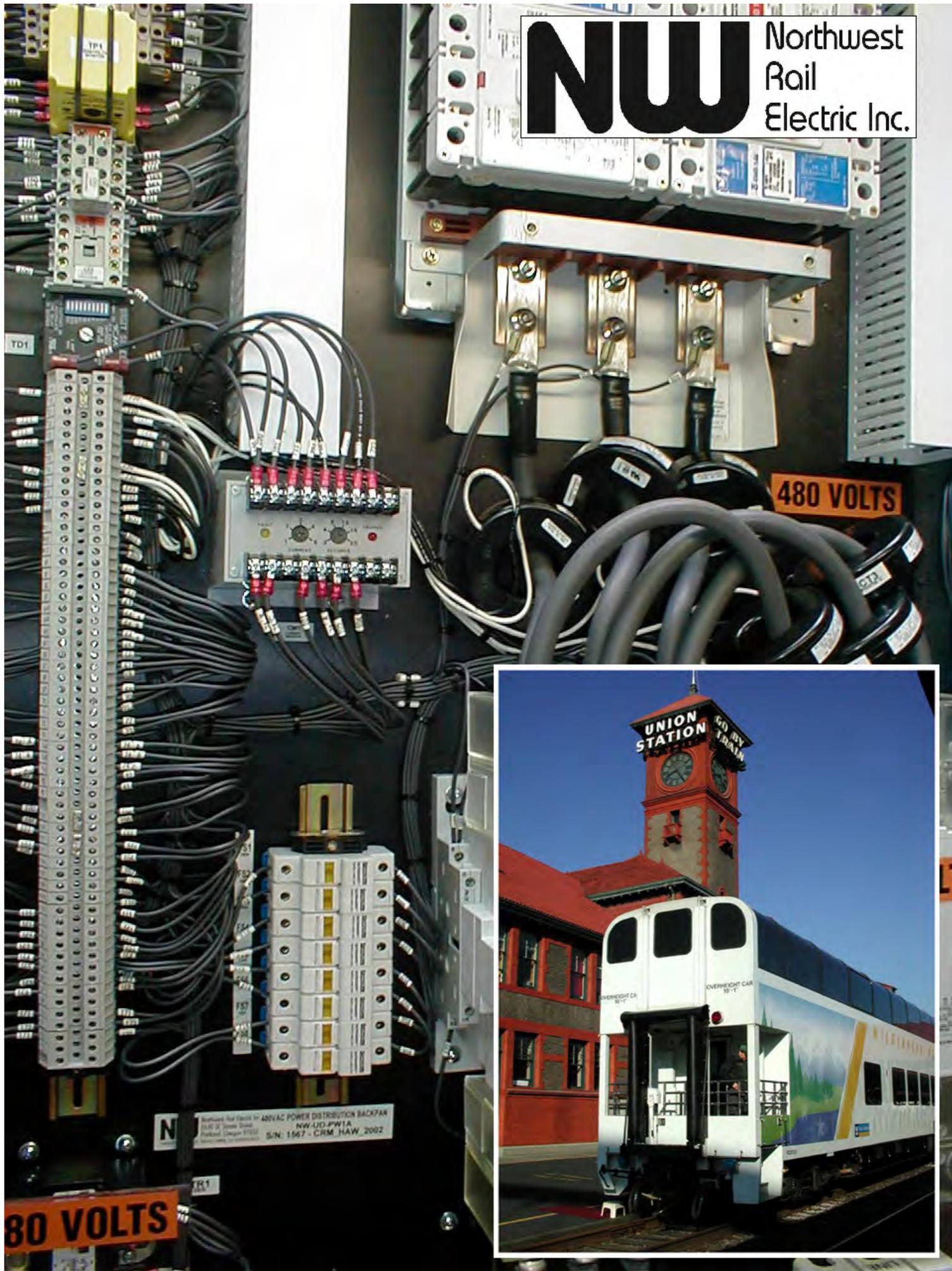


NW Northwest Rail Electric Inc.



**Railroad Passenger
Car Electrical and
Air Conditioning
Equipment**



Northwest Rail Electric Inc.
2630 SE Steele Street
Portland, Oregon 97202
503/231-4808, Fax 503/230-0572

On the Cover:

Operated by several different passenger carriers, the passenger cars used for transporting tourists in Alaska are some of the largest railway passenger cars in the world. Virtually all of the electrical control and air conditioning equipment on all of these cars, no matter the operator, was manufactured by Northwest Rail Electric in Portland, Oregon. The insert photograph shows one of the cars visiting Union Station in Portland, Oregon on its way north to Alaska. The electrical locker package for this car is shown in the main photograph.

