, and 2) This device must accept any interference received, including interference that may cause undesirable operation.

Battery Type # A23 12 volt



LUBRICATION & MAINTENANCE

Lubrication and Maintenance of the Athearn N-Scale 4-6-6-4 Challenger

The Athearn N-Scale Challenger Locomotive has been carefully engineered to provide years of trouble free operation. However, as with all things mechanical, a small amount of care and maintenance is required to insure the flawless operation of this fine model. These simple procedures will provide the necessary information to give you years of trouble-free enjoyment.

Care and Cleaning

Dust and debris are among the leading contributors to poor operation of any miniature mechanism. To maintain the quality performance of your locomotive, inspection and cleaning should be performed on a regular basis. A soft bristle brush should be used to remove dust from the superstructure. The use of soaps, solvents or detergents is not recommended for this purpose as they will have a tendency to mar the finish.

When not in use it is recommended that the locomotive and tender be stored in the protective sleeve in which it was packed. Also, store the wireless controller in the locomotive box with the battery removed.

When inspecting the underframe, make sure that all lint and dust are removed from the back of all wheel sets. Dirt build up in this area will foul the pick-up wipers and not allow proper electrical contact, negatively impacting performance.

Wheel Cleaning

The Athearn N-Scale Challenger Locomotive receives electric power from all drivers as well as eight of the tender wheels from both rails. This, coupled with the long overall wheelbase, provides for excellent electrical

contact. There should be few cases of erratic performance due to poor contact. However, over time, dirt from the rails will accumulate on the wheel surfaces and will need to be removed to assure peak operation. The use of a cotton swab to apply either alcohol or a good quality track cleaning solution is recommended. Carefully apply the solvents, taking care not to spill any on the painted surfaces. Alternatively, either an ink eraser or 'Bright Boy' abrasive block can be used to remove dirt deposits by carefully burnishing the wheel surfaces. When cleaning the wheels, also remove any dirt build up from the metal surfaces on the back rims of the wheels. This will assure that the wiper contacts will maintain good contact with the wheels.

Lubrication

This locomotive will arrive pre-lubricated from the factory and will not need additional lubrication until it has been run for quite some time. When it comes time to lubricate the locomotive, use only light weight oil and gear grease that is plastic compatible. Use a minimum amount. The plastics used for many of the components, such as the gears and drive lines, make them inherently self lubricating. Remember that too much lubrication can be more detrimental to the locomotive than too little.

The main points of lubrication, and type of lubricant are as follows:

- Axle bearings on the drivers — light oil
- Armature bearings on the motors — light oil
- Oil light bearings on the worm gear shafts — light oil
- Bearings on the centipede tender wheels — light oil
- Side rods at the crank pins — light oil
- Gear towers — light gear grease

By following the exploded drawings, access to each of these areas should be easily accomplished. If you are

not comfortable with disassembling this locomotive for lubrication take it to one of the many Model Railroad hobby shops that can provide this service.

Coupler Installation

The Athearn N-Scale Challenger model comes with the swivel coupler installed on the pilot. As on the prototype engines, you can have the coupler exposed on the pilot, or swing it around so that the pilot has no coupler in use. The "coupler" on this part is a dummy (non-operating) coupler.

An operating coupler can be installed on the pilot. Simply unscrew and remove this dummy coupler.

Replacing the Traction Tire

To provide tractive effort that rivals the prototype, four traction tires are factory installed.

To replace a worn or loose traction tire:

- Remove the crank pin nuts from the traction tire equipped driver.
- Loosen the remaining crank pin screws from the other drivers.
- Remove the eccentric crank, main rods, bushing and drive rod from the crank pin on the traction tire equipped driver.
- Slide off the traction tire and replace with a new tire.
- Reverse the procedure of disassembly.

