For testing all 12V batteries rated in CCA, SAE, DIN, JIS#, IEC, EN and CA. Also for testing vehicle Electrical System.
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1.0 - Introduction

1.1 – EQP-114 (Battery & Electrical System Tester):

This device uses modern technology in battery testing which can test batteries in all conditions. Testing procedures are quick and easy with repeatable results. Test Results can be printed directly on attached mobile printer or it can be stored in the computer for records.

1. Battery Test:

- Analyses the battery condition using microprocessor controlled testing methods without the need of fully charging it before test.

- The unit consumes very little current during testing hence the test can be repeated numerous times without worry of draining the battery and its results are highly accurate.

- Extremely safe as it does not create any sparks during clamp on and it takes less than 7 seconds to obtain the full analysed results of tested battery.

2. Grounding Test:

- Analyses the condition of the electrical return circuit contacts resistance which were connected to the engine or chassis body from the battery terminal with results and recommendations display after test.

3. Starter Test:

- Checks the cranking effectiveness of the battery to predict when the battery will fail to crank a vehicle basing on voltage profiles with results and recommendations display.

4. Alternator Test:

- This test checks the alternator charging condition during load at 2,000 RPM and without load at 3,000 RPM with results and recommendations displayed after each test.

This tester is maintenance free and does not require internal batteries. It powers up when connected to the battery posts during testing or through an external 12 Volts DC source for later review of the test results.
The operation is fast and simple. When connected to the battery posts, the instructions on the screen will lead you through. There is a warning tone to caution you to perform the correct steps. In the event that you need assistance there is a key. It will display information about each function when selected.

The results are consistent and repeatable and can be performed numerous times without heating up the unit. It is very safe as it does not create any sparks when connecting to the battery terminals during testing on the vehicle.

After the test, the results will be stored in its memory and can be reviewed again later. Also it can be printed directly on the attached mobile printer. It is equipped with a USB cable to be connected to a PC to store the results or have it printed out from a normal computer printer.

**1.2 Specifications:**

- **Operating Voltage:** 9V ~ 15V DC (max)
- **Analysing Capacity (Amps):**
  - CCA: 100 ~ 1700
  - IEC: 100 ~ 1000
  - EN: 100 ~ 1700
  - DIN: 100 ~ 1000
  - JIS#: 100 ~ 1700
  - SAE: 100 ~ 1700
  - CA: 100 ~ 1700
- **DC Volts Accuracy:** ± 2% Reading
- **Battery analysing time:** Less than 7 seconds.
- **Languages:** Multiple language options are available.
- **PC connection:** Through USB cable.
- **Printer head:** Thermo print head.
- **Paper width:** 57.5mm ± 0.5mm
- **Paper roll diameter:** Max. 40mm OD.
- **Printing Speed:** 50mm per sec.
- **Working Temperature:** 0°C ~ 50°C.
- **Working Humidity:** 10 ~ 80 %
2.0 Safety Measures:

For safety reasons, read this manual thoroughly before operating the device.

Always refer to and follow the safety instructions and testing procedures provided by the car or equipment manufacturer. The safety messages presented below and throughout this user’s manual are reminders to the operator to exercise extreme care when using this test instrument.

2.1 Safety Precautions:

- **DANGER**
  When the engine is running, it produces carbon monoxide, a toxic and poisonous gas. Always operate the vehicle in a well ventilated area. Do not breathe exhaust gases – they are hazardous that can lead to death.

- **CAUTION**
  To protect your eyes from propellant object such as caustic liquids, always wear safety eye protection.

- **DANGER**
  Fuel and battery vapors are highly flammable. DO NOT SMOKE NEAR THE VEHICLE DURING TESTING.

- **CAUTION**
  When engine is running, many parts (such as pulleys, coolant fan, belts, etc) turn at high speed. To avoid serious injury, always be alert and keep a safe distance from these parts.

- **WARNING**
  Before starting the engine for testing or trouble shooting, always make sure the parking brake is firmly engaged. Put the transmission in PARK (automatic transmission) or NEUTRAL (manual transmission).

- **WARNING**
  Always block the drive wheels. Never leave vehicle unattended while testing.
Never lay tools on vehicle battery. You may short the terminals together causing harm to yourself, the tools or the battery.

Engine parts become very hot when engine is running. To prevent severe burns, avoid contact with hot engine parts.

Do not wear loose clothing or jewelry while working on engine. Loose clothing can get caught in fan, pulleys, belts, etc. Jewelry can conduct current and can cause severe burns if it comes in contact between power source and ground.

When the engine is running, be cautious when working around the ignition coil, distributor cap, ignition wires and spark plugs. They are HIGH VOLTAGE components that can cause electrical shock.

Always keep a fire extinguisher readily available and easily accessible.

2.2 Other Precautions:

- This device is for testing 12 Volt batteries only.

- Its operating voltage is from 9V ~ 15V DC and should not be used on 24V directly. It will damage the unit. For 2 x 12V batteries (in series or parallel), disconnect the connections and test them individually.

- Battery that has just been charged by the charger contains surface charge and it should be discharged by turning ON the Head lights for 3~5 minutes before testing.

- Always attach the clips on the lead side of the battery terminal posts during testing so that it has a good contact. This will provide better and accurate results.

- Do not attach the clips directly onto the steel bolt that tightens to the battery terminal posts; this may give inaccurate readings or inconsistent results. (Note: This also applies to all other battery testing methods.)
• If the battery terminal posts are oxidised or badly corroded and the connections are bad, the tester will prompt you to check the connections. In this case, clean the terminal posts and perform the test directly on the terminal posts themselves.

• During testing of the battery while it is still in the car, make sure the engine is OFF.

• Do not store near high humidity or temperature area. Exposing to extreme temperatures will cause damage to the unit.

3.0 Working with Batteries

Lead-acid batteries contain a sulfuric acid electrolyte, which is a highly corrosive poison and will produce gases when recharged and explode if ignited and cause bodily harm.

When working with batteries, make sure you have plenty of ventilation, remove your hand jewelry, watch and wear protective eyewear (safety glasses), clothing, and exercise caution.

Do not allow battery electrolyte to mix with salt water. Even small quantities of this combination will produce chlorine gas that may harm you.