Introduction 2
 What Northwest Rail Electric Is: 2
 What Northwest Rail Electric Is Not: 2
 Electrical Locker Packages and Control Systems 3
 Standard Packages for the Typical Coach 3
 Custom and Complex Electrical System Packages 4
 More Custom Equipment Examples 5
 Electronic Controls and Networked Systems 6
 Generator Controls 7
 Heating and Air Conditioning Equipment 8
 Evaporator, Heat and Blower Unit 8
 Under-Car Condensers 8
 Package HVAC Units 9
 NW-2 9
 NW-4 9
 Custom Heating, Venting and Air Conditioning Products 9
 Head-End Power Parts, including Communications and MU 10
 HEP Generator and Control Systems 11
 Stadco Under-Car Generators 11
 Consulting 12
 Three Dimensional Models Available to Car Designer or Builder 12
 Contact Information 12

Introduction

Since the mid-1980s, Northwest Rail Electric has been a manufacturer and distributor of electrical products for railway passenger cars, including serving car rebuilders and new car builders ranging from the largest main line railroad companies in North America to railroad museums with only a single operating car. Vertically integrated to provide the widest range possible of all the required electrical equipment for railway passenger cars, a call to Northwest Rail Electric provides access to air conditioning equipment, head-end power equipment, electrical controls, complete electrical locker packages, diesel generator sets designed specifically for the railway passenger car industry, and a variety of other electrical products required for operating railway passenger cars.

What Northwest Rail Electric Is:

Northwest Rail Electric is a manufacturer of equipment that is designed specifically for use on railway passenger cars, and by extension distributes the specialty products that your local distributors will not carry because they are specific to railway passenger cars. You can also call us for a variety of advice and experience with many different types of passenger car rebuilds over the years.

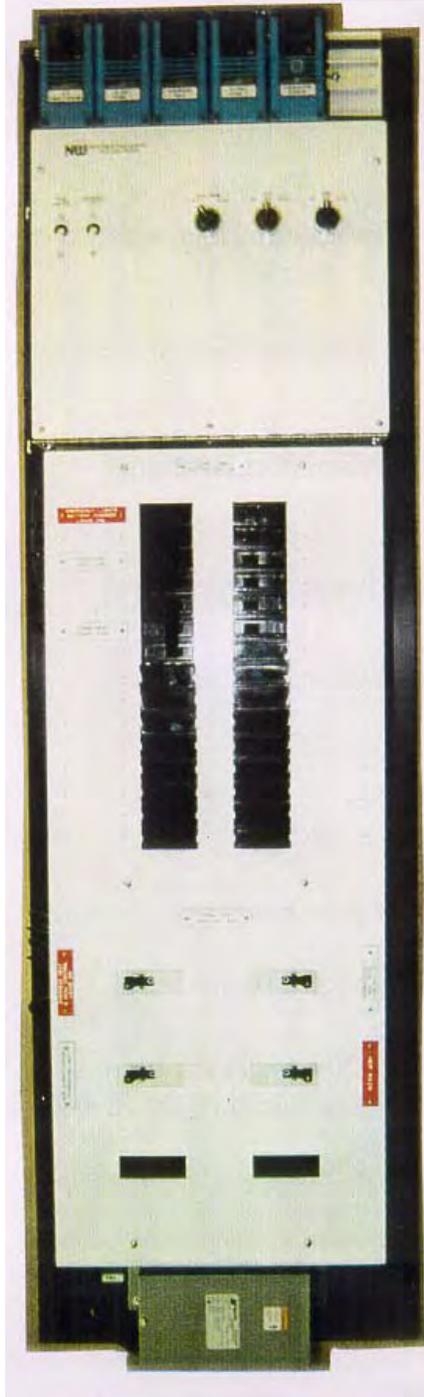
What Northwest Rail Electric Is Not:

We are not an electrical parts wholesaler or distributor for electrical, electronic, or air conditioning parts that are better purchased from your local distributor.