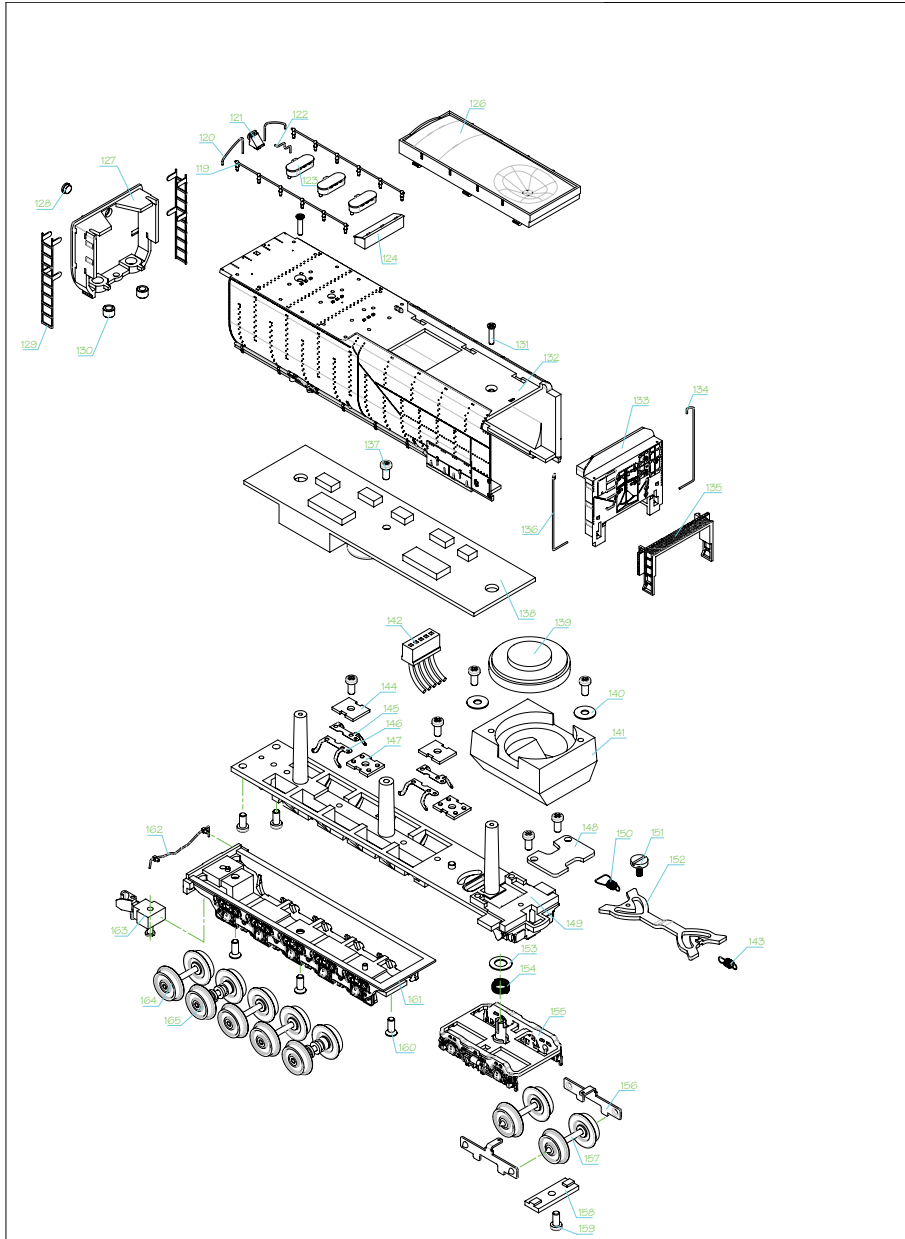
Replacement parts are available from Athearn Trains to the original purchaser for warranty repairs only. A warranty registration form must be on file at Athearn Trains to honor any parts requests.

| STEAM SOUNDS CHART | |
|---|---|
| Function | Idle/Moving |
| Double click F0 | Master Volume Control (4 Steps, same as F12) |
| F1 | Bell on/off |
| F2 | Whistle |
| F3 | Air release |
| F4 | Coupling |
| F5 | Brake squeal (repeat press will increase length) |
| F6 | Conductor |
| F7 | Fire box door open and close |
| F8 | Whistle type select |
| F9 | Steam associated sound |
| F10 | Water |
| F11 | Blower hiss |
| F12 | Master Volume Control (4 steps, off, min, mid, max) |
| F13 | Coal auger |
| F14 | Air hose firing |
| F15 | Air Release |
| F16 | Shoveling |
| F17 | Safety Air Pump |
| F18 | Sand |
| F19* | Bell type select |
| F20* | Bell Ring Rate |
| F21* | Bell Volume |
| F22 | Whistle Volume Control |
| F23 | Chuff Volume Control |
| F24 | Chuff Type |
| F25 | Air Brake Release |
| F26 | Coupler |
| F27 | Fire box door close |
| F28 | Firebox door open |
| | |
| Note: There are only a few DCC Systems on the market that can access functions higher than F12 | |
| *Note: F1 [Bell] does not have to be activated when using F190, F20 and F21. The Bell will come on automatically. Use F1 to turn off after using these functions for Bell adjustment. | |

