Welcome VA School Bus Technicians From Leece-Neville HEAVY DUTY SYSTEMS

Prestolite electric

Agenda

- Leece Neville
  - Company Overview & Product Offering
- Understanding the Charging System
  - Goal of the system testing
  - The System Components
  - Testing
  - Maintenance pointers for maximum performance throughout the presentation
- Increasing Industry Electrical Loads
- Under Hood Temps

Company Overview / Products

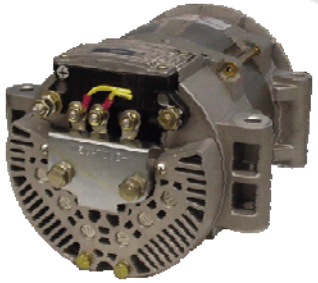
- U.S. Based Manufacturing/Distribution organization which is U.S. owned with a world wide footprint as well as knowledgeable product support & sales teams
- Extensive U.S. market in Heavy Duty rotating electrics
  - Known for very high output products, reliability, knowledge of the charging system for decades
- Established in 1909
- 1987 acquired Leece Neville
- 1988 acquired Motorola Arcade NY division

Claim to fame

Heavy Duty Rotating electrics

"**Low speed high current**" *Alternators*

4800/9800



2500/2800

8LHA

MDA

Titian Series Starters

In line gear reduced with Elect Soft Start Engagement for Mid Range Engines; Cummins ISB, DT466, Cat C7

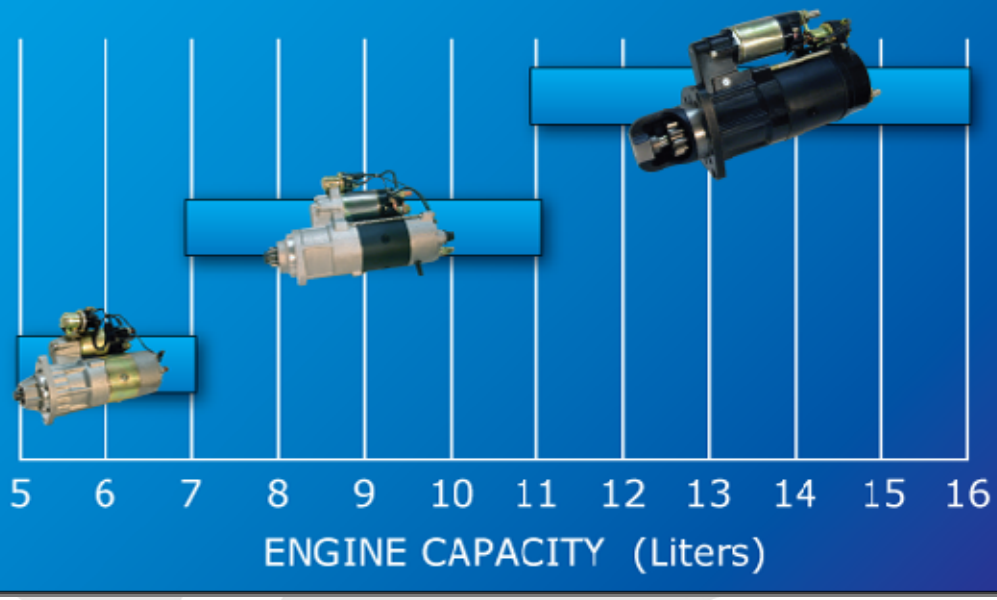
New AVI Product line

T-mount, Pad, J-180; Ford 'V' & G.M. Mounts Soon

Titan Series

- Complete gear reduced starter line
  - Cranking 5 to 16 liter diesel engines

Model	Frame	Output
Titan125	125	8.0 kW
Titan105	105	5.0 kW
Titan101	101	3.5 kW



Understanding the Charging System

- The Charging system is one of the most misunderstood and misdiagnosised systems on any vehicle
- To correctly diagnose charging issues we need to recognize;
  - the **charging system;** which consist of three individual components and are separate from the electrical system
    - they interact with each other
    - the adverse conditions they may produce and how they affect the other components in the system.
- Those components are:
  - **Batteries**
  - **Cabling including Connections**
  - **Alternator**

Basic Tools To Evaluate System

- Basic equipment needed to determine if the charging system is operating correctly

  – Voltmeter with Mv capabilities for accommodating an inductive amp clamp

  – D.C. Amp clamp or

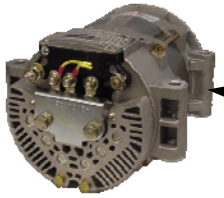
  – Stand alone D.C. amp clamp & volt meter

Goal of System Testing

TO IDENTIFY THE ABILITY OF THE CHARGING SYSTEM TO MAINTAIN VOLTAGE AND CURRENT FOR THE ELECTRICAL COMPONETS ON THE VEHICLE

We can do this by monitoring the current flow and voltages at the alternator and batteries as well as measuring any voltage drop that may interfere with that transfer of power.