Whenever possible, please follow the manufacturer's instructions for testing, jumping, installing, charging and equalising batteries.

➢ Never disconnect a battery cable from a vehicle with the engine running because the battery acts like a filter for the electrical system.

Unfiltered [pulsating DC] electricity can damage expensive electronic components, e.g. emissions computer, radio, charging system, etc.
Turn off all electrical switches and components; turn off the ignition before disconnecting the battery.

- For non-sealed batteries, check the electrolyte level. Make sure it is covering the plates, and it is not frozen before starting to recharge (especially during winters).

- Do not add distilled water if the electrolyte is covering the top of the plates because during the recharging process, it will get warm and expand. After recharging has been completed, recheck the level.

- Reinstall the vent caps BEFORE recharging, recharge ONLY in well-ventilated areas, and wear protective goggles.

Do NOT smoke or cause sparks or flames while the battery is being recharged because batteries give off explosive gases.

- If your battery is an AGM or a sealed flooded type, do NOT recharge with current ABOVE 12% of the battery's RC rating (or 20% of the ampere-hour rating).

Gel cells should be charged over a 20-hour period and never over the manufacturer's recommended level or over 14.1 Volts DC.

- Follow the battery and charger manufacturer's procedures for connecting and disconnecting cables and other steps to minimize the possibility of an explosion or incorrectly charging the battery.

You should turn the charger OFF before connecting or disconnecting cables to a battery.

Do not wiggle the cable clamps while the battery is recharging, because a spark might occur, and this could cause an explosion. Good ventilation or a fan is recommended to disperse the gases created by the recharging process.

- If a battery becomes hot, over 43.3°C (110°F), or violent gassing or discharge of electrolyte occurs, turn the charger off temporarily or reduce the charging rate.

- When charging the battery in the car with an external MANUAL charger, make sure that it will not damage the vehicle's electrical system or components with high voltages.

Even if this is a remote possibility, it is best to disconnect the vehicle's battery cables from the battery BEFORE connecting the charger.
4.0 – The Battery & Electrical System

4.1 – EQP-114

Black Clamp to battery negative (−) post.

Red Clamp to battery positive (+) post.

Figure 1

Detachable Mobile Printer.

USB port for connection to PC.

4.2 – Keypad Functions:

Figure 2

1  2  3  4  5  6  7  8
4.3 - Functions of Individual key:

1. Use this key to scroll up to the next item OR when it is in the keying-in Battery Ratings values mode, pressing this key once will increase the value by step of 5 units.

2. Use this key to shift the selection tab to the right item OR when it is in the keying-in Battery Ratings values mode, pressing this key once will increase the value by step of 100 units.

3. Use this key to scroll down to the next item OR when it is in the keying-in Battery Ratings values mode, pressing this key once will decrease the value by step of 5 units.

4. Use this key to shift the selection tab to the left item OR when it is in the keying-in Battery Ratings values mode, pressing this key once will decrease the value by step of 100 units.

5. Pressing this ENTER key once will get into the selected function or proceed to the next step.

6. To EXIT the function, pressing this key one will return the previous screen.

7. This is the HELP key. Pressing this key will enter into the help menu and it will explain the functions of the item you have selected in detail.

8. Press this key to print all the Test results on the Detachable Mobile Printer. The printing can be done only in View Last Test mode because here you have to check the final results before executing a printout.
5.0 – EQP-114 Setup

5.1 – Printer Installation

1. To install the mobile printer, first remove the detachable back cover of the tester by sliding outward (Fig. 3a). Then insert the mobile printer into the slot and push all the way in until it stops (Fig. 3b).

![Figure 3a](image1.png) ![Figure 3b](image2.png)

2. Open the printer cover. Place a screw and tighten to secure printer as shown (Fig. 4a). Place the thermo paper roll into the slot with the paper edge facing up (Fig. 4b). Make sure the paper protrudes about 20mm when the printer cover is closed (Fig. 4c).

![Figure 4a](image3.png) ![Figure 4b](image4.png) ![Figure 4c](image5.png)

5.2 – Select Display Language

The display language of the tester can be changed from the wake-up screen (Fig. 5). First go to Setup Menu by pressing the key until it has been highlighted and then press the key to enter.
Inside the Setup Menu (Fig.6), press \( \leftarrow \) to gain access to the Language Menu (Fig.7).

Select the preferred language by pressing \( \downarrow \) key to scroll to the item. Then confirm it by pressing \( \leftarrow \) save. Once it had been saved, the display will change to the language selected. Press \( \rightarrow \) key to exit and get back to the Main menu screen (Fig.5) to continue your test.

### 6.0 – Help Key

This selection helps you to familiarise with the usage of the EQP-114 as well as explaining the various test functions and results. To get into this function, just press ? key at any one of the functions displayed on the menu screens as shown below (Fig.8 and Fig 9):
For Example:

If help is needed on “Battery Test”, then press the key on this item and the display will change to as shown (Fig. 10).

Pressing the key will scroll down to the next item “Voltage” (Fig. 11 below) and so forth until it reaches “Life”.
To see the help text, press ? key again on the selected item and it will display on the screen.

If you need to quit, just press ← key will go back to the main menu (Fig. 5).

Let’s say you need help on “How to operate”. Pressing ? key in this selection will get into the display as shown below:

```
How to operate ▲▼
Operation:
Engine must be OFF.
Locate the battery.
Clamp Tester to Battery [+ and [-] posts. Check battery rating [CCA, SAE, JIS, DIN, IEC, EN, CA]. Key the rating values. The Tester will lead you through the whole testing process.
```

Press ► key will scroll down to the next page to continue reading the text (Fig. 13) below.

```
posts. Check battery rating [CCA, SAE, JIS, DIN, IEC, EN, CA]. Key the rating values. The Tester will lead you through the whole testing process.

[Exit] to menu.
```

If you wish to continue help on rest of the item like “Voltage, Battery ratings, Internal Resistance and LIFE”, press ➡ key anytime to go back to the main menu (Fig. 11).

Here just select the item you want with ▼ key and then press ? key will enter into the display screen with the explanation text.

To exit press ➡ key twice. You will go back to the main menu to begin testing. (Fig.5)
7.0 - Battery Test

7.1 – Start Testing

Performing Battery Test whilst it is still in the car:
Vehicle that was running has to have its engine OFF first and then switch ON the headlights for 30 seconds to remove the surface charge. After the headlights are switched OFF, let the battery rest for at least 1 minute to recover before testing commences.