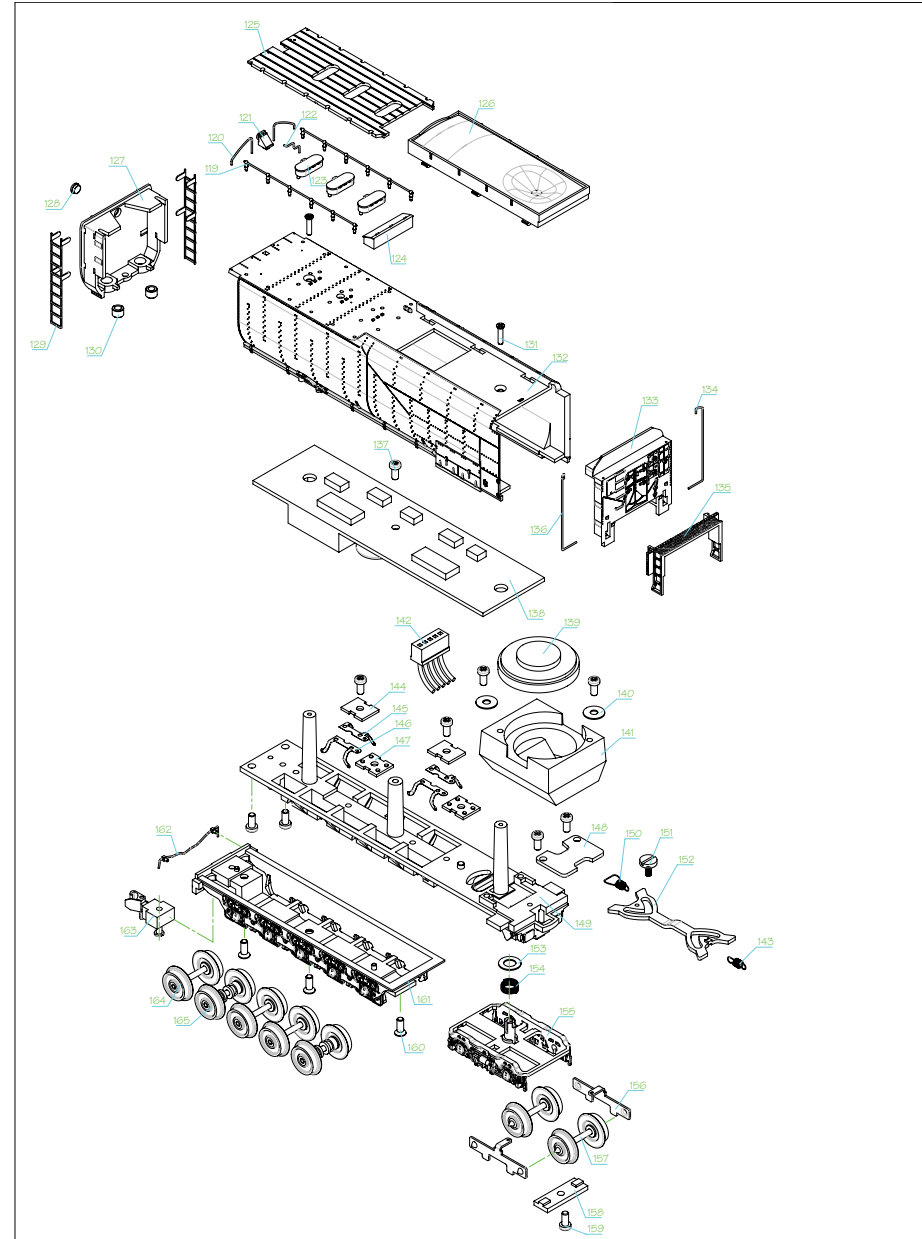
| CV CHART | | | | |
|----------|----------|--|---------|---------|
| CV | Register | Description | Range | Default |
| CV1 | R1 | Short address | 1-127 | 3 |
| CV2 | R2 | Start voltage | 0-32 | 0 |
| CV3 | R3 | Acceleration | 0-32 | 8 |
| CV4 | R4 | Deceleration | 0-32 | 8 |
| CV5 | --- | Top voltage | 0-32 | 24 |
| --- | R6 | Page number | --- | --- |
| CV29 | R5 | Basic configuration | --- | 2 |
| CV7 | R7 | Manufacturer version number | --- | 32 |
| CV8 | R8 | Manufacturer ID | --- | 143 |
| CV17 | --- | Long address upper byte | 192-231 | 192 |
| CV18 | --- | Long address lower byte | 0-255 | 3 |
| CV19 | --- | Advanced consist address | 0-127 | 0 |
| CV21 | --- | When CV21=0, all accessory functions will follow its own address. When CV21=1, all functions will follow the consist address | 0-1 | 0 |
| CV49 | | Master Volume Control (0=off, 1=low, 2=mid, 3=max) | 0-3 | 2 |
| CV50 | --- | Whistle type | 0-14 | 0 |
| CV51 | --- | Whistle volume | 0-3 | 3 |
| CV52 | --- | Bell type | 0-3 | 0 |
| CV53 | --- | Bell volume | 0-3 | 3 |
| CV54 | --- | Bell ring rate | 0-50 | 10 |
| CV55 | --- | Chuff type | 0-3 | 0 |
| CV56 | --- | Chuff volume | 0-3 | 3 |
| CV57 | --- | Brake squeal volume | 0-3 | 1 |
| CV58 | --- | Air release volume | 0-3 | 3 |
| CV59 | --- | Blower hiss volume | 0-3 | 3 |
| CV60 | --- | Fire box door volume | 0-3 | 3 |
| CV61 | --- | Injector volume | 0-3 | 3 |
| CV62 | --- | Coupling volume | 0-3 | 3 |
| CV63 | --- | Air pump volume | 0-3 | 0 |
| CV105 | --- | User identification number | 0-255 | 0 |
| CV106 | --- | User identification number | 0-255 | 0 |
| CV112 | --- | Conductor volume | 0-3 | 3 |
| CV114 | | Air pump type | 0-3 | 1 |
| CV118 | --- | Shoveling volume | 0-3 | 3 |
| CV119 | --- | Coupling fire volume | 0-3 | 3 |

| CV | Register | Description | Range | Default |
|-------|----------|---|-------|-------------|
| CV120 | --- | Chuff rate | 0-30 | 12 |
| CV121 | --- | Chuff start point adjustment | 0-7 | 3 |
| CV122 | | Double chuff enable | 0-1 | 1 (enable) |
| CV123 | | Load Control on/off (1=on) | 0-1 | 0 (disable) |
| CV124 | | Speed curve select (0=linear, 1=slow increase at slow speed, 2=fast increase at slow speed) | 0-2 | 0 |
| CV125 | --- | Factory default setting: Program it to 1 will restore all the CV to default setting | --- | 0 |