•Measure cable resistance to ensure power transfer



Amps

Voltage

•Amps

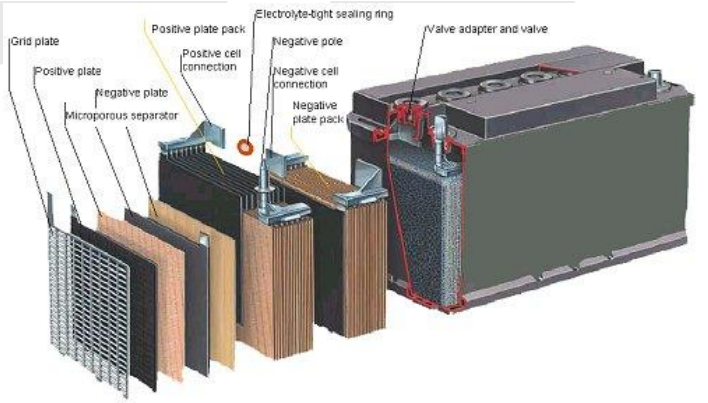
•Volts

•Voltage & current output of the alternator at engine idle

•Batteries, charging or discharging and the ability of the batteries to maintain a charge.

•Distribution point where chassis & body components can be checked (Optional) Where the charging & electrical system may connect

The Battery



- The Battery
  - **It's purpose is to crank the engine**
    - The battery does offer other important functions such as an **electrical filter** and **storage capacity** for the system.
  - **Affects on the system-**
    - If shorted or severely discharged it may demand HIGH amperage in conjunction with the electrical loads of the vehicle which the alternator may not be capable of producing at that speed and show a reduced voltage at the alternator. This can lead to a misdiagnosis of a failed alternator. At 75% state of charge or below a battery can absorb as much as 20% of its CCA rating from the alternator. Typical is 10%.
- Two of it's worst enemies is heat and vibration.

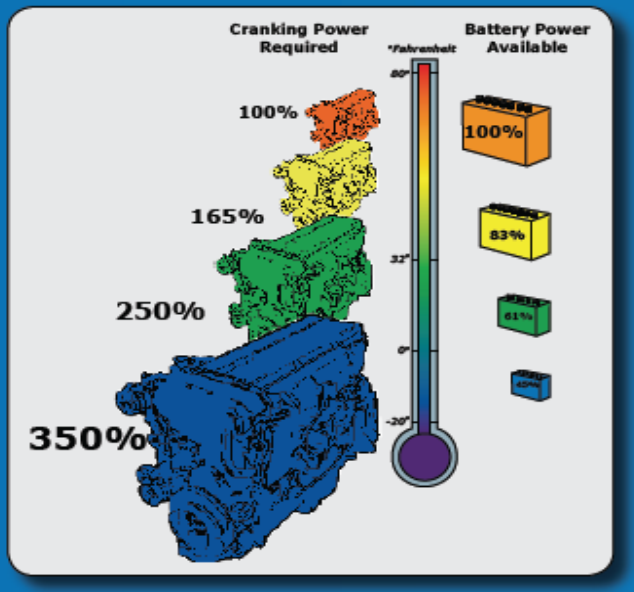
The Battery Capacity

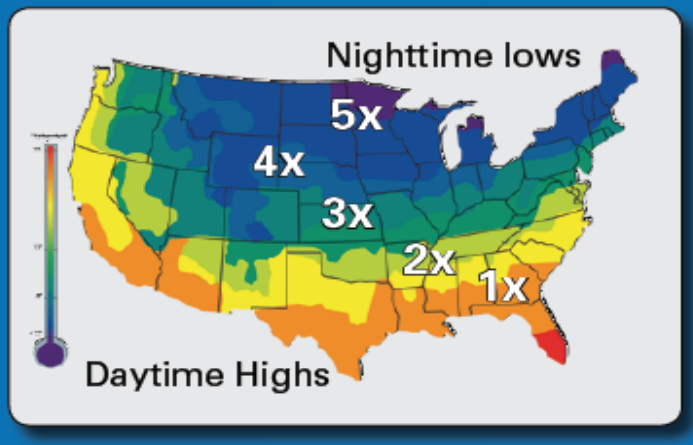
Leece-Neville HEAVY DUTY SYSTEMS

Cold temperatures inhibit the chemical reaction within the batteries, reducing their efficiency. At 0°F the available current from the batteries is only about 45% of the output available at 80°F.

To make matters worse, thickening of the fluids and tighter clearances due to metal contraction make the engine 3 1/2 times more difficult to turn over.

Add these together and you get a diesel engine that is 4 to 5 times harder to turn at 0°F than it is at 80°F.





When you have trucks going coast to coast and north to south you know that you're going to hit cold weather.

You may have an engine that is 4-5 times harder to turn over at night than it was just that morning.

You need a cranking motor that has the right mix of power, torque and speed to keep you on the move.

Battery Maintenance & Types

The Battery

– Typical Loads

- A healthy fully charged Group 31 battery requires nominally 5 amps to maintain a full capacity of 12.70 volts
- A healthy fully charged “D” Type requires nominally 10 amps to maintain a full capacity of 12.60 volts. It has a higher internal resistance.

