



100
PREVOST

PREVOST
THE ULTIMATE EXPERIENCE



HVAC & Battery Maintenance Recommendations

Robert Hitt

Agenda

Welcome

**AC System fundamentals &
Recommendations**

AGM Battery charging and characteristics



WHAT DOES HVAC MEAN?

- **H**ot **V**ehicles **A**ren't **C**hartered
- Heating, Ventilating, Air Conditioning
- Six required major elements:

Heating System (**H**) ←

Air Handling System (**V**) ←

Refrigeration system (**AC**) ←

Control System (**C**) ←

A driver who knows how to use it (**D**) ←

A tech who knows how to fix it (**T**) ←

If one of these items is missing, we will have an HVAC problem.

So, it really is an HVACCDT system!



THREE RULES OF HVAC

- Learn the basics,
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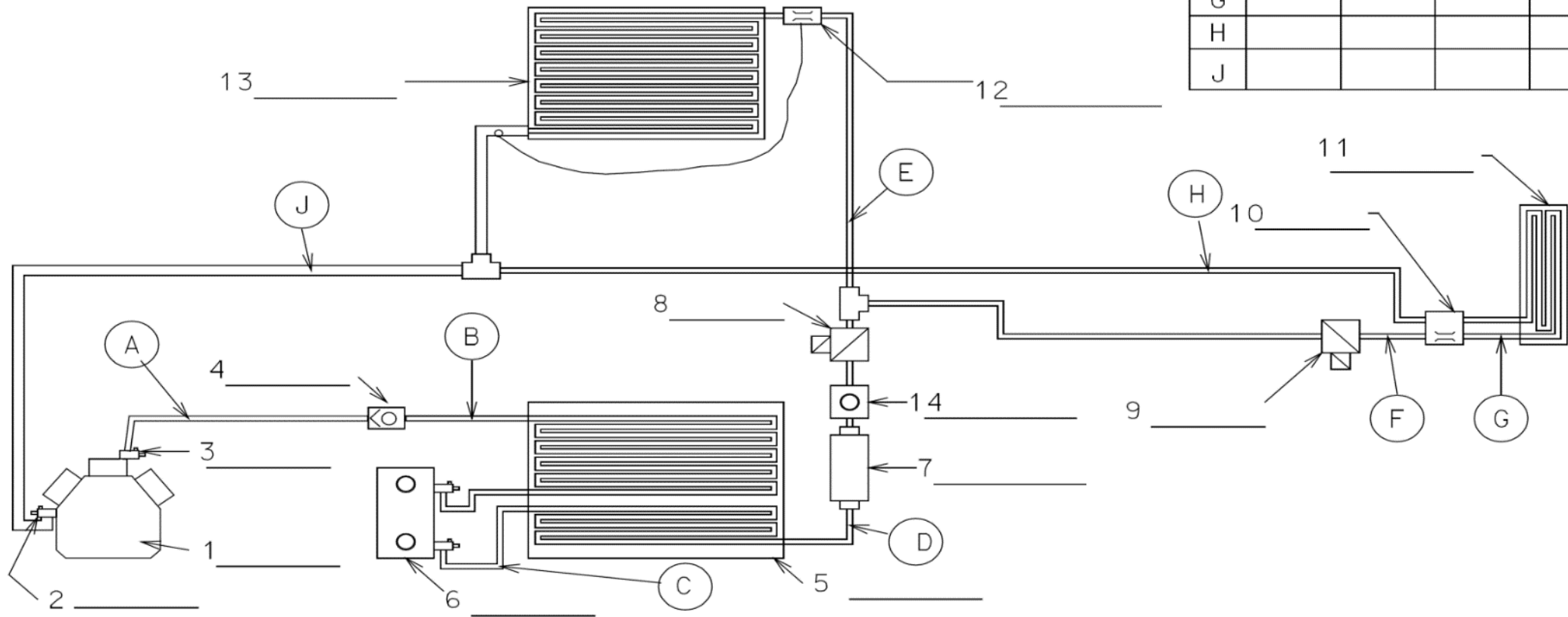
**CERTIFICATION!
CERTIFICATION!
CERTIFICATION**

ACTIVITY 10

1- IDENTIFY EACH COMPONENT FROM 1 TO 14

2- FOR EACH HOSES FROM A TO J, CHECK THE FIELD RELATED WITH THE FREON STATUS.