The engine and all other accessory loads must be OFF during test in order to have accurate results. When attaching the tester clips, make sure that the battery posts are not oxidized or badly corroded. Clean them first before clamping to it. Do not clamp onto the steel bolts directly which may give inaccurate and inconsistent results.

Testing on stand-alone batteries:

Clean the battery posts with a wire brush prior testing. For side post batteries, install stud adaptors. Do not use steel bolts for better results.

1. Attach the tester clips onto the battery terminal posts [ Red to (+) and Black to (–) ] the unit will power up and light up.

2. It will run through a self-test and when completed it displays the Main Menu as shown: (Fig. 15)
Here, it will let you select your choice from the Menu:

**New: Clear Memory**
Selecting this item will allow the tester to clear the last tested results stored in its memory and begin a new test.

**Continue Testing**
Selecting this item will allow you to continue the last test on the same car from where you had stopped.

For example:
If you had done Battery Test and later you wish to do Alternator Test or Grounding Test on the same car, just select this item and it will update the results after each test in its memory so that it can be reviewed later or be printed out.

**View Last Test**
Here it will let you review all the test results of the last tested car. The results stored will always be the updated ones which depend on the tests that had been done.

Use ◀ or ▶ keys to scroll for the pages during viewing.

Examples:

**Battery: Good**
- Measured: 406 CCA
- Rating: 630 CCA
- Volts: 12.45 V
- Int. R: 6.72 mOhm
- Life: 76%

**Results: High Ohms**
The grounding resistance of the engine or car chassis is high.
Clean the cable contacts or replace cable if necessary.
3. After you have made your choice, selecting “New: Clear Memory” or “Continue…Test” will proceed to the display below: (Fig. 18)

![Select Test](Select Test)

<table>
<thead>
<tr>
<th>Battery Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grounding Test</td>
</tr>
<tr>
<td>Starter Test</td>
</tr>
<tr>
<td>Alternator Test</td>
</tr>
</tbody>
</table>

Then press [Enter].

4. Pressing key once will scroll down to the next item if there is a need to select it.

5. As an example (Fig.18) the selected item was on “Battery Test” and it is being highlighted.

6. Press key will proceed to do the battery testing and if it has detected any surface charge on the battery, it will start to remove and a message is shown (Fig. 19) below.

![Figure 19](The Tester is removing the battery surface charge now.)

Please wait for a moment!
7. If the surface charge is too great for the tester to handle, it will prompt you with the instructions as shown: (Fig. 20) below.

![Figure 20]

**Battery surface charge is present!**

Turn the ignition key to ON position.

Switch ON the headlights to remove surface charge.

8. Wait until the surface charge removal has completed. The device will advise as follows: (Fig.21) and then press key.

![Figure 21]

**Battery surface charge has been removed.**

Turn ignition key to OFF position.

Switch OFF the headlights and then press [Enter].

9. If there is no surface charge present, it will enter into “Select Battery” menu screen as shown in Fig. 22

![Figure 22]

**Select Battery ▼▲**

SLI (Wet Type)

AGM (Flat/Spiral)

[Enter] to proceed
Here, selecting SLI (Wet type) battery meant that it tests Starting, Lighting and Ignition (SLI) batteries e.g. normal flooded types like Wet Low Maintenance (Sb/Ca), Wet Standard (Sb/Sb) Batteries.

If AGM (Flat/Spiral) is selected, then it will test Wet (MF) Maintenance Free (Ca/Ca), AGM/Gel Cell VRLA (Ca/Ca) Batteries.

10. Once the selection has been done, it will proceed to the display as shown in Fig 23:

11. Before selecting the ratings ‘CCA, SAE, EN, IEC, DIN, CA and JIS #’ from the menu, check the battery specification value. This value can be checked on the battery labels as some of the examples shown below:
If it is selected under JIS # (Japanese Industrial Standard) then the display will prompt you as shown (Fig.24) below.

Refer to the battery model (example: 80D26L or NX110-5L) on the Cold Cranking Amps (CCA) Table list supplied separately or from this manual on page 27 & 28 (See example Fig.25 below.)

<table>
<thead>
<tr>
<th>Battery Model (JIS#)</th>
<th>CCA</th>
<th>Battery Model (JIS#)</th>
<th>CCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEW</td>
<td>OLD</td>
<td>WET</td>
<td>MF</td>
</tr>
<tr>
<td>50D20R</td>
<td>50D20R</td>
<td>310</td>
<td>380</td>
</tr>
<tr>
<td>50D20L</td>
<td>85BR60K</td>
<td>310</td>
<td>380</td>
</tr>
<tr>
<td>50D23R</td>
<td>85B60K</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>50D23L</td>
<td>85B60K</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>50D24R</td>
<td>NT80-S6</td>
<td>390</td>
<td>95D31L</td>
</tr>
<tr>
<td>50B24L</td>
<td>NT80-S6L</td>
<td>390</td>
<td>95E41R</td>
</tr>
<tr>
<td>50D26R</td>
<td>50D20R</td>
<td>370</td>
<td>95E41L</td>
</tr>
</tbody>
</table>

Figure 24

Please refer to the charts provided for converting JIS# to CCA ratings before keying in the values.

Press [Enter] to continue...

Figure 25
Press ← key and the display will show: (Fig.26) below:

12. Referring to the Table list (Fig.25) basing on 80D26L, check the battery type: WET, MF, Sealed MF or Closed MF (CMF) as each category has different CCA ratings. For instance, if the battery is a Sealed MF (CMF) then it is rated at 630 CCA.

**Note:**
- **WET** - Wet Cell Type
- **MF** - Maintenance Free Type
- **SMF** - Closed or Sealed Maintenance Free

13. To enter the value 630, press ➤ key will increase the original value of 500 (Fig.26) by step of 100 units to 600. Likewise use ◀ key to increase the last two digits (00) to 30 by step of 5 units for each pressing. (Fig. 27)
Once the CCA rating of the battery is confirmed, press the \[ \leftarrow \] key will start the testing process. Refer to the display below (Fig. 28).