- Most appropriate type for high cycle, low discharge applications such as school bus
  – Group 31
    Less internal resistance= lower amperage requirements & faster recovery

ALL BATTERIES REQUIRE PREVENTIVE MAINTENANCE

- Cleaning batteries every 90 days can extend the life of the alternator and batteries by as much as two times

True State of Charge

Determining the True State of Charge

Percentage of Charge	
12.60 V	100%
12.45 V	75%
12.30 V	50%
12.15 V	25%

- **Remove the surface charge (turn headlights on for 2 minutes per battery and stabilize) and compensate for temperature change. Do not proceed with diagnostics if state of charge is less than 75% or 12.45 V**

Battery Testers

Testers – Pro's & Con's

– Frequent Carbon Pile testing example

- Normal nominal current draw required by most diesel engines is 600 to 800 amps. Most trucks are equipped with 3 or 4 Group 31 batteries, buses 2- D types. Most batteries develop a type of memory or burn in, into the plates from routine load characteristics
  - Example 2- 8D type batteries would see a current load of 350 amps while cranking nominally
  - Most 8D type batteries are 1000 to 1150 CCA batteries. When testing a battery with a carbon pile you would load the battery with 500 to 575 amps of current, almost 2 times that in which the battery normally sees. Frequent testing three to four times a year can degradate the life of the battery
  - Conductance testers apply no load while testing

– Limitations of Conductance Testers

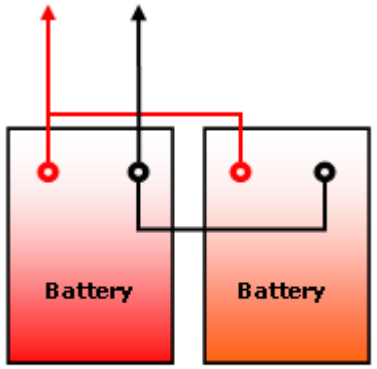
- Always have to utilize stud adapters
- Only 75% accurate testing at room temperature at or near 80F
- Only 40% accurate on "D" type batteries
- Until technology advances it is recommended to check batteries bi-annually with a carbon pile.

The Cabling

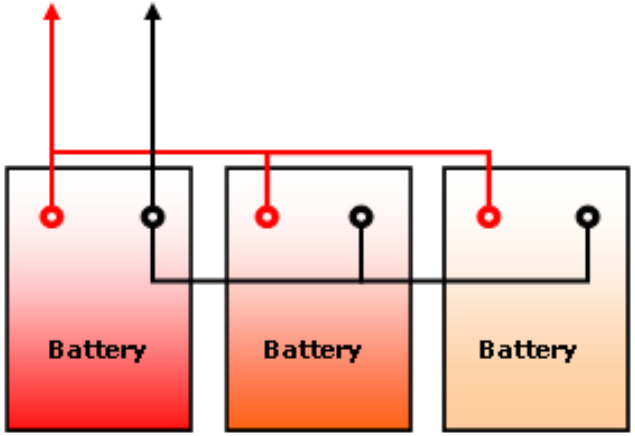
- **Purpose of the cabling (possibly the most neglected part of the charging system and one of the most important)**
  - The **correct** cabling will be sized and routed to allow the **maximum** output of the alternator to be supplied to the electrical components of the vehicle and **evenly** transferred back to the battery for recharging. If the cables are too small, corroded, or incorrectly routed; or if the connections of the terminals to the cables are loose and/or corroded; or the physical connections at the battery and starter or other connection points in the system are loose; this will cause excessive resistance in the circuit which can overheat the alternator diodes excessively which will lead to shortened life of the alternator, battery, and other electrical components because they may not receive the needed voltage required for maintaining them the same as if the alternator is underspeced for the vehicle.
  - Refer to TSB 1001 Wire Size Chart