	LIQUID	VAPOR	HI-PRESS	LO-PRESS
A				
B				
C				
D				
E				
F				
G				
H				
J				



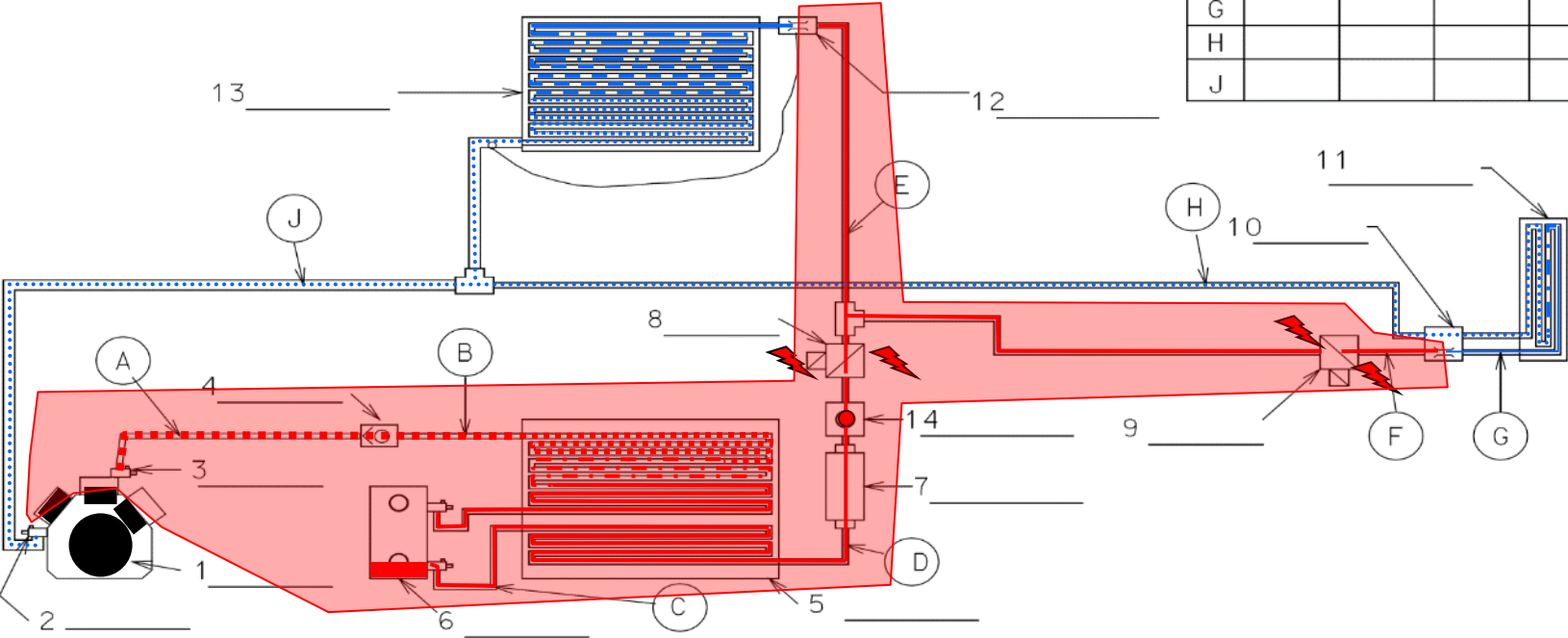
REFRIGERANT STATE

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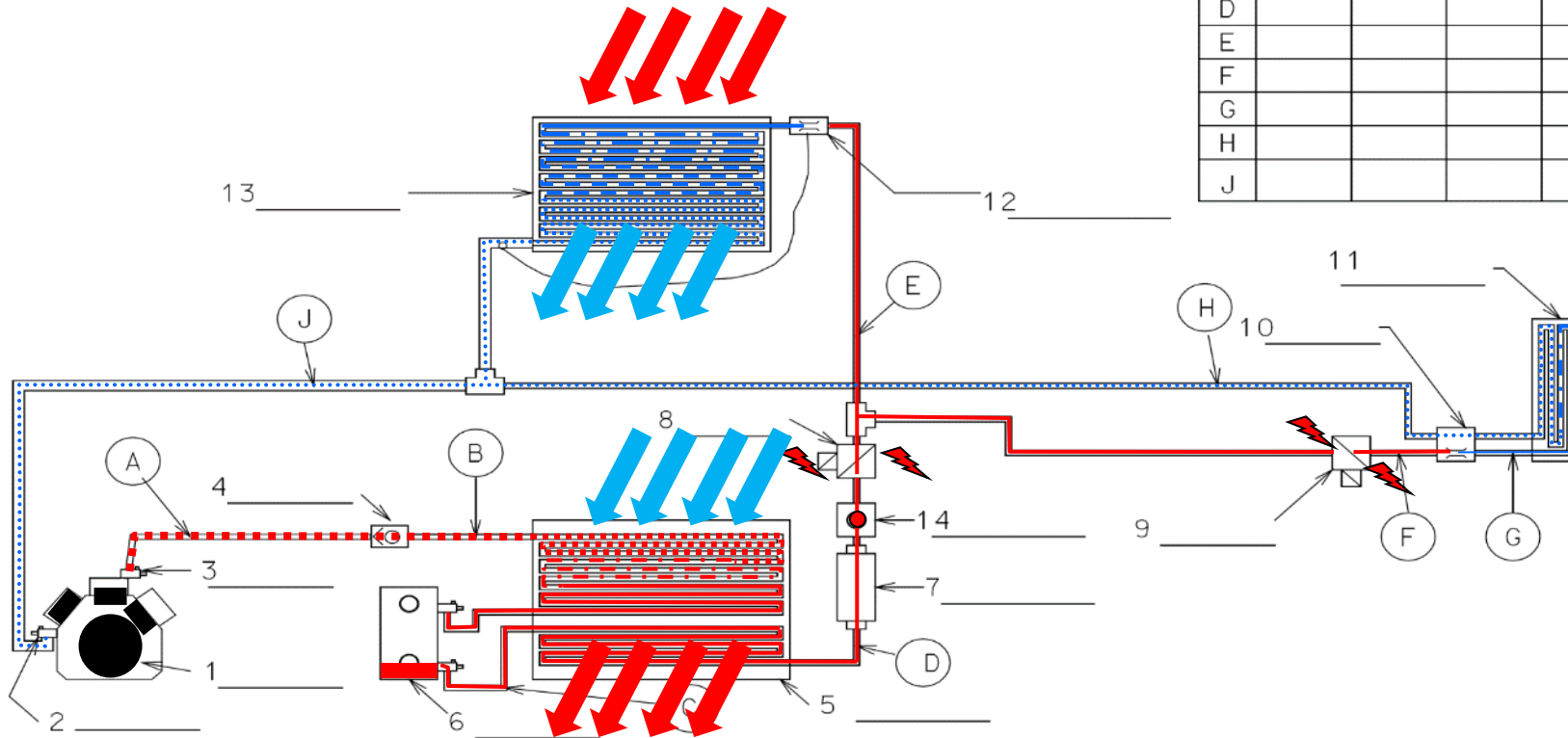
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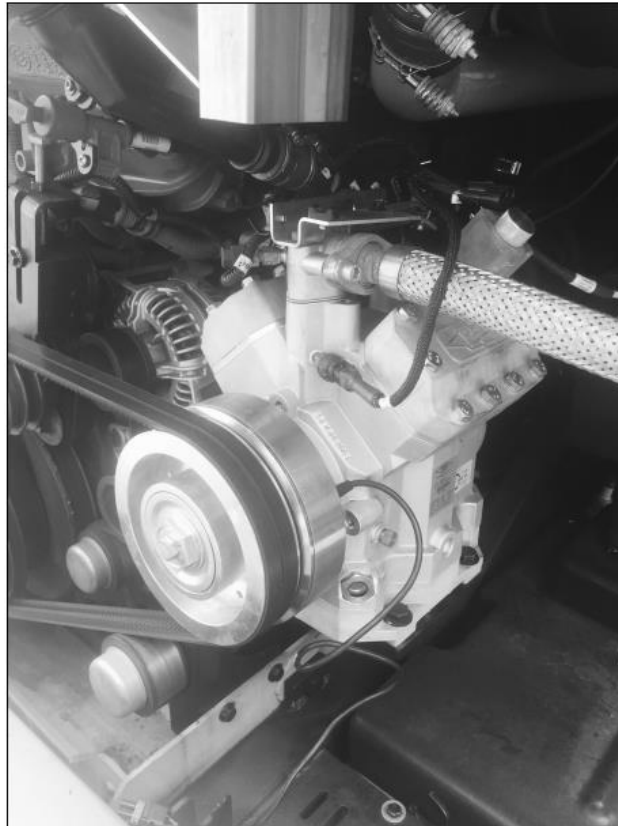


Compressors used on main A/C systems

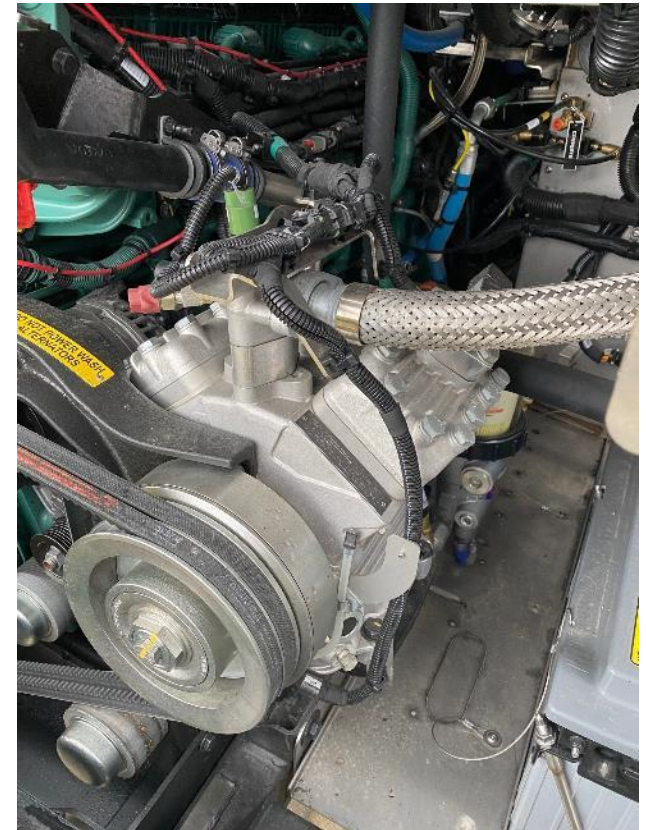
Carrier Model 05G



Bitzer Model 4NFCY Prevost and 9700



Bock FKX40/655K



COMPRESSOR OIL

- **O5G**
 - No oil change interval
 - It is recommended to change “on condition”
 - Inspect oil to determine if it needs changing
- **BITZER**
 - Check oil collection and tube; drain and document oil amount
 - There is a definite oil change interval or *change on condition*
 - Every 3 years or 10,000-12,000 operating hours
 - Icematic SW68 oil
- **BOCK**
 - Drain oil collection system (tube) every maintenance
 - Drain oil collection tube every 1400 hours
 - Change oil on condition; find cause for contamination/discolorization
 - Change oil at recommended interval

Oil level check requirements

- Refer to specific compressor manual for procedure
- Make sure coach is sitting level
- All compressors circulate oil throughout the refrigeration system
- All 3 types require high discharge pressure to “load” the system
- Block condenser to get discharge pressure in the 190-200 psig range
- Run interior temp setting to a high level, then introduce AC
- Operate system for 15 minutes at this load
- Check oil in accordance with the compressor instructions