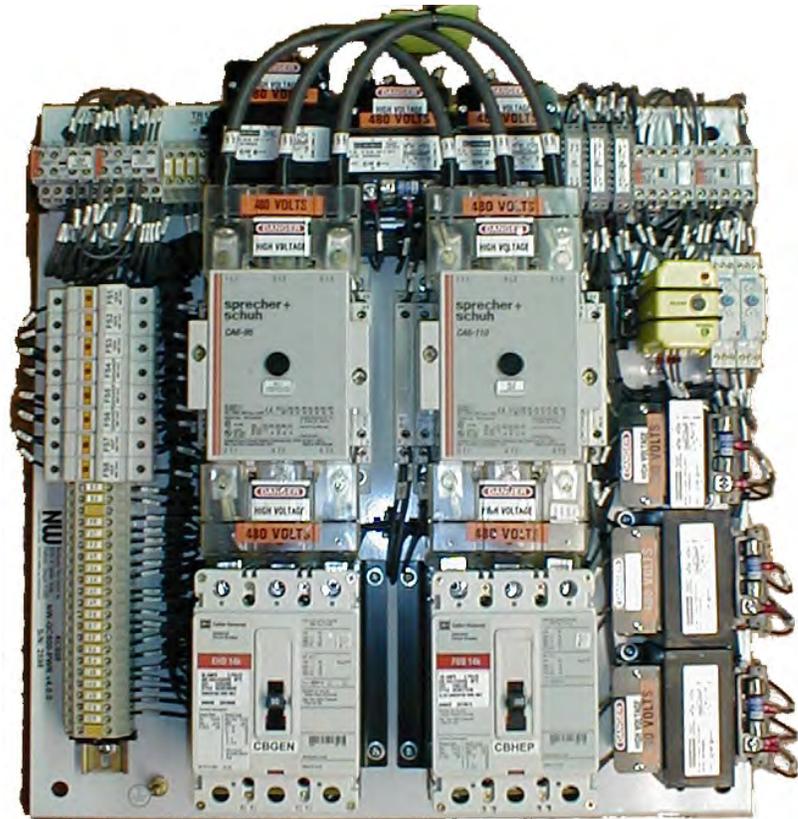
Electrical Locker Packages and Control Systems

Northwest Rail Electric makes a variety of electrical locker packages to fit a number of different customer requirements and a variety of railway car types.

Standard Packages for the Typical Coach



The simplest type of panel (**left**) includes heating and air conditioning control and circuit breaker panels for 480 volt three phase and 120/208 volt three phase and single phase circuits. The most complex packages, such as shown on the cover of this brochure, may include load shed, power selection between generator or HEP or yard power, automatic generator start-up and operation, current monitoring, generator feed to other cars, battery circuits and charging, and various custom features.