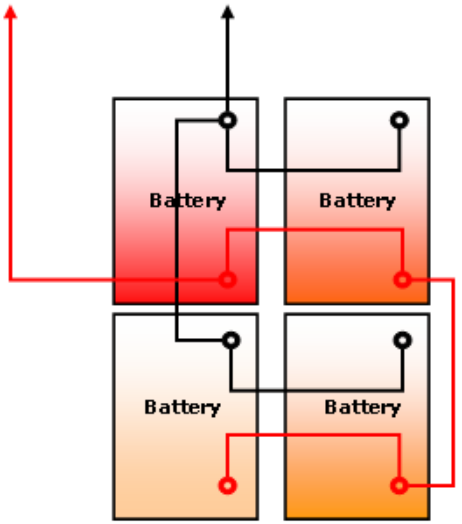
Battery Cabling

- Proper cabling
  - The affects of correct/incorrect cabling

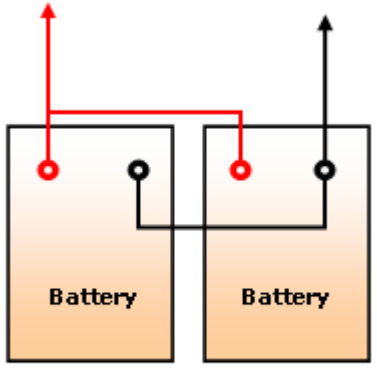


Incorrect Cabling

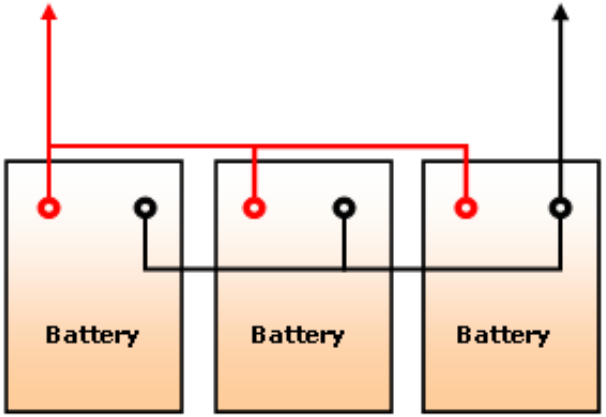




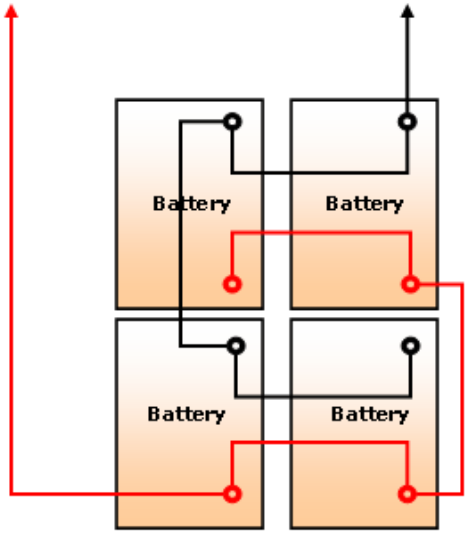
Incorrect cabling



Correct cabling



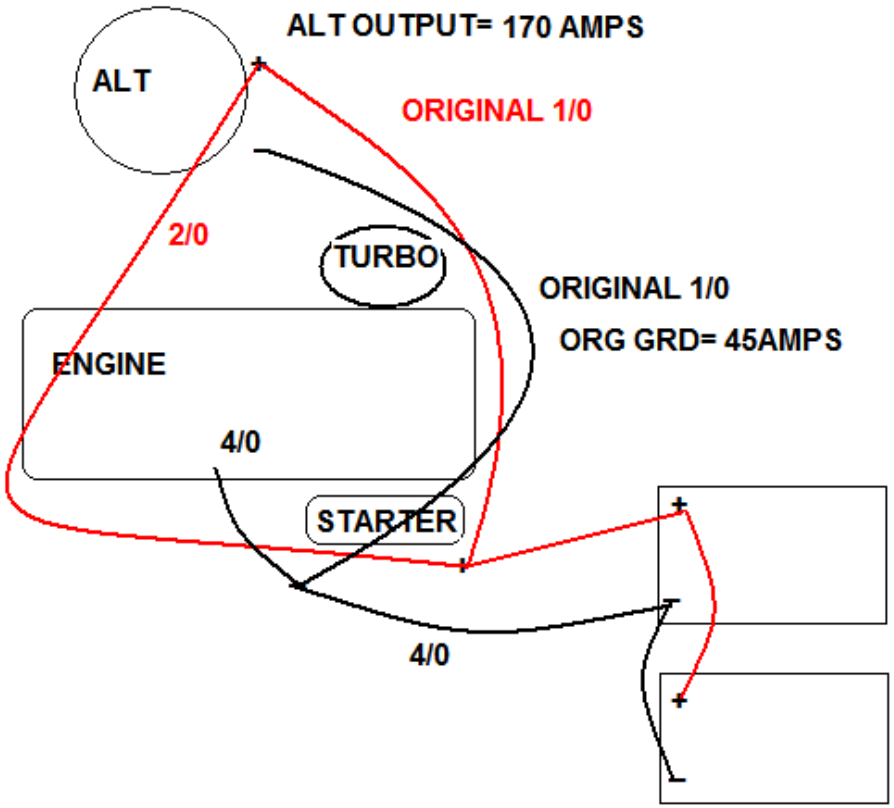
Correct Cabling



Correct cabling

Supply Cabling- Examples

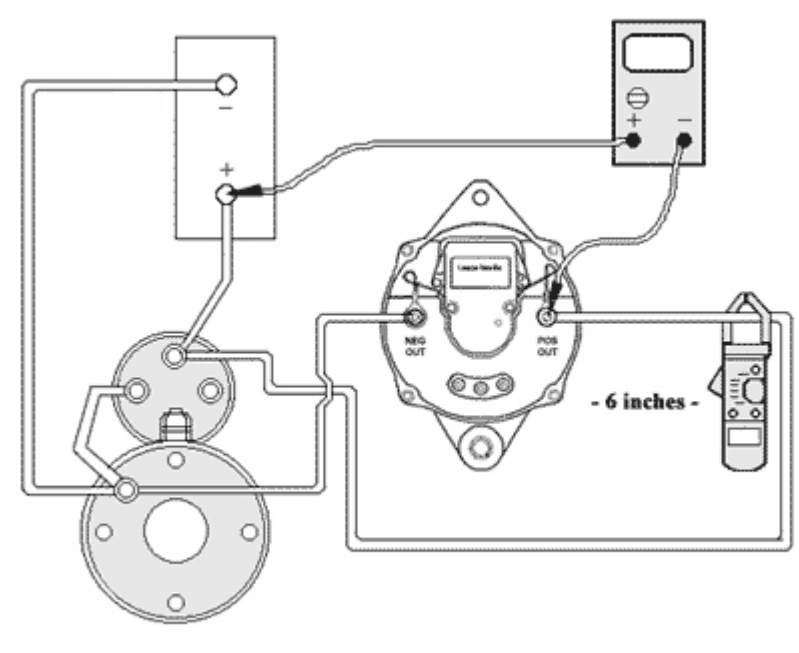
- Proper cabling
  - The sole purpose of this illustration is to show the affects incorrect cabling in the charging system can have on the other components in the system as well as other components on the vehicle.