MAINTENANCE INFORMATION BULLETIN FOR OIL



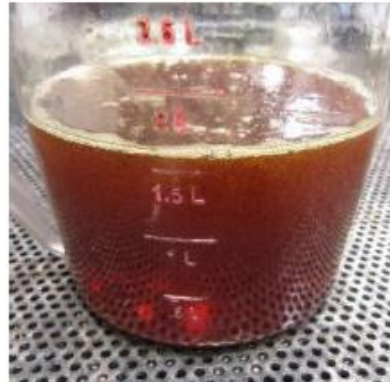
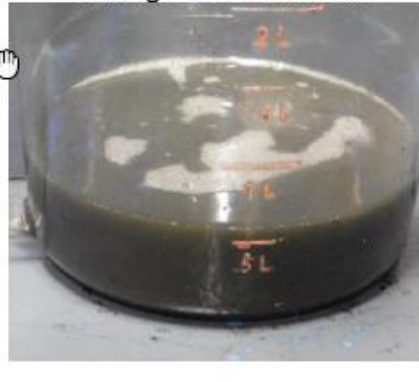


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MAINTENANCE INFORMATION

MI18-21A

DATE :	May 2018	SECTION :	22 HVAC
SUBJECT :	BITZER A/C COMPRESSOR OIL CHANGE INTERVALS		

OIL EVALUATION CRITERIA			
<p>Normal</p> 	<p>Shows deterioration Should be changed soon</p> 	<p>Must be changed at once</p> 	<p>Heavily deteriorated compressor has suffered damage due to this oil</p> 

Condenser Compartment



DISCHARGE CHECK VALVE



- Keep the liquid from the condenser from back tracking in to the compressor.
- Liquid is not good for compressor

The condenser is just like a heat exchanger
The hot gas starts at the top of the condenser
By the time gas is 2/3 down the tubes it has changed back in to a liquid

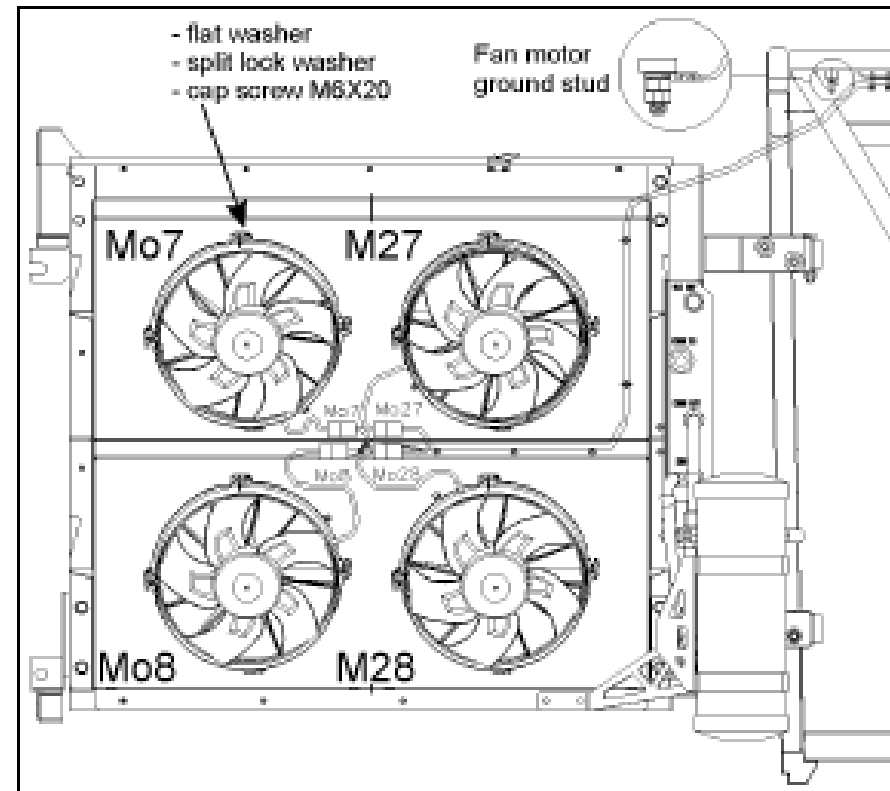
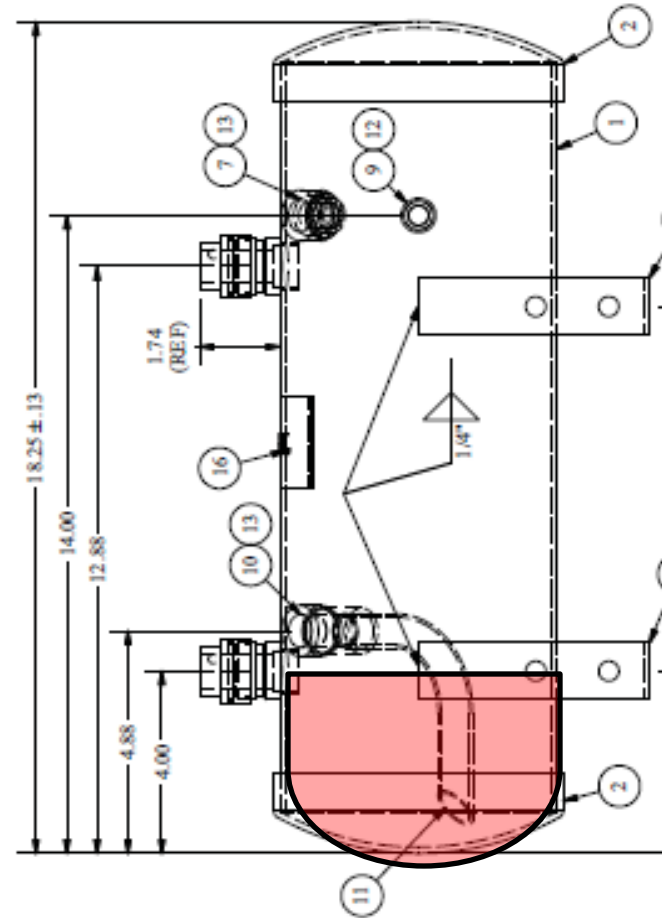


FIGURE 29: CONDENSER FANS

22363

Receiver tank

The receiver tank is located in the condenser compartment (figure 30). The function of the receiver tank is to store the liquid refrigerant. During normal operation, the level of the refrigerant should be approximately at the midpoint of the lower sight glass.



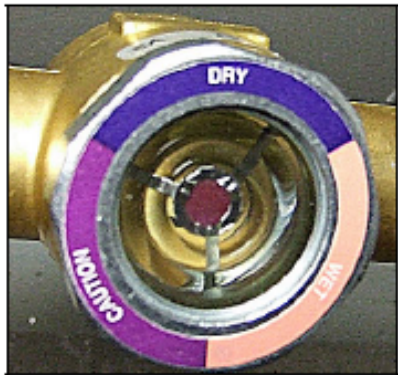
EK-415 Emerson Filter drier



MOISTURE INDICATOR

7.7 MOISTURE INDICATOR

The moisture sensitive element consists of a color changing ring which is reversible from pink to blue and vice versa as the moisture content in the refrigerant changes.



- PINK: high levels of moisture detected.
- PURPLE (caution): low levels of moisture detected.
- BLUE: dry, optimal operating conditions.

Since temperature changes affect the solubility, color change will also vary with the refrigerant temperature. The above table shows the color change for R-134a at various moisture levels and liquid line refrigerant temperatures.