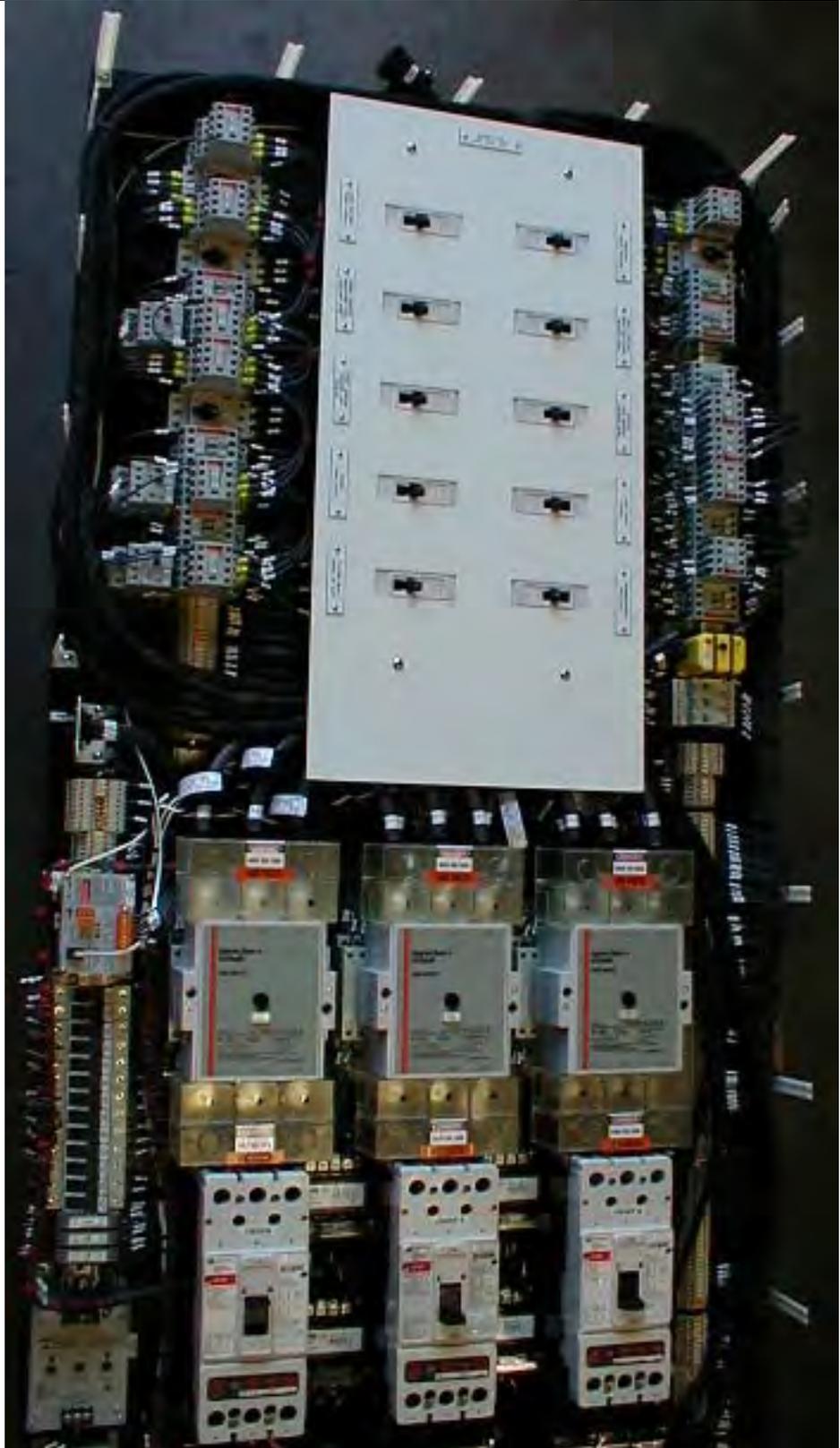


Switchgear systems include main circuit breakers for on-car generators, HEP circuit breakers, HEP control loop detection, phase rotation detection, and many other features required. Virtually all Northwest Rail Electric indicator lights are LEDs in order to provide maximum longevity and vibration resistance.

Custom and Complex Electrical System Packages

In situations where complex packages are required to fit inside a passenger car electrical locker, Northwest Rail Electric has produced electrical control systems to fit quite a number of unusual passenger car requirements, including:

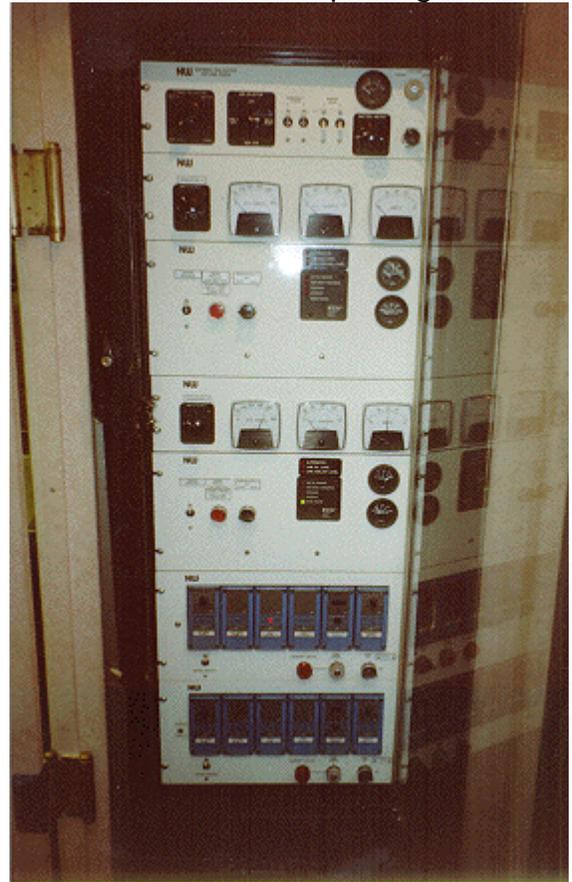
- ▶ Parallel control of generator sets for a scalable power car.
- ▶ Modular control panels so that any sub-system control may be disconnected and replaced.
- ▶ Larger than standard 480 volt 3 phase circuit breaker panels to feed power to a dining car galley, complete with load shed in the event there isn't enough power available to run all of the equipment at once.
- ▶ Complex DC control systems, including battery charging, DC-DC converters to supply multiple voltage systems, such as 12 volt lighting and communications systems from 72 volt locomotive battery power.
- ▶ Multiple zone air conditioning and heating control for dome cars, sleepers, or similar cases where one part of the car has substantially different heating and cooling needs than another car section.