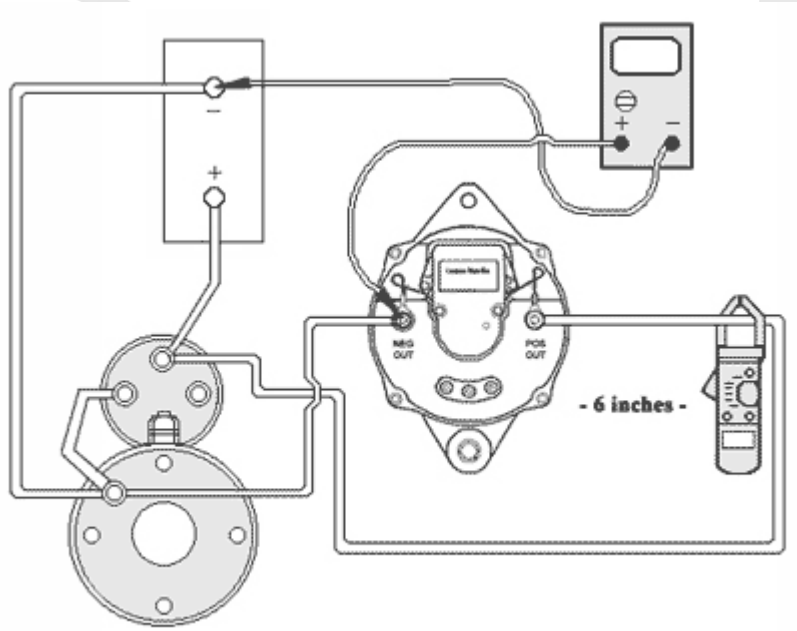


Higher amperage output makes the correct cable size and routing more critical for the proper operation of the entire charging system. Voltage will follow the path of least resistance

Cable Voltage Drop

- The cabling has to be capable of conducting the current output of the alternator back to the battery
- The best way to verify this is to measure it's resistance. This should be measured on the positive and negative cables. No more than .25 volt drop should be seen on either cable
- Proper cable sizing and connections are critical to voltage drop





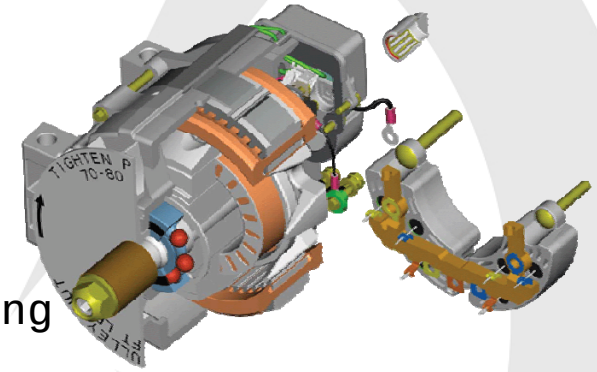
The Alternator

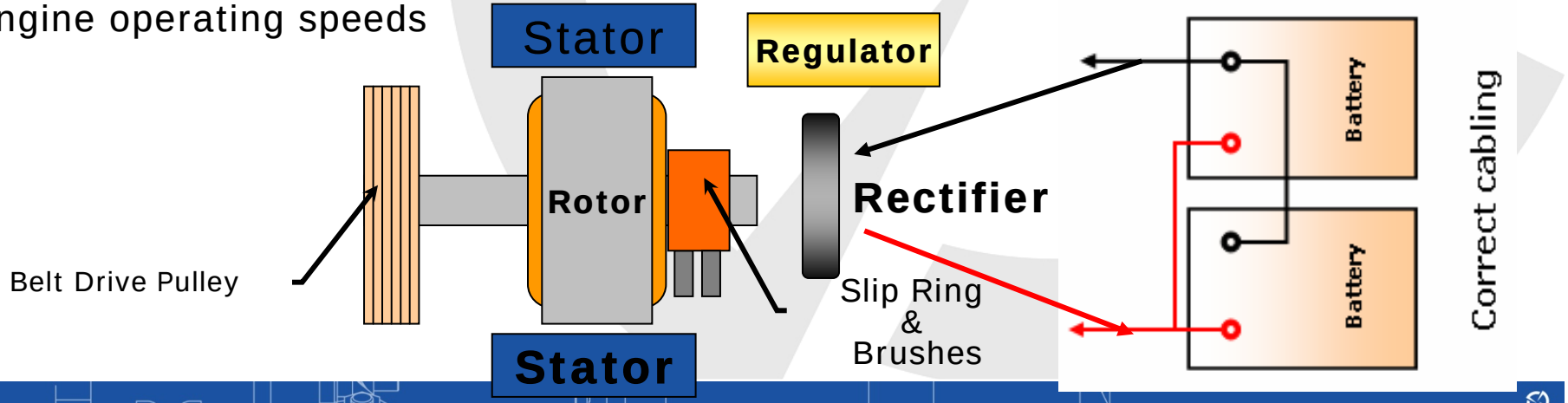
Alternator Purpose

– The purpose of the alternator is to supply and maintain adequate electrical voltage and current to meet the demands of the electrical components on board the vehicle which have minimum and maximum voltage limits for their proper operation and will directly affect the life expectancy of the components on board. This also includes the maintenance demands of the battery or batteries.