![Figure 28](image)

14. For less than 7 seconds, the results of the testing will be displayed on the LCD screen. (Fig. 29)

![Figure 29](image)

**Interpretations of the above results:**

1. **RESULTS:** **Good**
   
   A very straightforward display of the final results basing on the evaluation of the tested condition. ‘Good’ indicates the battery in good condition. ‘Replace’ indicates that the battery needs to be replaced. If not, the battery will fail anytime without any warning.
2. **Volts : 12.45V**
   The volts here indicated the State of Charge (SOC) of the tested battery which is 12.45V during open circuit condition. [Slightly above 80% SOC for Flooded (Lead Acid) batteries by referring to the table below.]

<table>
<thead>
<tr>
<th>SOC</th>
<th>Wet - Flooded (Sb/Ca, Sb/Sb)</th>
<th>AGM(Flat/Spiral) Wet MF (Ca/Ca)</th>
<th>AGM (Gel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 %</td>
<td>12.60V or higher</td>
<td>12.80V or higher</td>
<td>12.85V or higher</td>
</tr>
<tr>
<td>90 %</td>
<td>12.58 V</td>
<td>12.72 V</td>
<td>12.77 V</td>
</tr>
<tr>
<td>80 %</td>
<td>12.44 V</td>
<td>12.64 V</td>
<td>12.69 V</td>
</tr>
<tr>
<td>75 %</td>
<td>12.40 V</td>
<td>12.60 V</td>
<td>12.65 V</td>
</tr>
<tr>
<td>50 %</td>
<td>12.20 V</td>
<td>12.30 V</td>
<td>12.35 V</td>
</tr>
</tbody>
</table>

3. **Measured: 406 CCA**
   It means that the battery tested has a capacity of 406 CCA power available. CCA ratings has been used here, therefore the tested result is in CCA and if other rating (DIN, SAE, JIS, IEC, CA, or EN) were selected, it will base on the respective rating to calculate and show the results in that selected rating.

4. **Rating: 630 CCA**
   This is the battery capacity rated output which was stated on the label. Refer page 19 on how the rating is obtained.

**Please take Note:**

*This output value (406 CCA) is related to the actual power available in the battery in relation to that battery's rating (630 CCA). On average, a new battery’s CCA as measured by this will read 10-15% higher than its stated rating.*

As the battery ages, the CCA number measured by this will decrease so it reads near its rating. While this value is not the same as a CCA test, it is the best available measurement for showing a battery's current condition in relation to its rating.

*From the above example, a 630 CCA rated battery measuring 406 CCA available power does not mean that the battery would pass a CCA test at 406 CCA. The available power reading shows that the battery is not able to perform up to its rated ability (630 CCA).*

*In comparison to another battery when fully charged, the 630 CCA battery measuring 406 CCA is no stronger than a 400 CCA battery showing 400 CCA available power when fully charged.*

*The available power number is meant for comparison to its own rating. In fact, in this example the 630 CCA battery is failing to perform to its rating, while the 400 CCA battery is still working.*
Basing on SAE, CCA test is a manufacturing process control test applicable only on new, fully charged batteries. It does not produce an actual value, but is a PASS / FAIL test.

It measures the discharge load, in amps, that a battery can supply for 30 seconds at 0°F/-18°C while maintaining a voltage of 1.2 volts per cell (7.2 volts per battery) or higher.

Thus, the CCA test shows the minimum power requirement for the battery as rated, which means a battery rated at 400 CCA must measure 7.2 volts or above for 30 seconds when a load of 400 amps is applied at 0°F/ -18°C.

The above methods also hold for DIN, IEC, JIS, EN basing on its individual ratings.

5. **Int. R (Internal Resistance): 6.72mΩ**
   In normal condition, the internal resistance should fall between 2.0 mΩ ~ 15.0 mΩ. As a matter of fact, the higher the battery CCA readings obtained the lower the internal resistance should be.

6. **LIFE: 76 %**
   This is an indication of the battery life expectancy in percentage. If the life falls below 45 %, the RESULT will display “Replace” and it is time to change to a new battery.

**Explanation of the following terms used as shown on the LCD display:**

- **CCA (Cold Cranking Amps) – most commonly used Standard.**
  CCA is a rating used in the battery industry to rate a battery’s ability to start an engine in cold temperatures. This rating is the number of amperes that a new fully charged battery can deliver at 0°F (-18°C) for 30 seconds, while maintaining a voltage of at least 7.2 Volts for a 12V battery during cranking.

- **SAE (The Society of Automotive Engineers) Standard.**
  SAE has established Cold Cranking Amperes (CCA) rating for batteries as their standard. Therefore this rating is the same as CCA rating as mentioned above.

- **IEC (International Electrotechnical Commission) Standard.**
  IEC amperes rating require that at 0°F (-18°C), the number of amperes that the 12V battery can deliver while maintaining a voltage of at least 8.4 Volts for 60 seconds during cranking.

- **EN (European Norms) Standard.**
  EN amperes rating require that at 0°F (-18°C), the number of ampere that the 12V battery can deliver while maintaining a voltage of at least 6.0 Volts for 180 seconds during cranking.
• **JIS# (Japanese Industrial Standard)**
  JIS # amperes’ rating is based on Ampere Hours and is calculated using 20 hours rating. In this manual, it is using CCA ratings reference table list provided basing on the JIS model number (See page 24 & 25).

• **DIN (Deutsches Industrie Normen) Standard.**
  Basing on DIN, the rating requires that at 0°F (-18°C), the 12V battery is able to deliver the number of amperes while maintaining a voltage of at least of 9.0 Volts for 30 seconds and 8.0 Volts for 150 seconds during cranking.

• **CA (Cranking Amperes) Rating.**
  This rating is the number of amperes that a new fully charged battery can delivery at 32°F (0°C) for 30 seconds, while maintaining a voltage of at least 7.2 Volts for a 12V battery during cranking.

• **Unknown**
  If you are not sure which ratings (CCA, EN, IEC, JIS or DIN) that the battery is based on, then choose this setting. It will show the battery’s Voltage (State of Charge), CCA and the Internal Resistance (m Ohm) only. This selection can also be used to test 12V - Deep Cycle Batteries.