COLOR INDICATOR			
Temperature	BLUE (ppm)	LIGHT VIOLET (ppm)	PINK (ppm)
75°F (24°C)	Below 5	5-15	Above 15
100°F (38°C)	Below 10	10-30	Above 30
125°F (52°C)	Below 15	15-45	Above 45

p.p.m.= parts per million (moisture content)

Liquid line refrigerant solenoid types

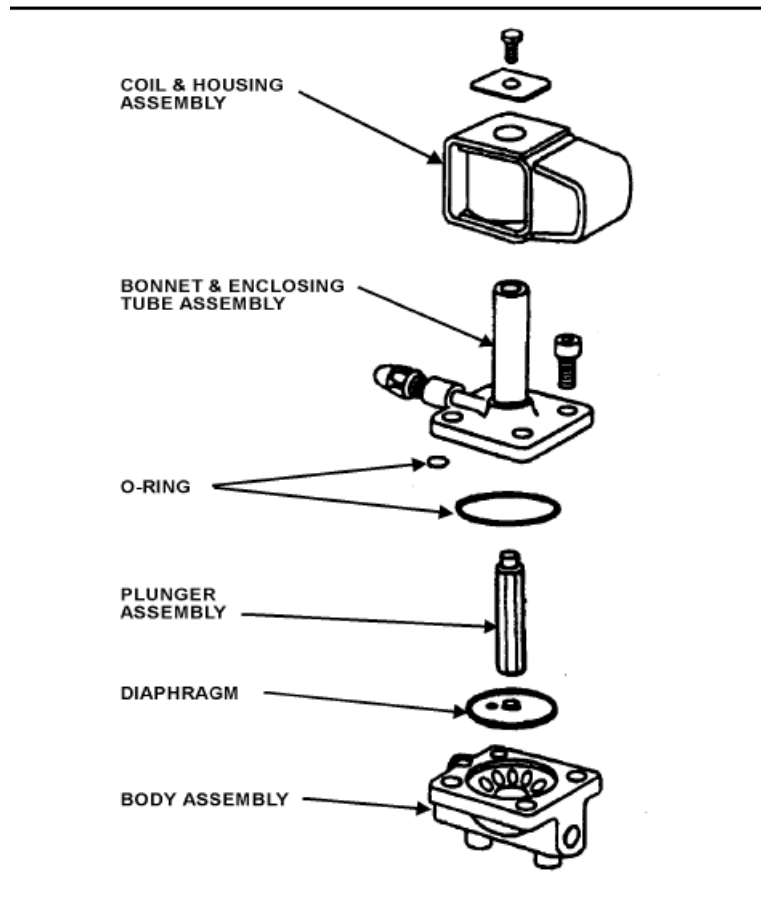


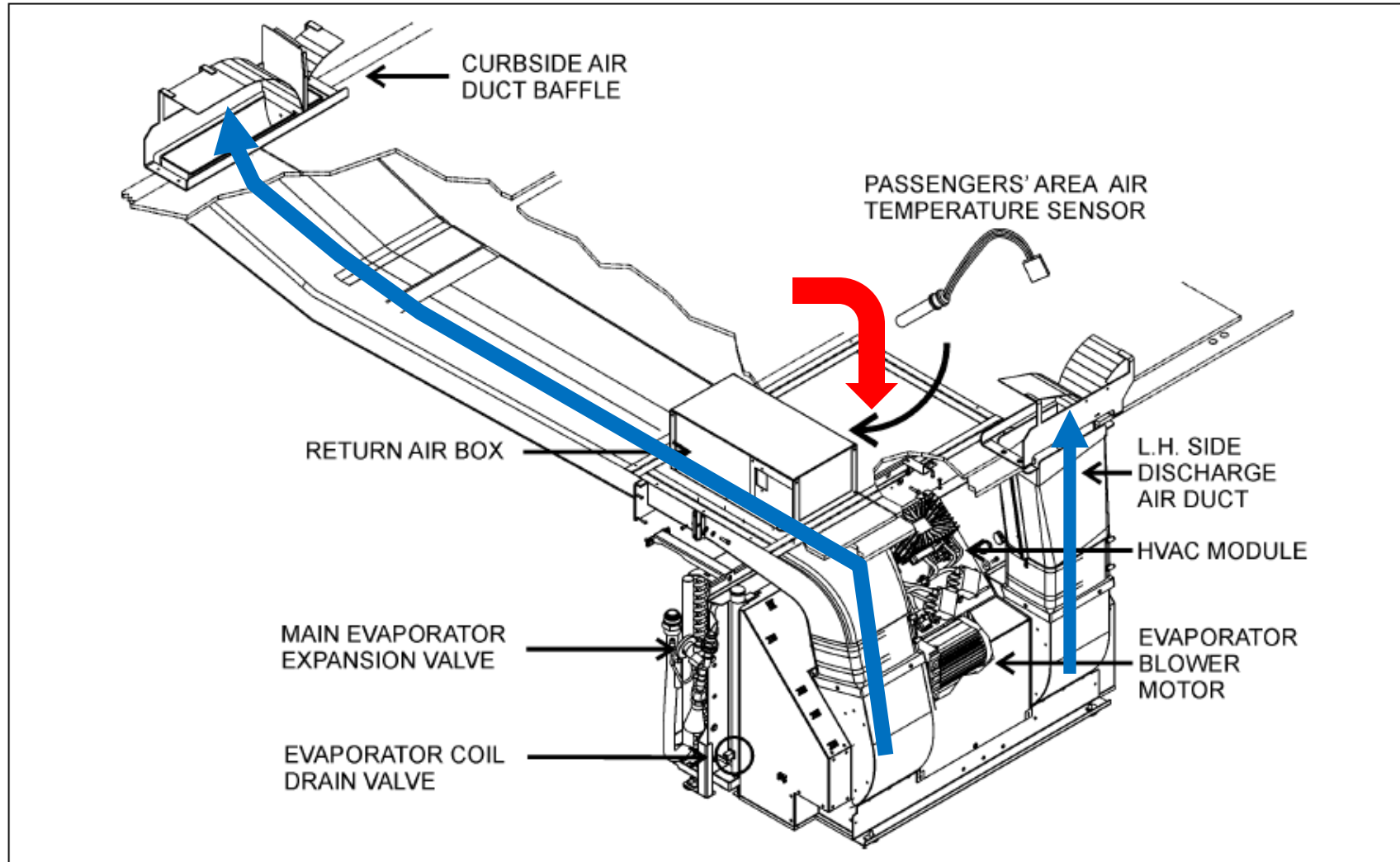
FIGURE 32: REFRIGERANT SOLENOID VALVE 22044