- ▶ Extensive current and voltage monitoring of various systems, with detailed system status indication and feedback.

More Custom Equipment Examples

For cases where none of our standard equipment fit the specific needs of the customer, we have produced a number of custom control panels, air conditioning condensers, HVAC blower packages, heaters, generator controls, HEP parts, and electrical locker packages.

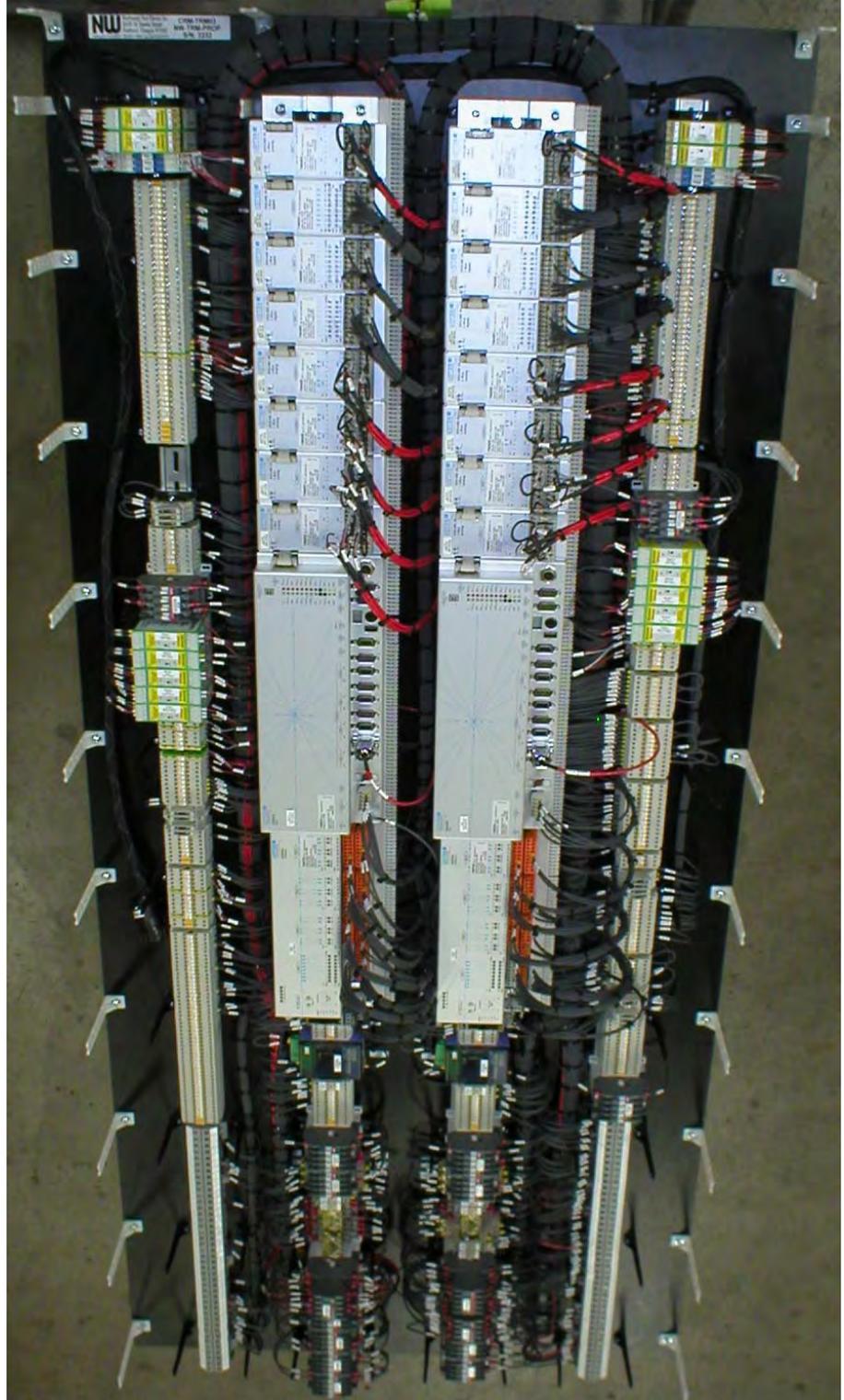


Electronic Controls and Networked Systems

In situations where electronic systems or graphical displays are desirable, Northwest Rail Electric has produced a variety of control systems. Some of these can communicate with a wireless shop network and report potential developing problems with equipment before those problems become significantly worse. In some cases, complete graphical displays are used.