An example of the results display is shown below: (Fig.30)

![Battery measurement example](image)

To determine the condition of the tested Deep Cycle Batteries, refer the **Volts** reading – State of Charge (should not fall below 12.60V when fully charged for Lead Acid Batteries, 12.85V for Gel Batteries and 12.80V for AGM Batteries) and the Internal Resistance [Int. R] of the tested battery should not be more 15 mOhm readings.
Batteries that had been left idle for long periods can still be tested with this. To perform the test, just clamp the clips onto the battery terminals and it will display the screen (Fig.31) as shown if its voltage falls below the normal 12.0 volts.

![Figure 31]

Battery voltage is below 12.00 Volts!
Press [Enter] to continue...

Press ← key to continue and the display will show: (Fig.32)

![Figure 32]

Select Rating

| CCA | SAE | DIN | JIS | IEC | EN | CA | Unknown |

Check the battery ratings and enter it as described in steps 10 to 12 (page 19~21) and the results will show as an example below: (Fig. 33 and Fig.34)

![Figure 33]

Battery: OK-Recharge
Measured: 220 CCA
Rating: 400 CCA
Volts: 11.96 V
Int. R: 12.24 mOhm

State of Charge is low!
Charge battery and test again.

![Figure 34]

Battery: To replace
Measured: 120 CCA
Rating: 400 CCA
Volts: 10.56 V
Int. R: 20.24 mOhm

State of Charge is low!
Internal resistance is high.
Fig. 33 Results shown [OK-Recharge], it indicated that the battery has to be fully charged first before repeating the test.

For Fig. 34, the Results shown [To replace], this meant that the battery needs to be replaced as its internal plate resistance [Int. R] is higher than 15 mOhm.

15. Pressing the key at any moment will exit and return back to the main menu screen (Fig. 18).

8.0 – Battery Ratings Charts

8.1 Japanese Industrial Standard (JIS#) CCA Ratings

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### Battery Model (JIS#) | CCA Rating | Battery Model (JIS#) | CCA Rating
--- | --- | --- | ---
NEW | OLD | WET | MF | SMF | NEW | OLD | WET | MF | SMF
50D23R | 85BR60K | 500 | | | | 105F51R | N100Z | 580
50D23L | 85B60K | 500 | | | | 105F51 | N100ZL | 580
50D26R | 50D20R | 370 | | | | 115E41R | NS120 | 650 | 800 | 960
50D26L | 50D20L | 370 | | | | 115E41L | NS120L | 650 | 800 | 960
55B24R | NX100-S6 | 435 | 420 | 500 | | 115F51R | N120 | 650 | 800 | 960
55B24L | NX100-S6L | 435 | 420 | 500 | | 115F51L | N120L | 650 | 800 | 960
55B24RS | NT80-S6S | 430 | 420 | 500 | | 130E41R | NX200-10 | 800
55B24LS | NT80-S6LS | 430 | 420 | 500 | | 130E41L | NX200-10L | 800
55D23R | 55D20R | 370 | | | | 130F51R | N150 | 780 | 920
55D23L | 55D20L | 370 | | | | 130F51L | N150L | 780 | 920
55D26L | N50ZL | 350 | 440 | 525 | | 145F51R | NS150 | 780 | 920
55D26R | N50Z | 350 | 440 | 525 | | 145F51L | NS150L | 780 | 920
60D23R | 60D20R | 520 | | | | 145G51R | N150 | 780 | 900 | 1100
60D23L | 60D20L | 520 | | | | 150F51R | NT200-12 | 640
65D23R | 65D20R | 420 | 540 | 580 | | 150F51L | NT200-12L | 640
65D23L | 65D20L | 420 | 540 | 580 | | 165G51R | NS200 | 935 | 980
65D26R | NS70 | 415 | 520 | 625 | | 165G51L | NS200L | 935 | 980
65D26L | NS70L | 415 | 520 | 625 | | 170F51R | NX250-12 | 1045
65D31R | N70 | 390 | 520 | 630 | | 170F51L | NX250-12L | 1045
65D31L | N70L | 390 | 520 | 630 | | 180G51R | NT250-15 | 1090
70D23R | 35-60 | 490 | 540 | 580 | | 180G51L | NT250-15L | 1090
70D23L | 25-60 | 490 | 540 | 580 | | 195G51R | NX300-51 | 1145
75D23R | 500 | 520 | 580 | | 195G51L | NX300-51L | 1145
75D23L | 500 | 520 | 580 | | 190H52R | N200 | 925 | 1100 | 1300
75D26R | F100-5 | 490 | | | | 190H52L | N200L | 925 | 1100 | 1300
75D26L | F100-5L | 490 | | | | 245H52R | NX400-20 | 1530 | 1250
75D31R | N70Z | 450 | 540 | 735 | | 245H52L | NX400-20L | 1530 | 1250

### 8.2 DIN & EN Standards Rating Chart

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8.3 YUASA Battery Rating Chart

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8.4 Rough CCA Guide

Given below is a rough CCA ratings guide for any unknown battery model basing on the capacity of the vehicle:

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<th>Approximate Battery CCA Rating</th>
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<td>2000 ~ 3000 cc</td>
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<td>3000 cc and above</td>
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<td>M. Benz over 3000 cc</td>
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</table>

9.0 – Grounding Test

The engine body and the vehicle chassis are always connected to the battery negative terminal to provide the electrical return path (grounding) for all the electrical components. Due to the surrounding environmental effect, the surface contacts of these joints or connections of these circuits are subject to oxidation and corrosion in a matter of time rendering them to have high resistance in it. One typical example is the connection at the battery terminals where oxidation and corrosion takes place very often. If these contacts were no good then it will pose a lot of electrical problems to the vehicle.

By checking the ground condition, this will measure the resistance from the engine body contact to the battery terminal then it will display the results and the recommendations.

9.1 – Start Testing

1. Make sure that the engine is switched OFF. Attach the clips onto the battery terminal posts and the unit will power up and lights up the LCD display screen.
2. It will run through a self-test and when completed it displays the Main Menu as shown: (Fig. 36)

![Figure 36]

Select Menu ▲▼
New: Clear Memory
Continue Testing
View last Test
Setup Menu
Then press [Enter].

3. After you have made your choice, selecting “New: Clear Memory” or “Continue...Test” will proceed to the display below: (Fig. 37)

![Figure 37]

Select Test ▲▼
Battery Test
Grounding Test
Starter Test
Alternator Test
Then press [Enter].