Alternator Basics

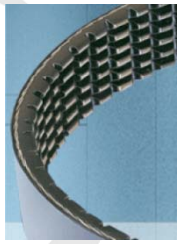
- An alternator or A.C. generator creates voltage by rotating a magnetic field inside of a looped conductor.
- The A.C. voltage is pushed through the looped conductor then it is converted to D.C as it flows thru the output rectifiers.
- The amount of Direct Current which is produced is based on how fast the rotor is being rotated by the engine and how much voltage is applied to the slip ring
- The regulator monitors & controls the alternators output voltage to a designed set point of 14.2 volts. If the alternator has been adapted to the application properly. This voltage set point will be maintained at all engine operating speeds





Alternator Considerations

- **Alternator**
  - **Belt Tension**
    - For every 20 amps of current produced in a typical alternator it requires 1 HP from the engine belt drive. High output alternators can require more than 10 hp from the belt drive. In many cases if the alternator is upgraded, the factory installed tensioner may be inadequate for proper belt tension
      - Self adjusting tensioners do wear and inspection of the belt is essential during preventative maintenance inspections. Indication of wear associated to the tensioner bushing would be the whitening or fraying of the belt edge. If this is noticeable tensioner could hang at an extremely high or very low belt load
- **Secure / stable mounting brackets**
  - Vibration is one of the alternators biggest enemy
- **Compartment temperature**
  - Should not exceed 210F
    - regulator components are very vulnerable
    - may consider remote mounted regulator



- **Cleanliness**

  – It is important that the alternator is free from dirt, dust grease oil and debris as air flow through and over components is critical for adequate cooling. * When cleaning do not utilize acidic based full strength degreasers or acid. There is a very thin film of varnish coatings on exposed components which can be etched away leading to premature failure.

- **Voltage drop “resistance”**
  - Must not exceed .25 volt on either positive or negative circuits individually

Is the alternator working?

- To determine if the alternator is capable of producing current and voltage
  - – With the engine shut down, measure voltage across the positive and negative alternator terminals. This should be battery voltage
  - – Crank the unit **with no electrical loads** and measure voltage at the alternator
- If this voltage increases from battery voltage to 13.7-14.2 volts; it is producing voltage and regulating it.

  If voltage remains the same as battery voltage it may not be; Check the amperage at the alternator with all loads off. You may have a defective battery.

  If ignition excited make sure power is on ignition terminal.

  Refer to TSB-1019

Diagnosing Repetitive Failures

- Repetitive failures tell us something is wrong in the charging system
- With repetitive alternator failures, it is critical to ensure the alternator is capable of meeting the amperage demands at idle to maintain **system voltage** so the electrical components as well as the batteries have sufficient operating voltage. If it is overloaded, and does not fail initially due to the inability to dissipate the heat generated, it will reduce the life expectancy of the alternator and the batteries, as well as other electrical components on the vehicle.
- There are three important items you **MUST** know before you can qualify an alternators output to resolve **repeat** failures from an overloading condition
  - 1 What is the electrical demand of the vehicle (loading)
  - 2 Can the alternator produce enough current at engine idle to meet these electrical demands? (output curve)
  - 3 Can this current be transferred sufficiently? (cable resistance)