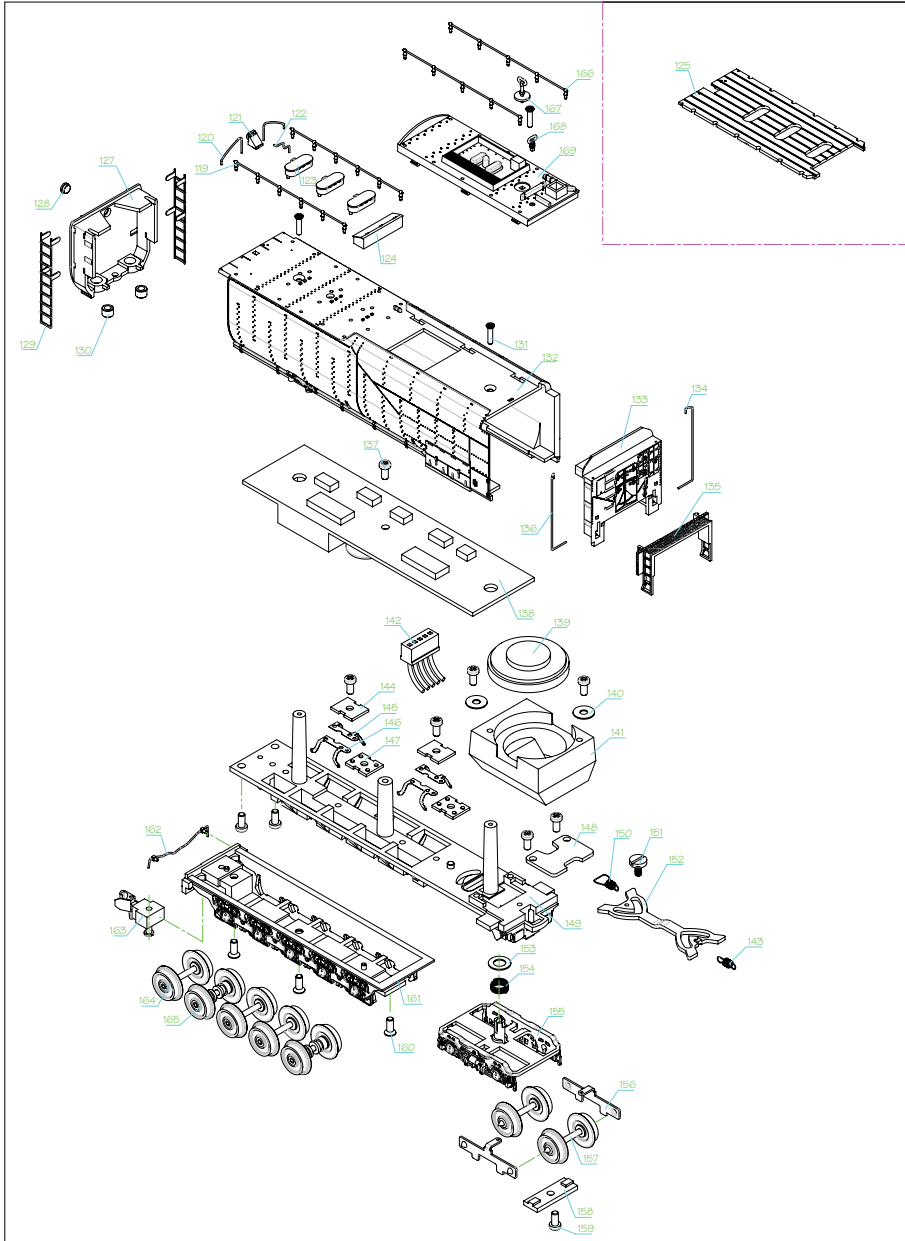
COAL TENDER



COAL TENDER with WOOD DECK



OIL TENDER



| Item # | Description | QTY |
|--------|-----------------------------|-----|
| 119 | Tender Handrail Top | 2 |
| 120 | Tender Handrail Rear Top | 2 |
| 121 | Tender Backup Light Base | 1 |
| 122 | Tender Backup Light Wire | 1 |
| 123 | Tender Manholes | 3 |
| 124 | Tender Toolbox | 1 |
| 125 | Tender Wood Plank | 1 |
| 126 | Coal Load | 1 |
| 127 | Tender Cover Rear | 1 |
| 128 | Tender Light Rear | 1 |
| 129 | Tender Ladder | 2 |
| 130 | Tender Screw Sleeve | 2 |
| 131 | Screw | 2 |
| 132 | Tender Body | 1 |
| 133 | Tender Cover Front | 1 |
| 134 | Tender Handrail Front Left | 1 |
| 135 | Tender Front Platform | 1 |
| 136 | Tender Handrail Front Right | 1 |
| 137 | Screw | 9 |
| 138 | Tender PC Board | 1 |
| 139 | Speaker | 1 |
| 140 | Washer | 2 |
| 141 | Speaker Base | 1 |
| 142 | Plug | 1 |
| 143 | Spring A for Draw Bar | 1 |
| 144 | Fix Plate | 1 |