Evaporator



X EVAPORATOR COMPARTMENT ARRANGEMENT



Expansion valve

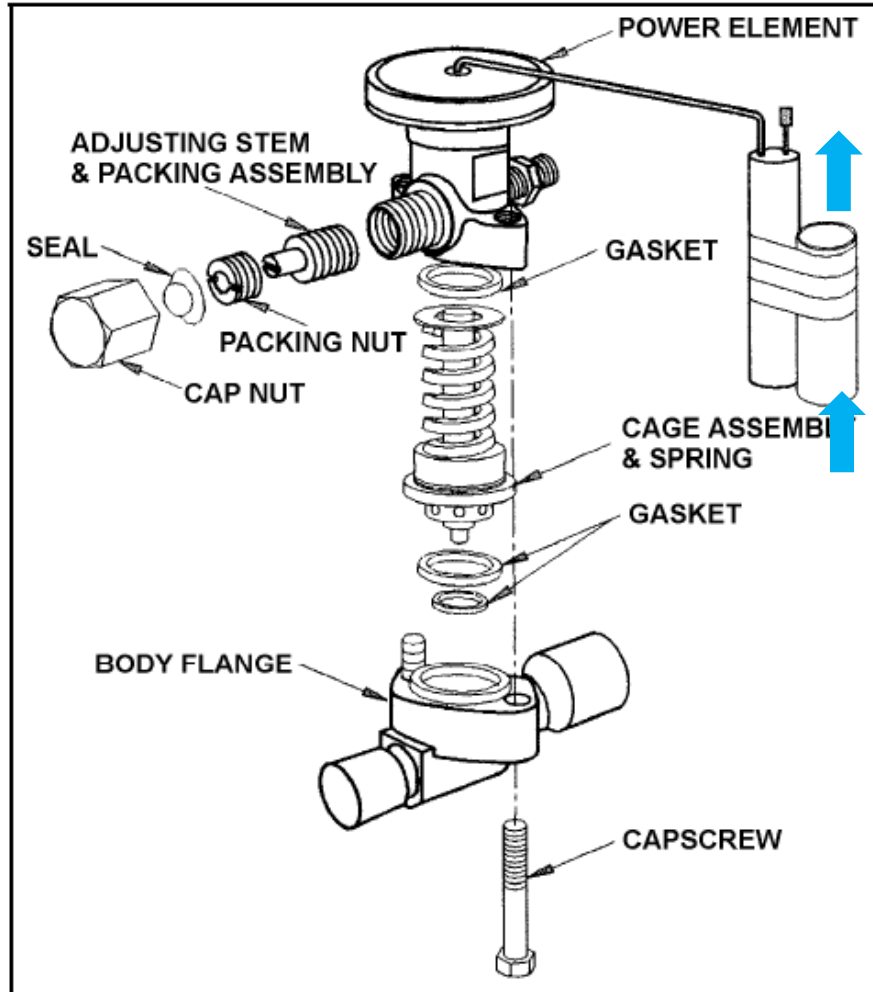
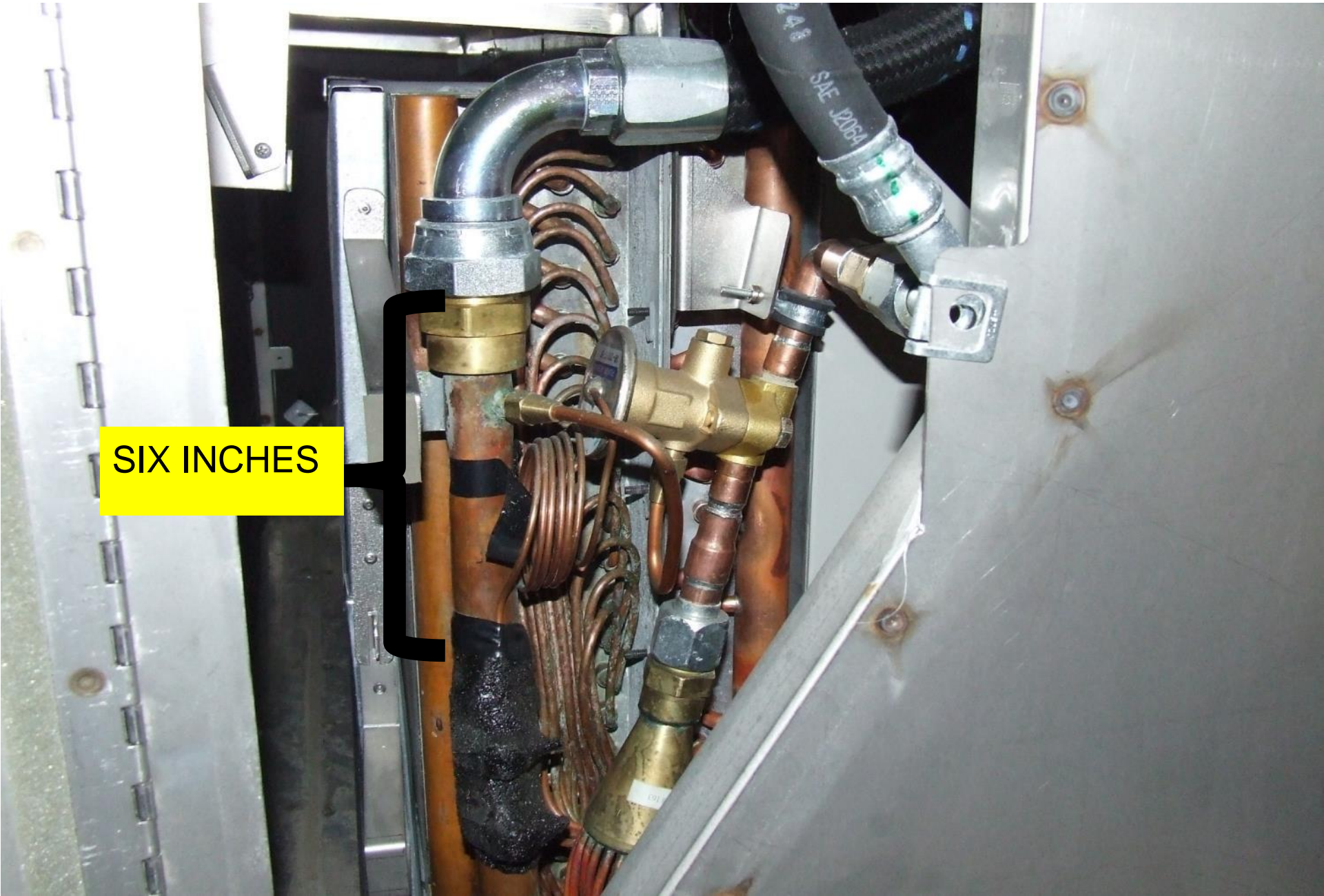


FIGURE 33: EXPANSION VALVE

22215



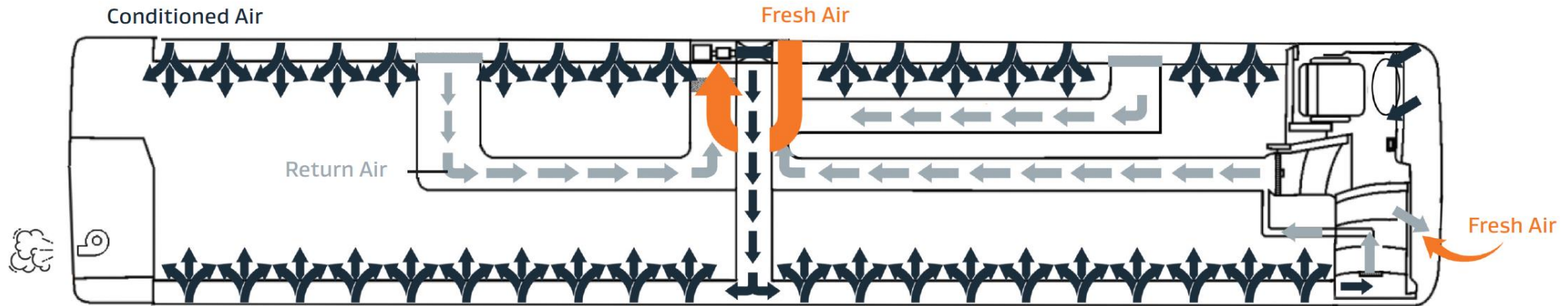


H3-45 COACH

PREVOST®

THE ULTIMATE EXPERIENCE

- H3-45 HVAC Air Circulation
- Approximately 2500CFM Air Flow
- 500CFM Fresh Air or Outside Air
- Cabin air is replaced every 5 minutes with fresh air



- Conditioned Air
- Return Air
- Fresh Air
- ☁ Cabin Exhaust



Air flow EFM is forced up through the outside wall vents up the window.