Connection schemes, display and control systems (touch screen, switch, button, or keyboard and mouse), and enclosure type are all selected to suit the needs of the customer.



Generator Controls



In order for the generator to be useful for the railroad industry, it must have a control system that is designed by those with experience with railroad equipment. Stationary generator control packages are generally part of the generator skid, and on a moving train if such a generator system were used on an under-car generator, the control equipment would be completely unserviceable. Stationary generator controls are also generally not designed for the type of vibration and accelerations seen, for example, during an excessively hard coupling of cars. Standard generator controls also have no interface system for HEP controls.

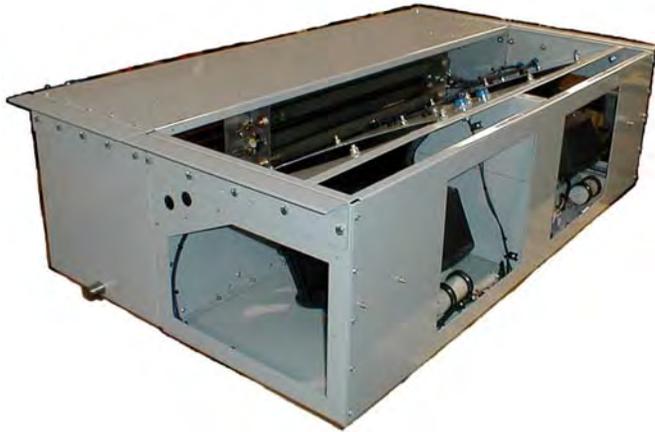
Northwest Rail Electric generator controls are designed for use on railroad equipment, and have a service history of use as varied as today's railroad passenger car usage: small museum operations to major main line railroad companies. Northwest Rail Electric generator controls include HEP control loop systems in order to feed the HEP system, automatic generator start and operation with HEP or other power failure, remote monitoring of engine operating and automatic shut down in the event of a generator problem.

Generator controls designed to communicate with engines that have an electronic interface include a number of features, including engine error logging.

Heating and Air Conditioning Equipment

Evaporator, Heat and Blower Unit

Our standard evaporator unit includes blowers, heater and air conditioning evaporator that will fit in most retrofit applications. Blowers are designed to be accessed from underneath, and the size and shape of the unit is designed to fit most common North American railway passenger car duct systems. The blowers on standard order units are single-piece welded aluminum impellers designed for long life in the rigors of the railroad environment, and have no set-screws holding the fan blades that will loosen over time. The blowers are also designed with a multiple speed motor, so that if they are controlled with a Northwest Rail Electric HVAC control system the units have three fan speeds. This reduces noise and increases comfort.



Under-Car Condensers

Our standard condenser is built to fit most passenger cars as well. All components are constructed with railroad service in mind. For example, the condenser coil features widely spaced copper fins, so the unit will survive under-car dirt and resulting cleaning. Powder coat finish assures metal parts a long life. All standard Northwest Rail Electric condensers are designed for mounting underneath a railway passenger car, as opposed to a common building unit that is designed to be

mounted on a concrete pad. The profile of the condenser is designed with under-car clearance profile requirements in mind. A number of different options are available, including several different capacities and pipe connection points. Standard units have a Maneurop MT series compressor, which has a long history of use on various Northwest Rail Electric railroad passenger car systems. As an option, the condenser may also be ordered with a Carlyle O6D compressor, which also has a long history of use in the railroad passenger car industry.





As mentioned above, Northwest Rail Electric condensers are specifically designed for mounting under a railroad passenger car. The shape of the frame allows the side of the unit that faces the side of the car to have the most clearance. Mounting angles at each end of the frame are designed for a supporting frame, so that railroad policies about supporting under-car mounted equipment with a frame structure may be easily followed.

Package HVAC Units

Northwest Rail Electric has developed several different package Heating, Venting and Air Conditioning units that include all of the required functions in a single unit.