| 145 | Pick Up Plate Left | 2 |
| 146 | Pick Up Plate Right | 2 |
| 147 | Isolator Plate | 2 |
| 148 | Coupler Cover | 1 |
| 149 | Tender Chassis | 1 |
| 150 | Spring A for Draw Bar | 1 |

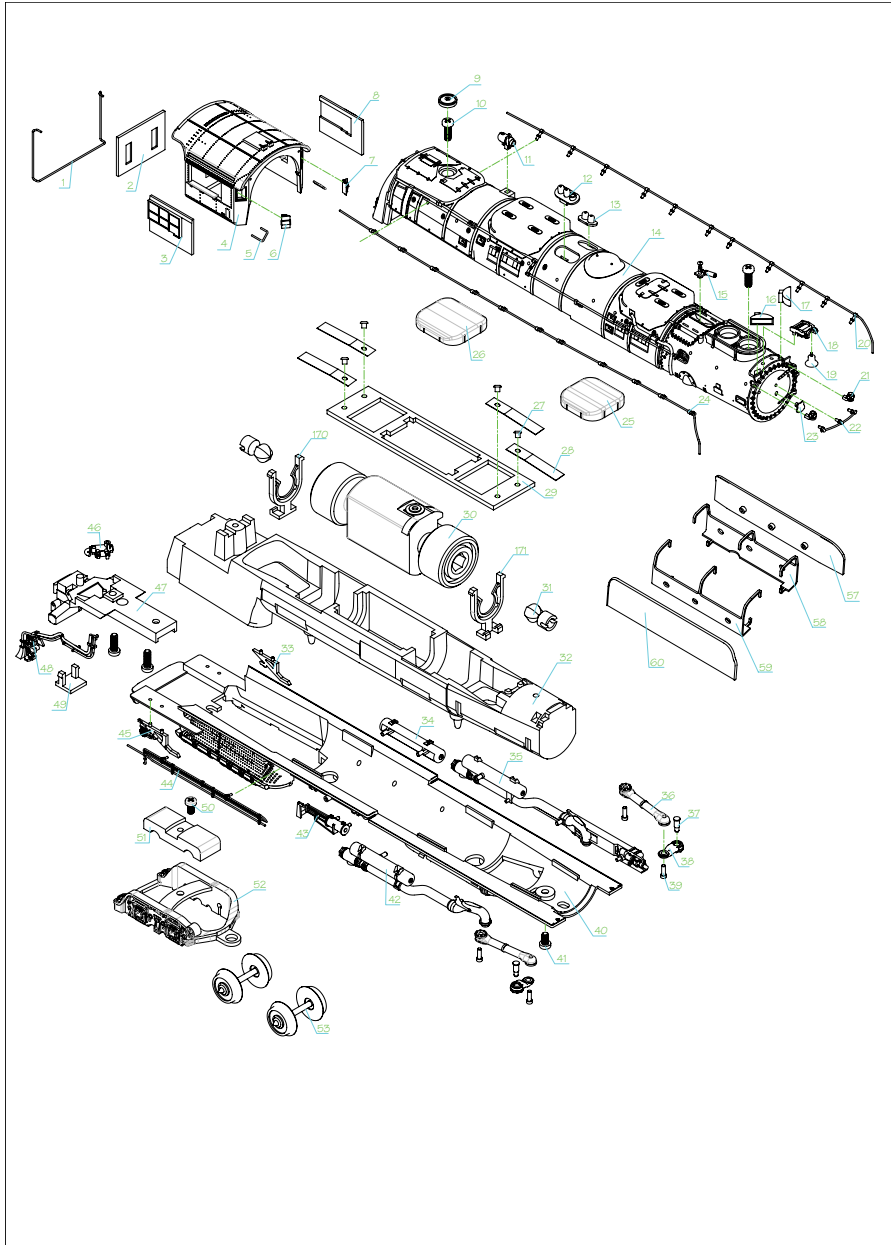
| Item # | Description | QTY |
|--------|--------------------------------------|-----|
| 151 | Tender Couple Pin | 1 |
| 152 | Draw Bar | 1 |
| 153 | Washer | 1 |
| 154 | Tender Spring | 1 |
| 155 | Tender Trailing Truck | 1 |
| 156 | Tender Pick Up Plate | 2 |
| 157 | Tender Trailing Wheel Assembly | 2 |
| 158 | Truck Fix Plate | 1 |
| 159 | Screw | 1 |
| 160 | Screw | 2 |
| 161 | Tender Truck | 1 |
| 162 | Tender Lift Bar | 1 |
| 163 | Micro-Train Coupler (1015) | 1 |
| 164 | Centipede Wheel Assembly | 3 |
| 165 | Centipede Wheel w/ Bearings Assembly | 2 |
| 166 | Oil Bunker Handrail | 2 |
| 167 | Oil Bunker Part #1 | 1 |
| 168 | Oil Bunker Part #2 | 1 |
| 169 | Oil Bunker | 1 |
| 170 | Tender side handrail | 2 |
| 171 | Tender Body | 1 |