4. Pressing key once will scroll down to the ‘Grounding Test’ (Fig.38)

![Figure 38]

Select Test ▲▼
Battery Test
Grounding Test
Starter Test
Alternator Test
Then press [Enter]
5. Press ← key will proceed to the display as follows: (Fig. 39)

```
Grounding Test

Clip the Black clip to engine body or the car chassis and the Red clip to the battery [+].

Press [Enter] to begin.
```

**Figure 39**

6. Now transfer the BLACK tester clip from the battery [-] terminal to a suitable position on the engine or chassis body leaving the RED clip still attached to the battery [+].

7. Press ← key again and it will start analyzing (Fig. 40)

```
Analysing ...

Please wait!
```

**Figure 40**

8. Once it has finished analyzing, it will prompt you with an instruction (Fig. 41) stating that you should unclamp the Black clip from the engine or chassis body and transfer to the battery negative [-] terminal within 20 seconds time limit. If you don’t, the testing procedure has to be repeated as the gathered data will be lost.
9. Once the Black clip is clamped onto the battery [-] terminal, the tester display will light up as shown. (Fig. 42)

10. Now you need to press key to proceed and the display will show as follows (Figure 43).
11. If the measured resistance reading is within limits, then it will display as follows (Fig. 44)

![Figure 44](image)

**Results: OK**

The grounding resistance of the engine or car chassis is within limit.

12. If the measured resistance reading has gone beyond the limits, then it will display the screen as follows (Fig. 45).

![Figure 45](image)

**Results: High Ohms**

The grounding resistance of the engine or car chassis is high.

Clean the cable contacts or replace cable if necessary.

**Note:**

The above indicates that the ground contact from the engine body to the battery is bad. Check for rusted or corroded point of contacts. If found, dismantle it for cleaning or replacement before reinstalling the battery. Repeat the test again after fixing.

Another thing is that if you suspect that the result is in question, you may conduct the test with the Black clip clamp at a different location.
13. If you did not follow the right procedures during the testing, it will display the results as follows (Fig. 46) below:

<table>
<thead>
<tr>
<th>Results: Not detected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong procedures.</td>
</tr>
<tr>
<td>Try again and follow the step by step instructions given.</td>
</tr>
</tbody>
</table>

Figure 46

14. To exit the program, pressing the key at any moment will exit and return back to the main menu screen (Fig.38).

10.0 – Starter Test

This test actually checks the cranking effectiveness of the battery and also can predict when the battery will fail to crank a vehicle.

This is designed to address the weakness of conventionals with its cranking power measurements. Simply connect the analyzer to the battery in the vehicle and start the engine!

To understand the working principle of the tests, let’s look at the wave form displays taken during the cranking tests with an oscilloscope.
Figure (A) above shows the voltage profile of a healthy battery during the cranking of an engine. The graph starts off at the battery's nominal voltage, and a voltage drop is detected when the vehicle is cranked. The voltage recovers to the battery's nominal voltage and eventually rises to approximately 14.4 V when the alternator starts charging the battery.

For Figure (B) where a typical 2 year-old battery, you noticed the difference in the voltage drop which indicates that it is weaker but still usable.

Whereas Figure (C) represents a very weak battery that can barely crank a car and is due to fail in the very near future.

As voltage profiles can indicate the relative ability of the tested battery in starting an engine, so there is no need for knowledge on the starter motor requirement or the battery's rating and size.

The EQP-114 will capture the highest voltage drop and calculate the final results which should not be lower than 9.6V average during cranking and computes the result after the test.

10.1– Begin Testing

1. With engine OFF, place the vehicle transmission in NEUTRAL for Manual and PARK for Automatic then apply the parking brake.

2. Connect the tester to the battery terminals and the display will light up.

3. After you have made your choice, selecting either “New: Clear Memory” or “Continue…Test” will proceed to the display below: (Fig. 48)
4. From the main MENU, select ‘Starter Test’ by scrolling down using key. The screen will show (Fig.49).

```
Figure 49

Select Test ▲▼

Battery Test
Grounding Test
Starter Test
Alternator Test

Then press [Enter].
```

2. Press key to continue and the display will show: (Fig.50)

```
Figure 50

Starter Test

Battery: 12.45V

Crank engine now until it starts. Then press [Enter].
```

3. Switch the ignition key to ON and start cranking the engine until it starts. Immediately after that press key and the results will show as follows (Figure 51):
4. If the voltage drop is too great during the cranking, the tested results will display as follows (Figure 52) and will prompt you to check the starter system.

![Figure 52](image)

**Result: High Drop**

Min. Volts: 8.56V  
Volt Drop: High

Check starter relay, battery terminals or battery has aged.  
Press [Exit] to main menu.

5. During cranking when it detects that there is no drop in voltage, it will display the following screen (Figure 53).

![Figure 53](image)

**Result: Not detected**

No change in volt drop.  
Check clamping at battery side and test again.  
Press [Exit] to main menu.

6. Pressing the key at any moment will exit and return back to the main menu screen. (Fig.49)
11.0 – Alternator Test

An alternator is the device used to produce the electricity the car needs to run and to keep the battery charged. The alternator uses the principle of electromagnetic induction to produce voltage and current. The four main parts of the alternator are the Rotor, Stator, Diode Pack, Voltage Regulator and an Ammeter or Indicator Light to inform the driver of any problems. All of these parts must be in good working order for the alternator to do its job.

The Rotor is a coil of wire wound around an iron core. The Rotor rotates as the alternator shaft rotates and current passes through brushes. The Rotor winding passes the Field current. This causes the Rotor to produce a magnetic field. So basically the Rotor is a rotating electro magnet.

The Stator is a set of three windings fixed to the case of the alternator and these windings are static i.e. they don’t rotate. As the Rotor rotates its magnetic field “cuts” each Stator winding in turn, this induces a current in each winding. The outputs from the Stator windings are 120 degrees apart and are alternating current (AC).

But vehicles run on DC current, so we need something that will convert the AC current to DC current. This is the job of the diode pack. A diode is an electrical one-way check valve that will let current flow in only one direction. The typical diode pack uses four diodes to accomplish this. AC current is feed in on one side of the diode pack and DC current comes out the other side. The diode pack here will rectify the alternating 3 phases from the Stators and combine them into a single Direct Current which also works the dash ammeter or indicator light.