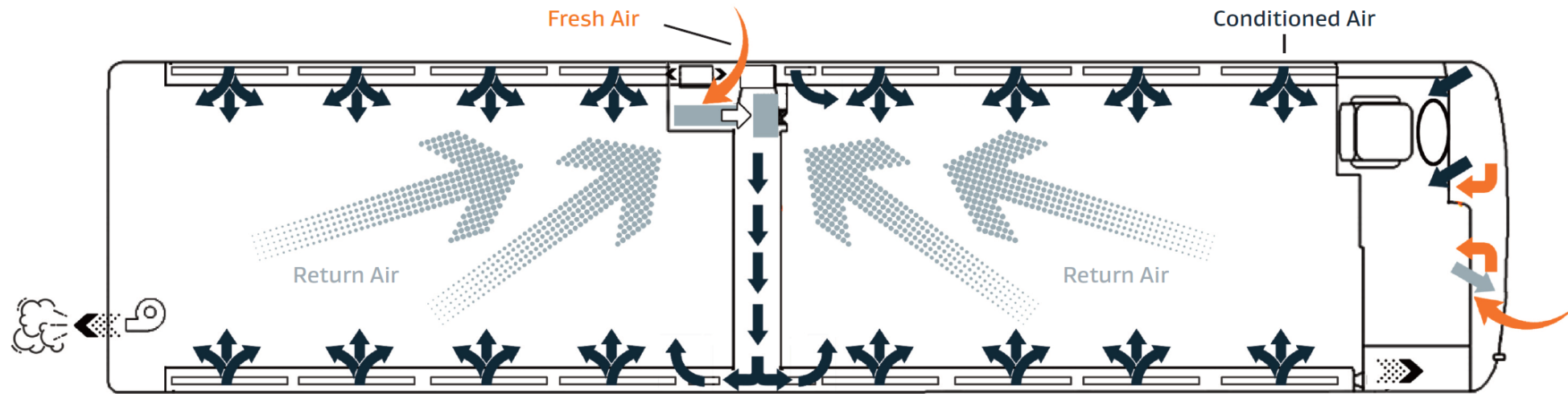
To the parcel racks and roof and forced down to the air return.

X3-45 COACH

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To the parcel racks and roof and forced down to the air return.

Evaporators should never wear a sweater!



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AGM Batteries

Advantages over lead acid

Testing

Charging

Recommended Equipment

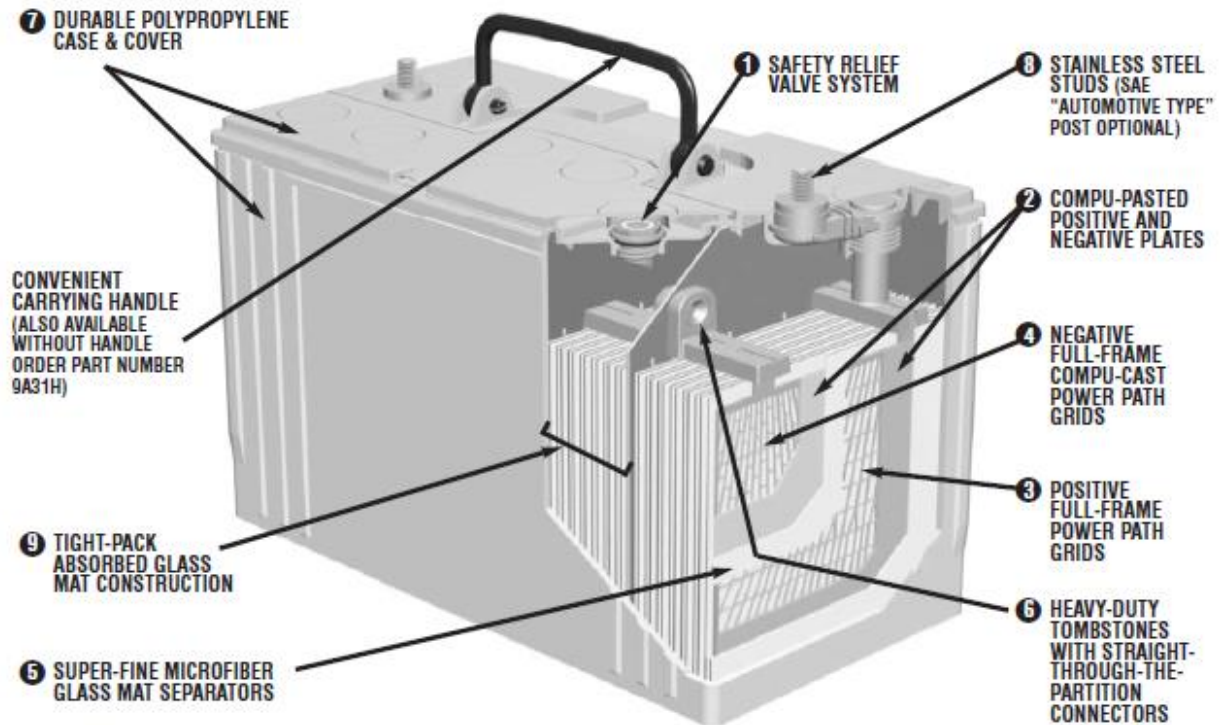


SOME FACTS ABOUT AGM BATTERIES

- **Absorbed Glass Mat.**
- AGM use Lead-Acid combination same as common “Flooded batteries”.
- AGM batteries are valve-regulated, the cells are sealed with a pressure relief valve that prevents gases from escaping.
- Positive and Negative plate are sandwiched between layers of glass mat made of blend of micro fibers.

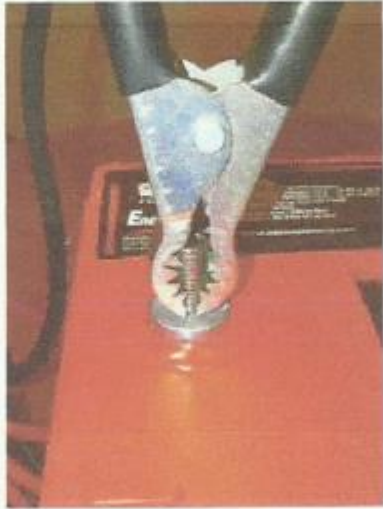


*Today's Modern Truck Needs a Modern Battery
Advance AGM Deka Batteries...
What's on the Inside Counts*



ODYSSEY

Incorrect Charge or Test Cable
Clamp Connection



Correct Charge or Test Cable
Clamp Connections



EXTREME POWER AND ENDURANCE

A collection of four Odyssey Extreme AGM batteries of various sizes, arranged on a red and orange background. The batteries are prominently displayed with their labels clearly visible.

ODYSSEY[®]
Extreme
SERIES™

www.odysseybattery.com

AGM have a 4 to 5X lifecycle over lead acid

Resist Vibration & Shock

Deep cycle capability

Don't leak or require filling



SOME FACTS ABOUT SHIPPING

Did you know AGM batteries are not consider as Dangerous good when come the time to ship batteries. As long as:

- Battery post are protected against short circuits.
- Battery is identified as “NONSPILLABLE”

4.7 Shipping Classification

Lifeline® AGM batteries have been tested and determined to be in compliance with the vibration and pressure differential tests in accordance with DOT 49 CFR 173.159(d) and Special Provision A67 of the International Air Transport Association (IATA) Dangerous Goods regulations. As such, they are classified as a “NONSPILLABLE BATTERY” and can be shipped as non-hazardous material by any means. To comply with DOT shipping regulations, the battery must be packaged to protect against short circuits and the battery and outer packaging must be plainly and durably marked “NONSPILLABLE” or “NONSPILLABLE BATTERY”.

REF: LIFELINE Document 6-0101

AGM VS OPEN CIRCUIT VOLTAGE

- Prevest use Volvo batteries #21258363 (DEKA 8A31) 110 amp/h
- Reserve cap : 200 min and CCA : 800 Amp.
- Open circuit voltage of the battery is based on percentage of state of charge remaining in the battery. With OCV =12.6V , SOC = 75%, Charge is $110 \times 75\% = 82.5$ amp/h.
- OCV can be measured with a Voltmeter and then convert in % SOC
- But to avoid reading surface charge, this test should be performed 4 hours after batteries seat with no cable.
- Table here show OCV to be used with Volvo battery “DEKA 8A31”

Deka :

% CHARGE	OPEN CIRCUIT VOLTAGE
	AGM
100	12.8 or higher
75	12.60
50	12.30
25	12.00
0	11.80

TESTING AGM BATTERIES

- Batteries Analyzer are available on auto tool market with different configuration. This tool can give the technician good information about State of Charge (SOC), State of Health (SOH), Cold cranking amperage (CCA) or Impedance. Test resulted from Analyzer is usually “Good” , “Recharge and Retest” or “Failed”. This tool is not mandatory for Prevest AGM batteries test.
- 2 important tests need to be perform prior to replace a battery. Both test need to be performed on each battery with all cables removed. But first, perform visual inspection. Never try to recharge a battery with a broken case or if the case is swelled up at one of the cells.