SUPERSTRUCTURE PARTS LIST

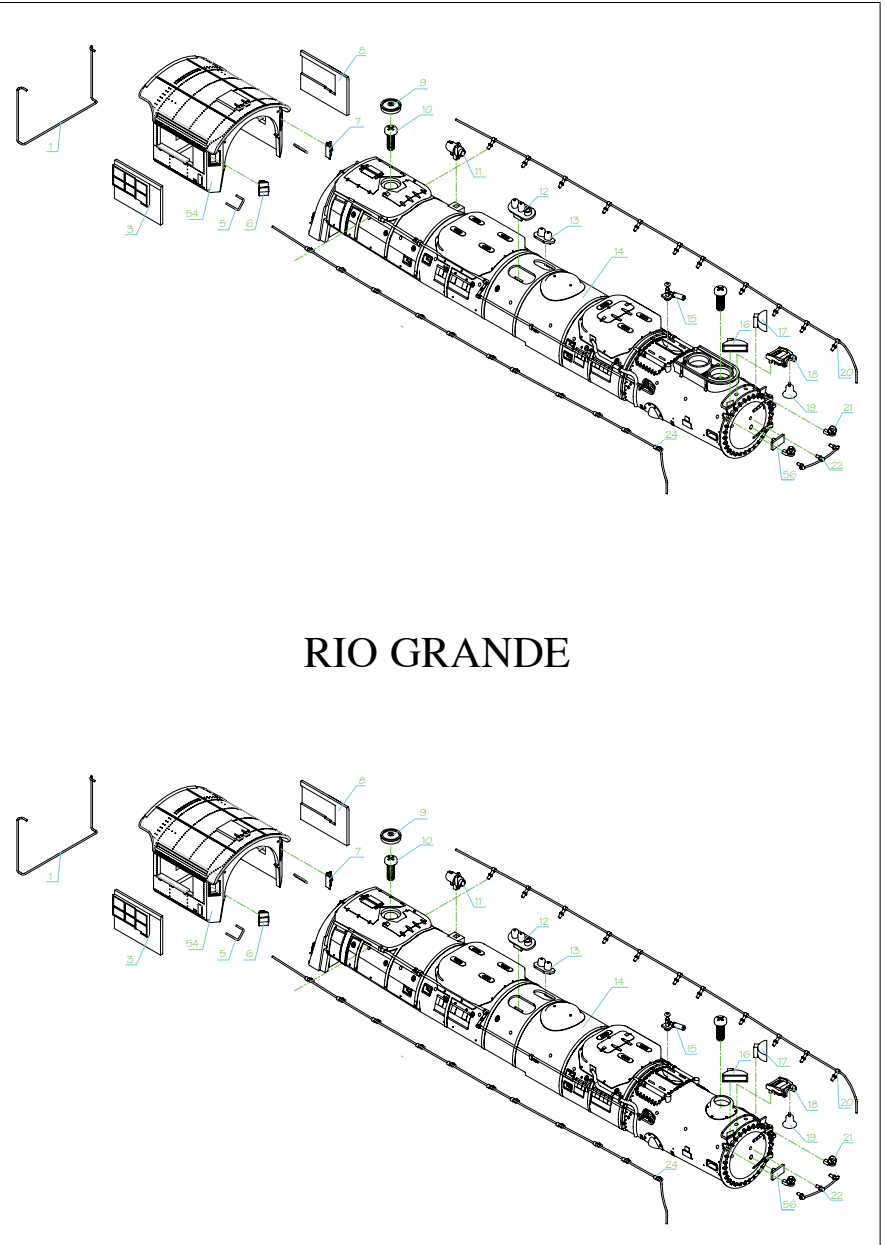
| Item # | Description | QTY |
|--------|--------------------------------|-----|
| 1 | Cab Handrail Rear | 1 |
| 2 | Cab Door & Window Glass Rear | 1 |
| 3 | Cab Window Glass Side Right | 1 |
| 4 | Closed Cab | 1 |
| 5 | Cab Handrail Front | 2 |
| 6 | Cab Window Glass Front Right | 1 |
| 7 | Cab Window Glass Front Left | 1 |
| 8 | Cab Window Glass Side Left | 1 |
| 9 | Boiler Half-Top | 1 |
| 10 | Screw | 4 |
| 11 | Generator (Single) | 1 |
| 12 | Whistle-Triple | 1 |
| 13 | Whistle-Double | 1 |
| 14 | Boiler-Double Stack | 1 |
| 15 | Safety Valve | 1 |
| 16 | Numberboard Right | 1 |
| 17 | Numberboard Left | 1 |
| 18 | Bell Support | 1 |
| 19 | Bell | 1 |
| 20 | Boiler Handrail Left | 1 |
| 21 | Marker Light | 2 |
| 22 | Smoke Box Door Grabiron | 1 |
| 23 | Union Pacific Numberboard | 1 |
| 24 | Boiler Handrail Right | 1 |
| 25 | Forward Dome Weight | 1 |
| 26 | Rear Dome Weight | 1 |
| 27 | Eyelet | 4 |
| 28 | Contact Plate for PC Board | 4 |
| 29 | Locomotive PC Board | 1 |
| 30 | Motor Assembly | 1 |
| 31 | Join Head for Motor | 2 |
| 32 | Boiler Weight | 1 |
| 33 | Cab Support Left | 1 |
| 34 | Air Tank Rear Left | 1 |
| 35 | Piping for Rear Cylinder Left | 1 |
| 36 | Link Bar for Front Cylinder | 2 |
| 37 | Pin for Front Cylinder | 2 |
| 38 | Piping for Front Cylinder | 2 |
| 39 | Pin for Link Bar | 4 |
| 40 | Boiler Bottom | 1 |
| 41 | Screw | 1 |
| 42 | Piping for Rear Cylinder Right | 1 |
| 43 | Reverse Cylinder | 1 |