Now that we have a DC current that the vehicle can use, we need a way to control that current. That is the job of the voltage regulator. As the name implies, it regulates the voltage going to the battery. It does this by turning current to the field (stator) terminal of the alternator on and off.

If the battery voltage goes below 13.5 volts, the voltage regulator sends current to the field terminal and allows the alternator to start charging. Current will then flow into the battery and bring it up to full charge.

If the voltage goes above 15.0 volts, the voltage regulator shuts off the current to the field terminal and keeps the battery from overcharging and cooking itself. This is how the voltage regulator controls the alternator output.
When you first start your vehicle, the alternator needs some current to start working. The voltage regulator supplies this current from the battery to the field (stator) terminal of the alternator to get it started.

The state of charge of the battery controls amperage output of the alternator. When the battery has a full charge, the electro-motive force of the voltage lowers the amperage to almost zero. As the battery charge wears down, the electro-motive force is not enough to stop the amperage, so it flows into the battery and charges it again.

11.1 – Start Testing

This test is to check the MAX and MIN charging voltages output of the alternator at 3000 RPM without load and 2000 RPM with all loads ON. With this test you can determine the alternator’s condition when in reference with the vehicle’s Service Manual.

No load testing at 3,000 RPM

1. With engine OFF, place the vehicle transmission in NEUTRAL for Manual and PARK for Automatic and apply the parking brake.
2. Attach the clips onto the battery terminal posts and it will power up and lights up the LCD display screen.

3. It will run through a self-test and when completed it displays the Main Menu as shown: (Fig. 55)

![Figure 55]

Select Menu ▲▼

New: Clear Memory
Continue Testing
View last Test
Setup Menu
Then press [Enter].
4. After you have made your choice, selecting either “New: Clear Memory” or “Continue…Test” will proceed to the display below: (Fig. 56)

```
Select Test ▲▼

Battery Test
Grounding Test
Starter Test
Alternator Test
```

Then press [Enter].

Figure 56

5. Pressing key to scroll down to the ‘Alternator Test’ (Fig.57)

```
Select Test ▲▼

Battery Test
Grounding Test
Starter Test
Alternator Test
```

Then press [Enter]

Figure 57

6. Press key to continue and the display will show: (Fig.58)

```
No Load Test

Start the car engine and keeps it running.
```

Then press [Enter] to begin.

Figure 58
Start the engine and then press key again and the screen will prompt you as shown below (Fig. 59).

Follow the instructions, make sure that all loads (lights, air-conditioning, etc) are OFF. Rev the engine up to 3,000 ~ 3,500 RPM then press key and maintain the engine speed for about 10 seconds and release the pedal. The maximum and minimum voltages values will be captured.

After that press key again and it show as below (Fig 60.)

With the captured readings, analysis can be done by referring to the limits as indicated that MAX voltage should not exceed 15.0V (max. voltage at 3,000 RPM) and MIN voltage should be more than 13.3V (min voltage during idling speed).
7. Press key will show the results of the test (Figure 61):

![Results: Good]

<table>
<thead>
<tr>
<th>Results: Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>At 3,000 rpm,</td>
</tr>
<tr>
<td>No load Test:</td>
</tr>
<tr>
<td>Average Charging Volts: 14.2V</td>
</tr>
</tbody>
</table>

Press [Enter] to continue to Loading Test.

![Figure 61]

8. If either minimum or maximum charging volts are not within the voltage range limits then it will display one of the screen as below (Figures 62 & 63) and it will prompt you to check the charging system for the fault.

![Results: Low charge]

<table>
<thead>
<tr>
<th>Results: Low charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>At 3,000 rpm,</td>
</tr>
<tr>
<td>No load Test:</td>
</tr>
<tr>
<td>&gt;13.3V: Min 13.2V</td>
</tr>
<tr>
<td>Check for loose belt and the alternator.</td>
</tr>
</tbody>
</table>

![Results: High charge]

<table>
<thead>
<tr>
<th>Results: High charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>At 3,000 rpm,</td>
</tr>
<tr>
<td>No load Test:</td>
</tr>
<tr>
<td>&lt;15.0V: Max. 15.6V</td>
</tr>
<tr>
<td>Check alternator and the regulator.</td>
</tr>
</tbody>
</table>

![Figure 62]

![Figure 63]

**Testing with load at 2,000 RPM**

As more electrical accessories, such as lights, heater, air conditioning, car stereos, etc. were used; the electro-motive force decreases and this will allow more amperage from the alternator to flow into the battery to compensate for the added load. This test is to check the alternator’s behavior during loading.

9. Continue from the previous test (either Fig. 61, 62 or 63); proceed to the next step by pressing key will enter to the display as follows. (Fig.64)
Follow the instructions, switch ON all electrical loads (Head Lights, Radio, Air-conditioning, Heater, etc). Rev the engine up to 2,000 ~ 2,500 RPM then press key and maintain the engine speed for about 10 seconds and release the pedal. The maximum and minimum voltages values will be captured. (Fig.65)

With the captured readings, analysis can be done by referring to the limits as indicated that **MAX voltage should exceed 13.5V** (max. voltage at 2,000 RPM) and **MIN voltage should be more than 12.5V** (min voltage during idling speed).
After that press key again and the results will be shown as below (Fig 66.)

**Results: Good**

At 2,000 rpm,
Loading Test:
Average Charging Volts: 13.3V

![Figure 66]

10. If either minimum or maximum charging volts are not within the voltage range limits then it will display one of the screens as below (Figures 66 & 67) and it will prompt you to check the alternator system for the fault.

**Results: Low charge**

At 2,000 rpm,
Loading Test:
>13.5V: Max. 13.3V

Check for loose belt and the alternator.

![Figure 67]

**Results: Low charge**

At 2,000 rpm,
Loading Test:
>12.5V: Min. 12.4V

Check for loose belt and the alternator.

![Figure 68]

11. To exit the program, pressing the key at any moment will exit and return back to the main menu screen (Fig.57).
12.0 – View Last Test Results

To view the results of the last test, EQP-114 has to be connected to an external power source by either clamping its clips directly to a 12Volt car battery or connected to a PC via the USB port.