  Refer to TSB 1025

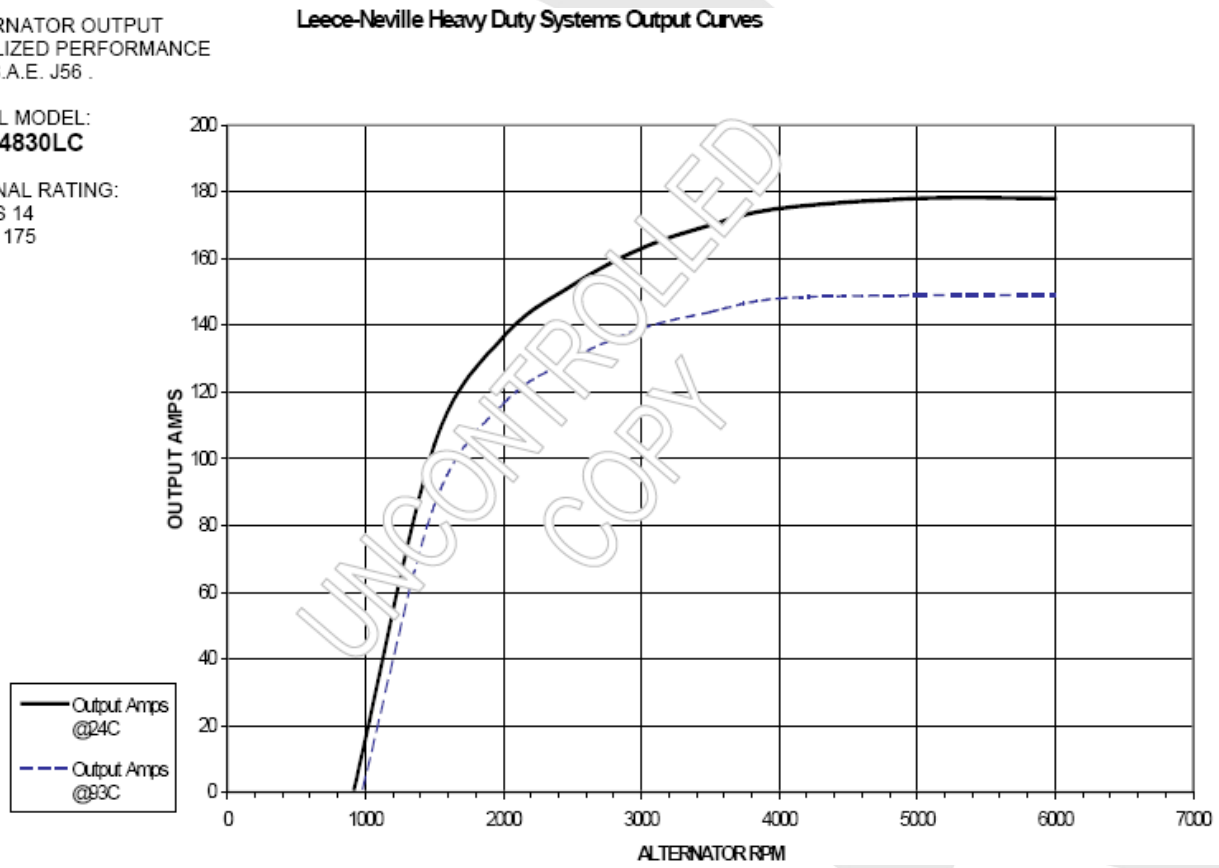
Size Does Matter

- Things to consider
  - Vehicle Electrical Loads
  - Alternator output curve at idle. Where is the current needed the most?

ALTERNATOR OUTPUT
STABLIZED PERFORMANCE
PER S.A.E. J56 .

INITIAL MODEL:
A0014830LC

NOMINAL RATING:
VOLTS 14
AMPS 175



•NOTE THAT ANY STANDARD ALTERNATOR WILL LOOSE ABOUT 10% EFFICIENCY WHEN HOT DUE TO THERMAL DEGRADATION OF THE MAGNETICS

Increasing Loads

- Electrical loads are continually increasing on bus and truck applications mainly due to emission controls and ADA requirements
- Many times elect components are added after manufacture without consideration to the charging system
- Because of the increased electrical demands and other issues our minimum alternator recommendation for a standard school bus with a 2010 engine is 240 amps *

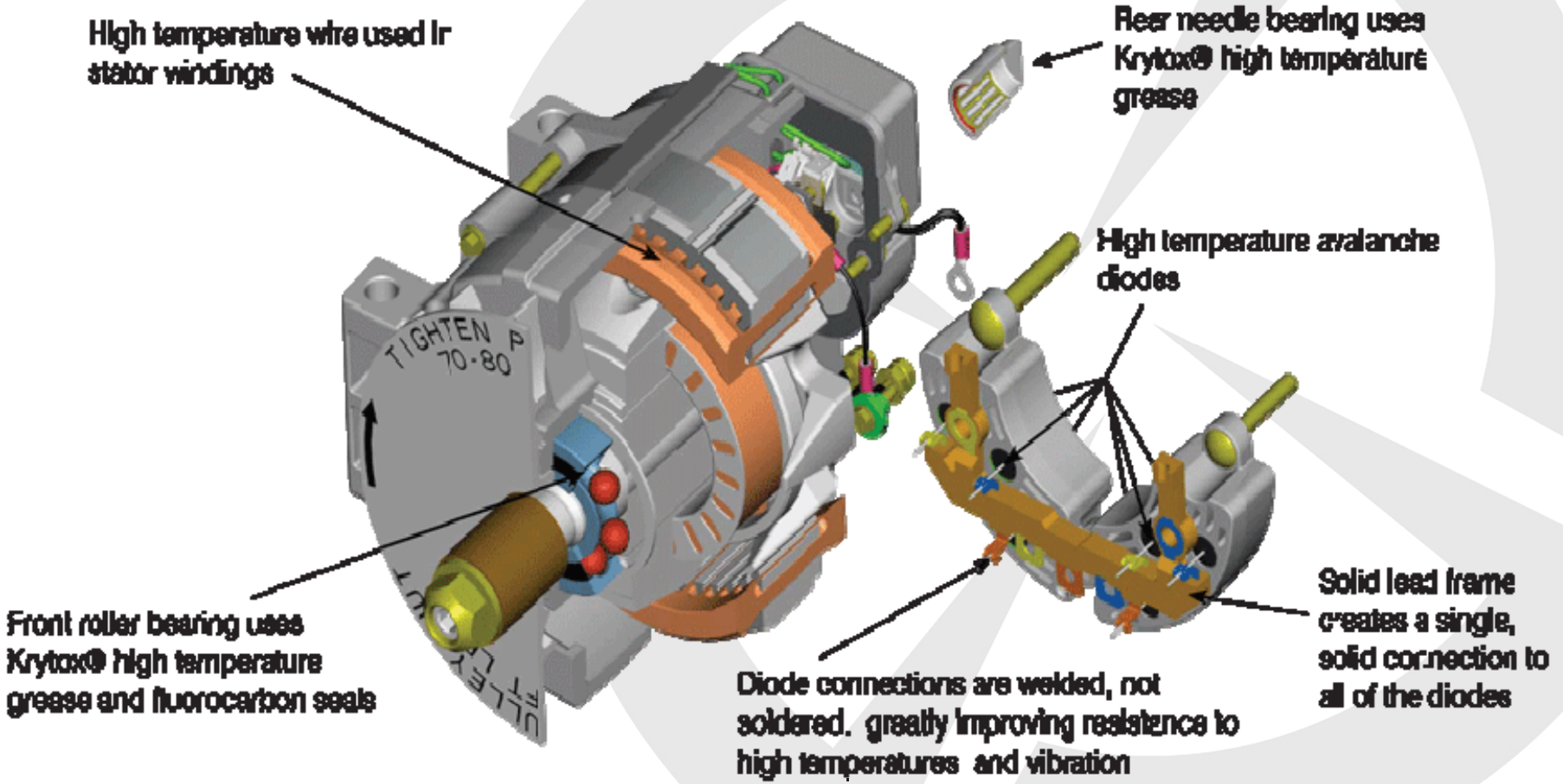
- **Industry progression (typical)**
  - •1970 65 Amps 1980 90 Amps
  - •1990 105 Amps 1995 160 Amps
  - •1998 175 Amps 2005 185 Amps
  - •2010 May be an additional 250 amps electrical loading *