| Item # | Description | QTY |
|--------|---------------------------|-----|
| 44 | Piping Outside Firebox #2 | 1 |
| 45 | Cab Support Right | 1 |
| 46 | Water Pump | 1 |
| 47 | Frame | 1 |
| 48 | Piping Outside Firebox #1 | 1 |
| 49 | Wire Cover | 1 |
| 50 | Screw | 1 |
| 51 | Trailing Truck Weight | 1 |
| 52 | Trailing Truck | 1 |
| 53 | Trailing Wheel Assembly | 1 |
| 54 | Open Cab | 1 |
| 55 | Boiler-Single Stack | 1 |
| 56 | Rectangular Numberboard | 1 |
| 57 | Smoke Deflector Right | 1 |
| 58 | Steel Support Right | 1 |
| 59 | Steel Support Left | 1 |
| 60 | Smoke Deflector Left | 1 |
| 170 | Motor Saddle (Large Hole) | 1 |
| 171 | Motor Saddle (Small Hole) | 1 |

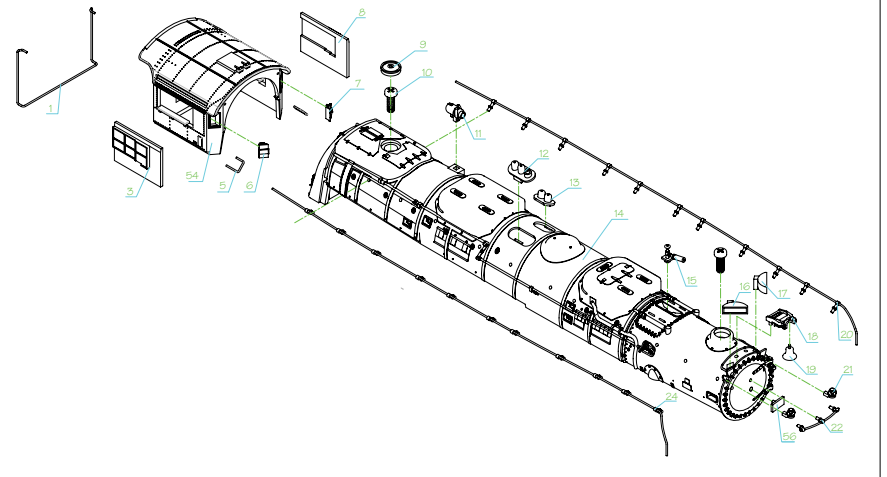
UNION PACIFIC



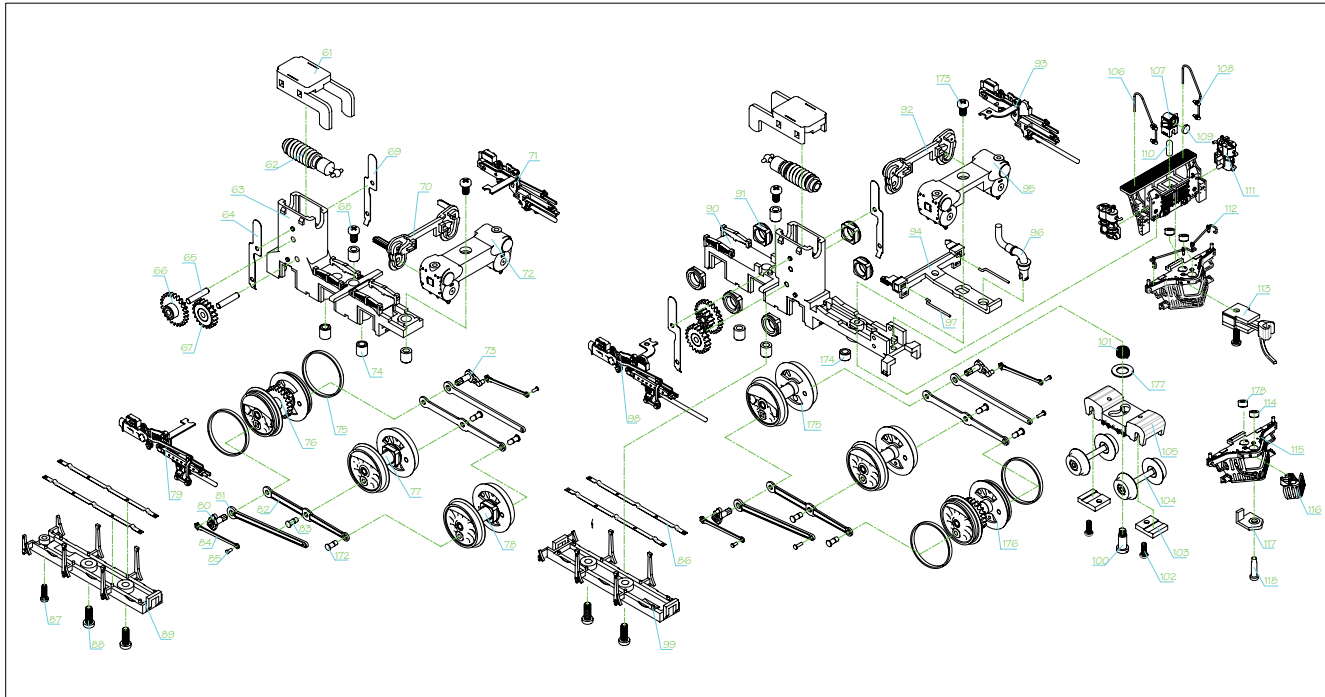
CLINCHFIELD



RIO GRANDE



RUNNING GEAR



| Item # | Description | QTY |
|--------|------------------------------------|-----|
| 61 | Worm Cover | 2 |
| 62 | Worm Assembly | 2 |
| 63 | Rear Gear Box | 2 |
| 64 | Contact Plate Right | 2 |
| 65 | Gear Shaft | 4 |
| 66 | Compound Gear | 2 |
| 67 | Idler Gear | 2 |
| 68 | Screw | 3 |
| 69 | Contact Plate Left | 2 |
| 70 | Rear Cylinder Cover Left | 1 |
| 71 | Expansion Link Assembly Rear Left | 1 |
| 72 | Rear Cylinder | 1 |
| 73 | Crank Left | 2 |
| 74 | Brass Sleeve 2# | 7 |
| 75 | Tire | 4 |
| 76 | Rear Driving Wheel Assembly | 2 |
| 77 | Middle Wheel Assembly | 2 |
| 78 | Rear W/O Driving Wheel Assembly | 1 |
| 79 | Expansion Link Assembly Rear Right | 1 |

| Item # | Description | QTY |
|--------|-------------------------------------|-----|
| 80 | Crank Right | 2 |