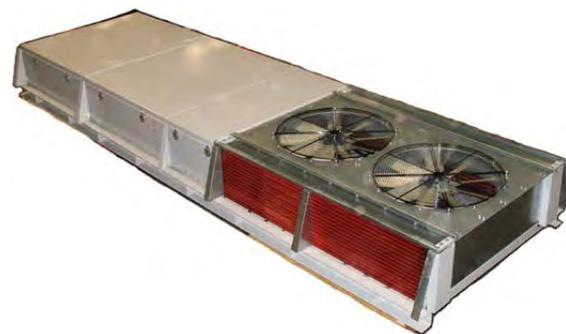


NW-2

The NW-2 system is a package air conditioner evaporator and condenser designed for situations that have a duct that leads from under the car to the rest of the duct system. As can be seen in the photograph at left, the unit has a profile that is specifically designed for mounting under a railroad passenger car and providing the required clearance. Heat may be built into the unit or be located in the ductwork separately.

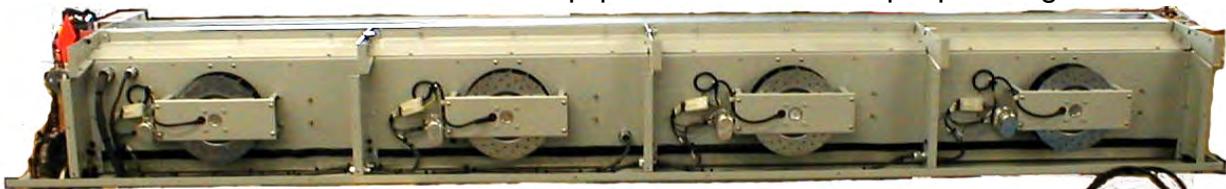
NW-4

The NW-4 is a roof-mounted HVAC system with up to 11 tons of cooling and 24 kW of heat. Two refrigeration circuits are included so that even a compressor failure or other significant air conditioning system problem will still only cause a partial failure. Variable fan speed and air conditioning modulation provides passenger comfort with savings.



Custom Heating, Venting and Air Conditioning Products

In situations where there are severe physical limitations or various special requirements, Northwest Rail Electric will build HVAC equipment that suits unique passenger car needs.



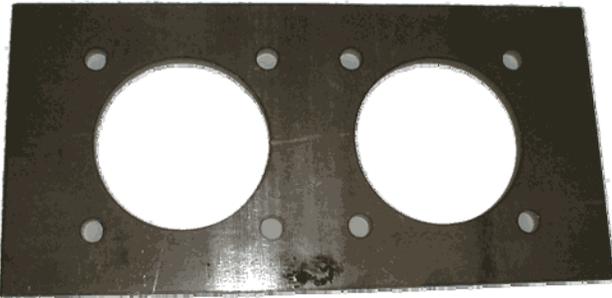
Head-End Power Parts, including Communications and MU



For transmitting the power from the generator to the rest of the train, as well as providing other specialty car to car connection needs, Northwest Rail Electric stocks a number of parts that are unique to the HEP systems used today. Some of these parts are our own specialized HEP parts in order to meet a need, while others are hard to find parts manufactured by others. The

range of head-end products includes:

- ▶ HEP Connectors, Jumpers, Connector Housings and Extension Cables
- ▶ Mounting plates for the HEP Connectors
- ▶ Hard to Find Wire Lugs required for HEP system assembly



- ▶ Multiple-Unit and Communication Receptacles and Cables



- ▶ Splice Boots specifically designed for HEP Systems
- ▶ Wire cleats sized specifically for HEP



- ▶ MU and COM Mounting Boxes and Junction Boxes



- ▶ HEP Junction Boxes
- ▶ Various other unique HEP hardware

A number of custom products have also been developed for customers that have situations that can not be met using standard products. This has included:

- ▶ Custom HEP junction boxes for power cars or other unique situations.
- ▶ Custom HEP mounting plates, wireway duct covers, junction boxes, and a host of other specialized materials designed to meet the needs of unique HEP installations.
- ▶ Custom cable cleats and cable cleat clamp plates for unique under-car situations.

HEP Generator and Control Systems

The origin of electrical power on a train is the foundation of all the other equipment, for if there is no reliable source of power, there is no system to control, nor is there any power to run the air conditioning or all of the other systems on the passenger cars.