1. Once powered up, the wakeup screen will display as follows:

2. It will run through a self-test and when completed it displays the Main Menu as shown: (Fig. 71)

Then press [Enter].
3. Pressing $\downarrow$ key once will scroll down to the ‘View last Test’ Fig. 72 below.

![Figure 72]

Select Menu ▲▼
New: Clear Memory
Continue Testing
View last Test
Setup Menu
Then press [Enter].

4. Press $\leftarrow$ key will proceed to display the last test results depends on the type of test you had performed earlier. (Fig. 73)

![Figure 73]

Battery: Good
Measured: 406 CCA
Rating: 630 CCA
Volts: 12.45 V
Int. R: 6.72 mOhm
Life: 76%

5. To view the next page, press $\downarrow$ or $\uparrow$ key to get to the page you want. Some examples below are: (Figs. 74, 75, 76 & 77)

![Figure 74]

Results: High Ohms
The grounding resistance of the engine or car chassis is high.
Clean the cable contacts or replace cable if necessary.

![Figure 75]

Result: High Drop
Min. Volts: 8.56V
Volt Drop: High
Check starter relay, battery terminals or battery has aged.
Press [Exit] to main menu.
12.1 Printing the Last Test Results

Printing of the Last Test Results can only be done while in this View Last Test mode. This is to ensure that the results printed will be the final ones as every test redone will be updated in its memory.

Important:
The Tester has to be connected to a 12V battery in order to work with the mobile printer. This is because it needs higher Amps to operate which the PC USB output is unable to provide.

To print just press key on the tester, the mobile printer will start printing.

Note:
To printout on normal computer printer, it has to be connected to the PC with EQP-114 software installed. (See Print Results from Normal Printer – Page 54).

To exit the program, pressing the key at any moment will exit and return to the main menu screen (Fig.71).
13.0 – PC Link

The PlusQuip EQP-114 is also designed to link with PC for data storage and printout through normal printer. To do so, the PC has to install the driver and the software provided in order to operate.

13.1 - Installing Software.

**Important Note:**
Before you start to install the driver, please do not plug the EQP-114 into the computer’s USB port or else the installation will fail and the computer cannot detect the proper driver for the EQP-114 when connected.

If you have made the above error and wish to install the driver the second time, you need to uninstall the previously installed driver first before starting to reinstall again. This time make sure that the EQP-114 is not plugged in.

**Step 1.**
2. Unzip and open the downloaded files. Install the operating system driver (Suitable for Windows XP, Vista and 7 only) by double clicking on the Driver Installer icon.
3. Now double click on the EQP-114 Setup file icon. Follow instructions on screen to install the EQP-114 software.
4. Now link up the EQP-114 with your PC. In the Setup Menu display press → key to highlight “PC Link” and then press ← key to activate.

**Step 2.**
Back to desktop, open the EQP-114 program by left clicking the BESA icon and the display page will show as follows:

This COM port number should be the same as listed on the Device Manager. If you find that this field is blank, unplug the USB cable and plug back again. The COM will appear.
Step 3. Now link up the EQP-114 with PC by the following procedures:

1. On the Main Menu page (Fig. 78) below, select Setup Menu by pressing key to highlight it and then press key.

![Figure 78](image-url)

2. In the Setup Menu display (Fig. 79), press key to highlight “PC Link” and then press key to activate.

![Figure 79](image-url)

It will remain in this display while logging into the PC. Do not press any other keys because the EQP-114 is already communicating with the PC.

3. To confirm the communication; click on [ Get Data From ] tab and the Last Test Result will appear. See example below.
If there is no communication, a message text box will appear: In this case repeat Step 7 – No.2 and 3 procedures again.

13.2 Printing Results from normal printer:

While on this page, if you wish to print out the results, make sure that your printer is connected to the computer. Click on [PRINT] tab and a text box will appear. Select the right printer and click [Print] tab to print.

13.3 Saving Results:

If you wish to save the results from this page, then click on [SAVE] tab. A message box will appear. Type in the file name and click [Save] tab.
Disclaimer

All information, illustrations, and specifications contained in this user manual are based on the latest information available at the time of printing. The right is reserved to make any changes at any time without obligation to notify any person or organisation of such revisions or changes.

Furthermore, the manufacturer or its sales agents are not liable for errors contained herein or for incidental or consequential damages (including lost profits) in connection with the furnishing, performance or use of this material.

This user manual tells how to use and perform the required procedures on vehicles. Safe and effective use of this is very much dependant on the user following the normal practices and procedures outline in this manual.

14.0 – Warranty Information

14.1 – Limited Warranty

This limited warranty cover defects in materials and workmanship for a period of twelve (12) months which begins from the date the product is purchased by the end user and is subjected to the following terms and conditions:

1. Within the warranty period, the manufacturer will repair or replace, at their options, any defective parts and return to the owner in good working condition.

2. Any repaired or replaced parts will be warranted for the balance of the original warranty or three months (3) months from the date of repair, whichever is longer.

3. This warranty only extends to the first owner and not assignable or transferable to any subsequent owner.

4. Cost of delivery charges incurred for the repair of the product to and from the manufacturer will be borne by the owner.

5. This limited warranty covers only those defects that arises as a result of normal use and does not cover those that arises as a result of:
   • Unauthorised modifications and repair.
   • Improper operation or misuse.
   • Accident or neglect such as dropping the unit onto hard surfaces.
• Contact with water, rain or extreme humidity.
• Contact with extreme heat.
• Cables that have broken, bent contact pins or subject to extreme stress or wear.
• Physical damage to the product surface including scratches, cracks or other damage to the display screen or other externally exposed parts.

14.2 - Limitations of Warranty

Other than the foregoing limited warranty, the manufacturer does not make any other warranty or condition of any kind, whether express or implied.

Any implied warranty of merchantability, or fitness for use shall be limited to the duration of the foregoing limited warranty.

Otherwise, the foregoing limited warranty is the owner’s sole and exclusive remedy and is in lieu of all other warranties whether express or implied.

The manufacturer or any of its exclusive sales agents shall not be liable for any consequential or incidental damages or losses arising of the loss of uses of this product.

All warranty information, product features and specifications are subjected to change without prior notice.