TEST# 1 : Check OCV and recharge batteries with compatible AGM charger.

Example: Prevest AGM has an OCV of 12.30V. (50%) . This battery need 55 amp/h charge. With a 20amp charger it will take 4 hours @ 65% efficient.

TEST#2 : When the batteries is fully charged SOC =100% Perform a load test with a carbon pile. Load each battery individually with 400amp for 15sec.

Pass-Fail is related to ambient temperature

PASS-FAIL VOLTAGE/TEMP. FOR 12V BATTERIES	
0° F - 8.5V	50° F - 9.4V
30° F - 9.1V	70° F - 9.6V



PRIOR TO RECHARGE A BATTERY PERFORM A VISUAL INSPECTION

Failed



Good



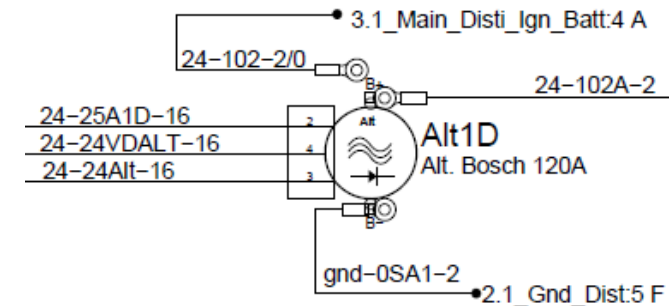
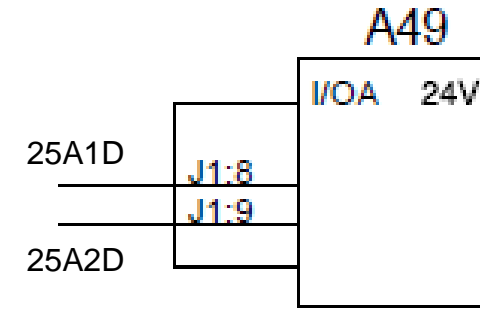
CHARGING A BATTERIES WITH OCV BELOW 8V



- When batteries OCV is lower than 8V, each battery must be charge individually.
- Most of batteries charger got a reverse polarity protection. Batteries charger will not automatically start when battery voltage is lower than 8V. To start the charge use charger polarity bypass switch or connect a good battery in parallel with the low OCV battery.
- In order to recharge a low OCV batteries we need to start with boost charge. Use a basic wheel charger as shown on picture. Recharge in boost mode until OCV =12V (SOC 25%). “Always Remove charger and wait few minutes to check OCV”.
- Then finish the charge at lower voltage/ampereage to avoid overheating of battery and destroy AGM cell relief valve. Calculate charging time in function of battery SOV vs Charger capacity.

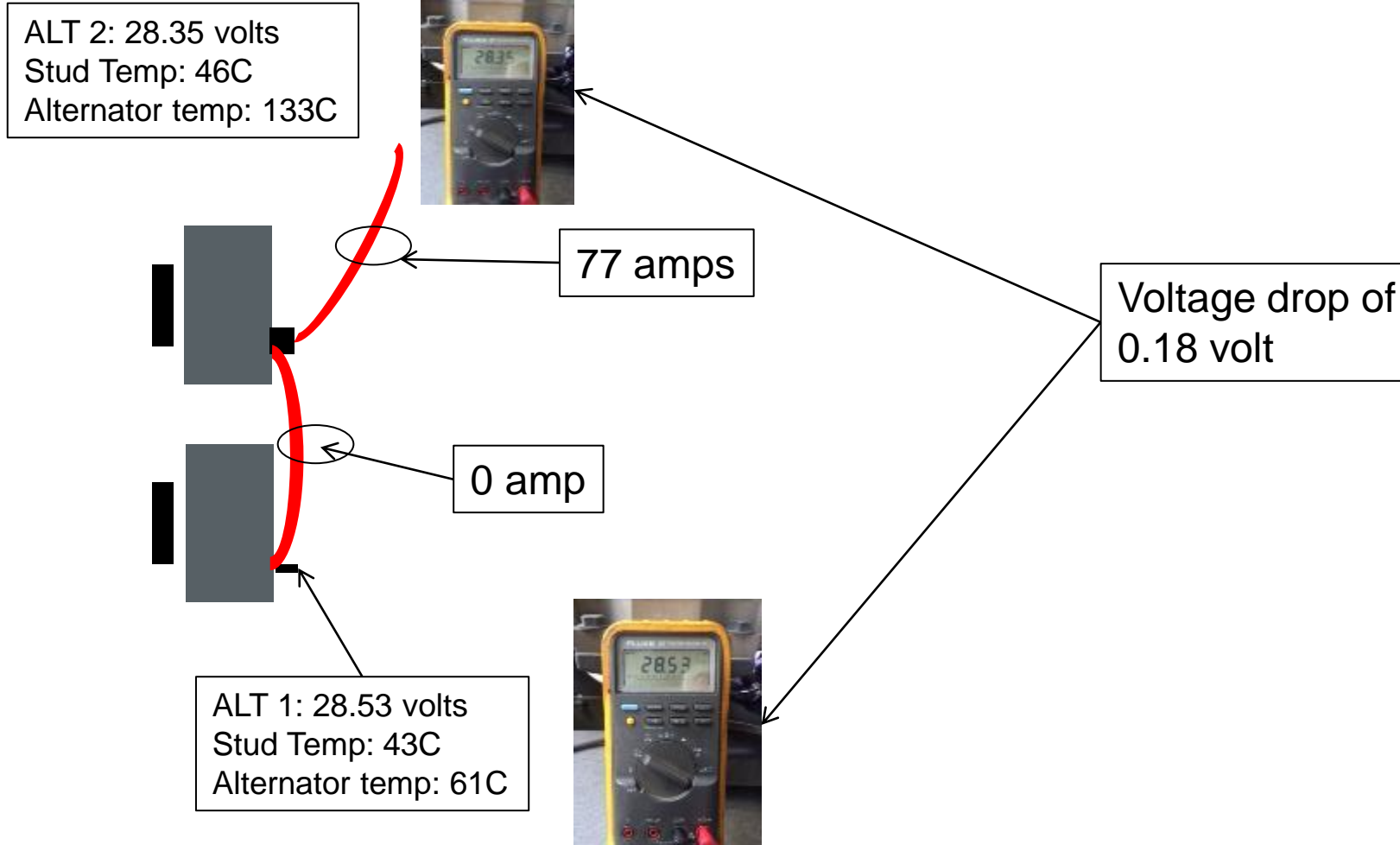
ALTERNATOR TEST.

- First indication of alternator failed is Battery indicator light on the dash with a multiplex fault for ALT#1 (Lower) and ALT#2 (upper) open circuit.
- But never assume Alternator 1 is lower alternator. Perform more testing before replacing alternator.
- With engine running and park brake apply, use a voltmeter to back probe A49 pin 8 and 9.
 - Good: With engine running voltage should be $\geq 26.8V$ on both inputs.
 - Failed : Voltage = 12V means wire 25AxD open.
 - Failed: Voltage = 1.2V means alternator not charging.
- If voltage one alternators input failed. Disconnect top alternators to see if good alternator still reading good at A49 input. If yes, top alternators need to be replaced. If not replaced lower alternators.
- Checking current draw on batteries cable is good as long as you get enough load to have both alternators charging. Total amperage of 100 amp on main cable with 100 amp on alternator jumper do not mean upper alternator is not charging.