| 81 | Main Rod | 4 |
| 82 | Side Rod | 4 |
| 83 | Pin for Side road | 4 |
| 84 | Small Rod #2 | 4 |
| 85 | Pin #1 | 12 |
| 86 | Pick Up Plate for Gear Box | 4 |
| 87 | Screw | 1 |
| 88 | Screw | 4 |
| 89 | Rear Gear Box Cover | 1 |
| 90 | Front Gear Box | 1 |
| 91 | Bearing | 12 |
| 92 | Front Cylinder Cover | 1 |
| 93 | Expansion Link Assembly Front Left | 1 |
| 94 | Front Piston Track Fix Support | 1 |
| 95 | Front Cylinder | 4 |
| 96 | Piping Under Smoke Box | 1 |
| 97 | Piston Track Shaft | 1 |
| 98 | Expansion Link Assembly Front Right | 1 |

| Item # | Description | QTY |
|--------|--------------------------------|-----|
| 99 | Front Gear Box Cover | 1 |
| 100 | Screw for Leading Truck | 1 |
| 101 | Spring for Leading Truck | 1 |
| 102 | Screw | 2 |
| 103 | Leading Truck Cover | 2 |
| 104 | Leading Wheel Assembly | 2 |
| 105 | Leading Truck | 1 |
| 106 | Pilot Handrail Right | 1 |
| 107 | Head Light | 1 |
| 108 | Pilot Handrail Left | 1 |
| 109 | Front Light Glass | 1 |
| 110 | Bulb | 1 |
| 111 | Compressor | 2 |
| 112 | Cowcatcher Lift Bar | 1 |
| 113 | Micro-Train Coupler (1016-1) | 1 |
| 114 | Brass Sleeve #1 | 1 |
| 115 | Pilot | 1 |
| 116 | Dummy Swivel Cover | 1 |
| 117 | Support for Dummy Swivel Cover | 1 |

| Item # | Description | QTY |
|--------|----------------------------------|-----|
| 118 | Screw | 1 |
| 172 | Pin #1 for Side Rod | 4 |
| 173 | Screw | 1 |
| 174 | Brass Sleeve #2 | 1 |
| 175 | Front W/O Driving Wheel Assembly | 1 |
| 176 | Front Driving Wheel Assembly | 1 |
| 177 | Washer | 1 |
| 178 | Brass Sleeve #3 | 1 |



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