Stadco Under-Car Generators



Northwest Rail Electric is a distributor for Stadco diesel generator sets that are designed for use under railway passenger cars. The vast majority of generators on the market today are designed strictly for stationary use, do not have components or frame that will survive very long in the railroad industry, and in general are simply not designed to be suspended from under a railroad passenger car. Stadco diesel generators are designed from the start with the needs of the railroad passenger car in mind, including such features as a roll-out track for service, as seen in the above photograph. Stadco generators are in use on cars ranging from executive office passenger cars on major North American railroad companies to single cars used by very cost-conscious tourist railroads and railroad museums.

A generator mounted under one of the passenger cars allows any locomotive to be used to pull the train. Even if HEP from a locomotive is available, an under-car generator makes a good backup system in the event power from the head end fails. Stadco generators are available from 20 to 175 kW. Designed with railroad cars in mind, even cars with extremely tight clearance requirements have enough space.



Northwest Rail Electric builds generator controls that are specifically named by Stadco for use with their diesel generators without voiding the Stadco warranty.

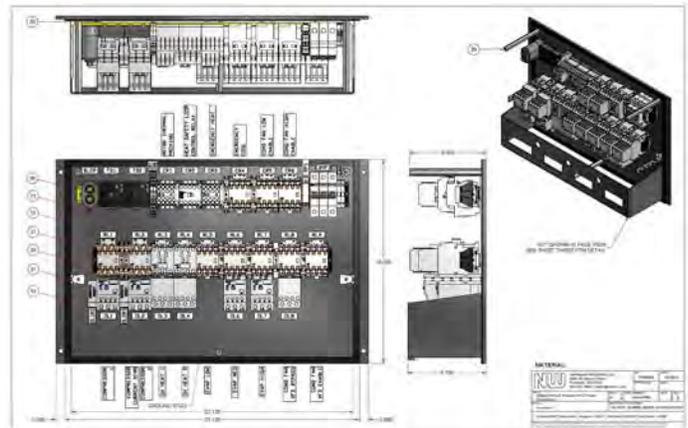
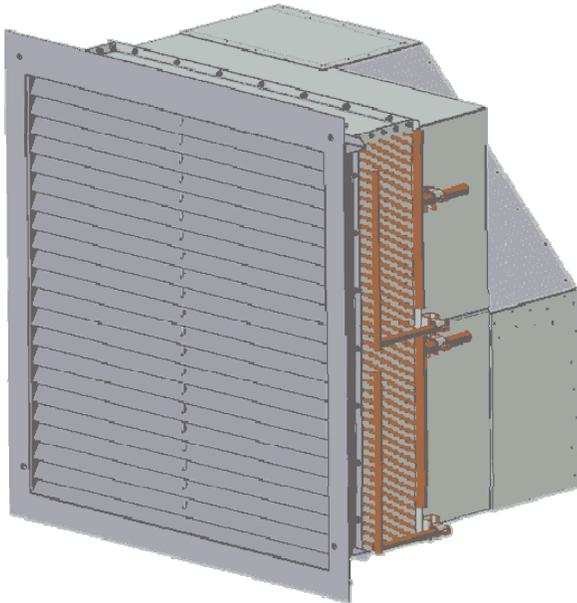
Consulting

We have been involved in several hundred passenger car HEP conversions, and passenger cars using Northwest Rail Electric systems are operating from Panama to Alaska, on everything from baggage cars to business, office and inspection cars owned by the largest of North American railroad companies. We have evaluated passenger cars for customers, and worked with many different car builders and rebuilders, tourist railroads, railroad museums, private car owners, maintenance of way contractors, several transit agencies and all North American class 1 railroads, one entertainment company, and one portable museum group.

Three Dimensional Models Available to Car Designer or Builder

Designing a railroad passenger car can be a difficult business, as there is never enough space to fit all of the desired equipment and have enough space left over for required items such as air conditioning duct work and electrical control equipment.

In order to assist the car designer or builder, it is possible for Northwest Rail Electric to provide complete three dimensional computer aided design and drafting (CADD) models in several different formats. This allows the inclusion of Northwest Rail Electric control and air conditioning equipment into the car design before work even begins on the structure of the car. This allows interferences to be checked, access points examined, and overall functionality and suitability to be tested in the design phase of the project.



Contact Information

Get in touch with us today to see how we can help you with all your railroad passenger car needs!

NW Northwest Rail Electric Inc.
2630 SE Steele Street
Portland, Oregon 97202
www.nwrail.com 503/231-4808, Fax 503/230-0572