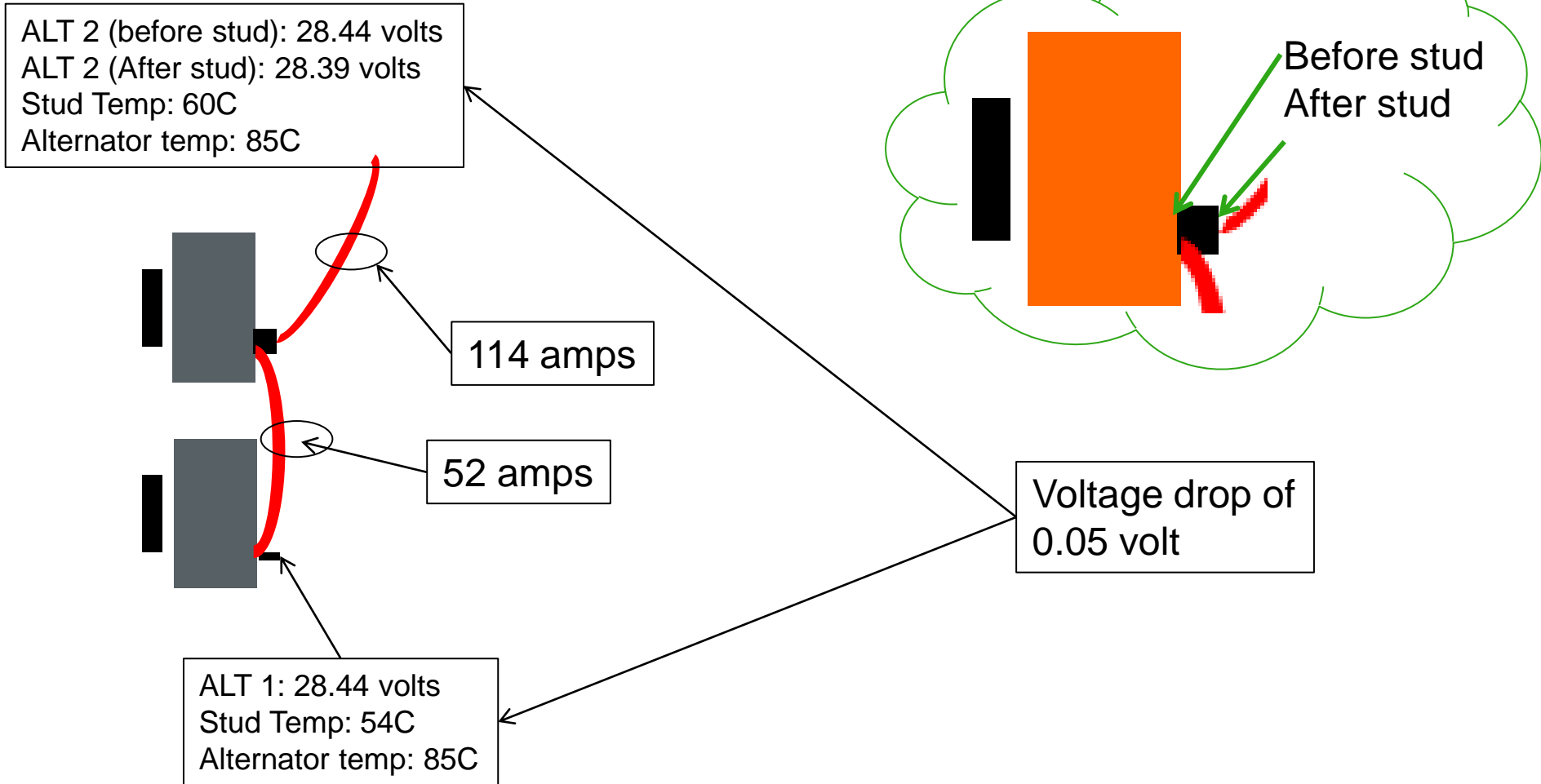
REPEAT CHARGING SYSTEM ISSUES

- We first confirmed that the Alternator 1 (bottom alternator) was not charging using an Amp meter clamp. We also took some more readings. See below

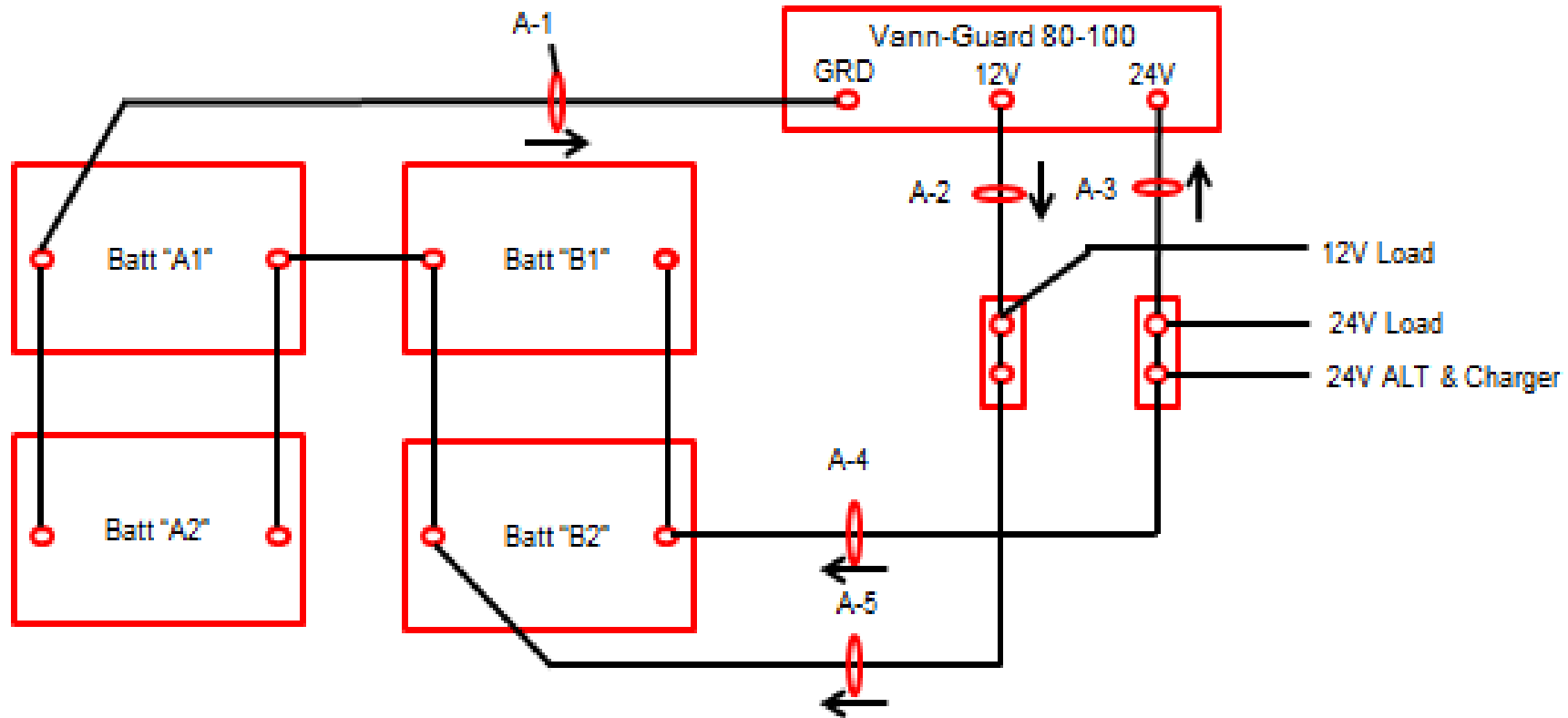


REPEAT CHARGING SYSTEM ISSUES

- We reinstall a new alternator and also build a new jumper cable that we crimped and soldered the ends. Here were the new readings



CHECK AMPERAGE IN-OUT



Batteries equalizer is basically a 12V power supply. Total amp out of 12V post = 24V amp IN + GRD amp IN.
 TEST : Engine running, park brake apply, with max 12V load turned on (Headlamp, marker light and Radio)
 Check current with Amp-Meter.
 Equalizer work well when $\text{Amp}(A2) = \text{Amp}(A1) + \text{Amp}(A3)$. *Check direction of arrows in above diagram*
 A-4 and A-5 is the Amperage required to recharge batteries.

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