* SCR Emission Controls

Rising Under Hood Temperatures

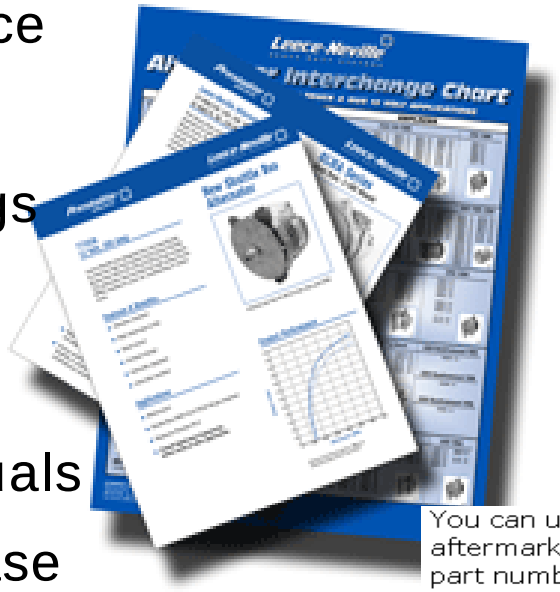
- Emission controls are a major reason for increased under hood temperatures
  - EGR systems, engine grid heaters, regen systems
  - Larger Coolant Packages increases heat rejection into engine compartments
  - Larger fans requiring more horsepower
  - Retarding the timing to meet emissions also increases exhaust temperatures
  - CNG,LNG,& LPG gas engines run much hotter than diesel
- Low engine hoods and high mount turbos on forward engine transit vehicles create hot spots
- We have recorded temperatures on some transit type or flat nose buses with diesel engines at 230 degrees F. on older buses
- Engines may be hotter on ’07 and even hotter on ’10 model engines

- Changes to meet the demands of higher temperatures



www.prestolite.com

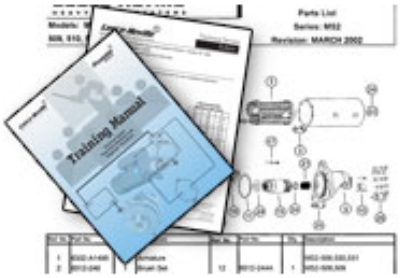
- Cross reference
- Brochures
- Contact listings
- Parts list
- Diagrams
- Training Manuals
- Knowledge base



Support

Product support and customer service

- Technical bulletins, training manuals, trouble shooting guides



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- Contact us here **866.288.9853**

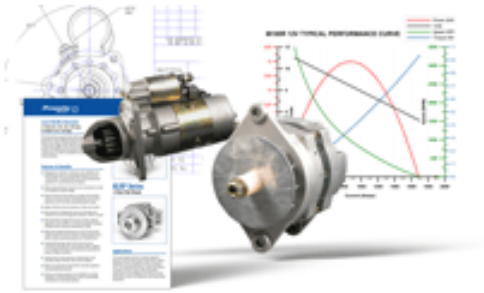
Now Available! - Knowledge Base (FAQ's)

You can use this form to search our database for aftermarket competitor, OE customer, and military NSN part numbers as they cross reference to our parts.

Products

Product and technical info

- Product Details, output curves, dimensional drawings and brochures



New! - Cross reference and application lookup

New! - Parts Breakdowns

TSB 1025

Prefer to download the complete files? (*click for example*)

Alternators	(PDF, 1795K, 1/8/04)	Click here
Starter Motors	(PDF, 1961K, 1/8/04)	Click here

Enter part number

Search

You can enter in partial part numbers and still get results, however you must enter in a minimum of 4 characters.

For example, a search for **0545** will return the following:

Delphi alternator	**1100545**
Cargo starter motor	**110545HC**
NSN listing	**2390-00-314-0545**
others, not displayed	

Thanks GA School Bus Technicians

Leece-Neville HEAVY DUTY SYSTEMS

Thanks For Your Time