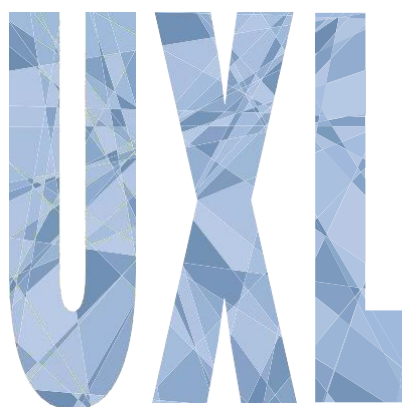
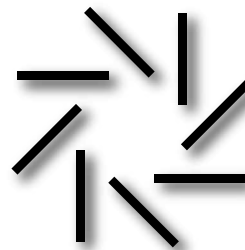
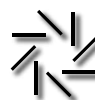
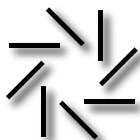




**MAINTENANCE-FREE  
VALVE REGULATED LEAD-ACID  
STATIONARY BATTERIES**

# **UXL SERIES**

## **APPLICATION MANUAL**



Creating the Future of Energy

# UXL SERIES

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## 1 INTRODUCTION

Since 1984, the UXL Series battery has established reputation as a very reliable power source. Yuasa is satisfied with this fact but, now, Yuasa has developed the New and Refined UXL Series which is the culmination of the Yuasa's 80 years ceaseless

innovation.

The New and Refined UXL Series Batteries are made to meet the growing request for longer life and higher reliability with minimized maintenance.

## 2 APPLICATIONS

Telephone exchanges  
Telecommunications  
UPS(Uninterruptible Power Supplies)  
Control equipment  
Instrumentation  
Fire and security systems  
Microprocessor based office machines

Alarm systems  
Emergency lighting  
Engine starting  
Solar powered systems  
Marine equipment  
Electronic switching systems

### Important Notice for Medical Applications:

For Medical Applications, GS Yuasa prohibits usage of life-supporting and life-sustaining device and the related application. For the detail, please contact to GS Yuasa group's sales office or dealer.

## 3 FEATURES

### Safety

No electrolyte leakage will occur from terminals or case of any UXL Batteries ensuring safe and efficient operation.

### Maintenance-Free

There is no need to replenish with water thanks to the unique gas recombination system which transforms the generated gas into water.

### Gas Pressure Venting System

Designed to release excessive gas and reseal automatically in the event gas pressure rises to a level above the normal rate. Thus, there is no excessive gas build-up in the battery.

### Explosion-Proof

A safety valve and a special filter prevent the chance of battery explosion and ensure complete safety in normal use.

### Long Design Life (25°C)

UXL Batteries remain in float service for 20 years.

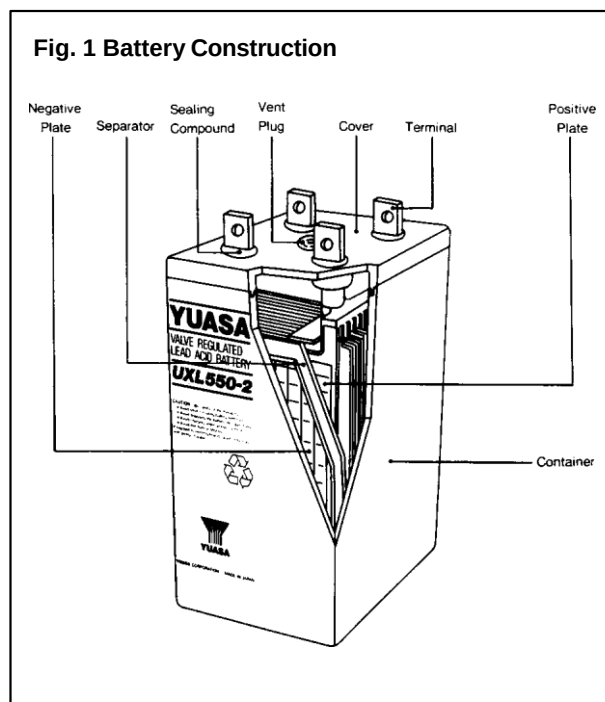
### No Equalizing Charge Required

No equalizing charge is required.

# APPLICATION MANUAL

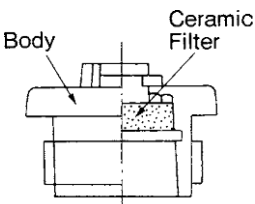
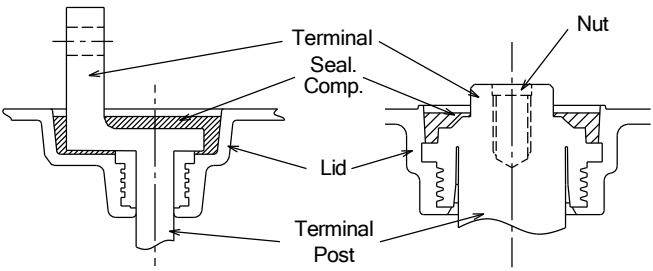
## 4 CONSTRUCTION

YUASA UXL Batteries are so designed that the necessary quantity of electrolyte is impregnated in the plates and separators to eliminate the need for free electrolyte and to enhance the capability of negative plates to absorb the oxygen by making them moist, thus preventing decrease of the electrolyte and making possible the battery sealed. The construction and the functions are shown in Fig.1 and Table 1 respectively.



**Table 1. YUASA UXL Battery Construction and Functions**

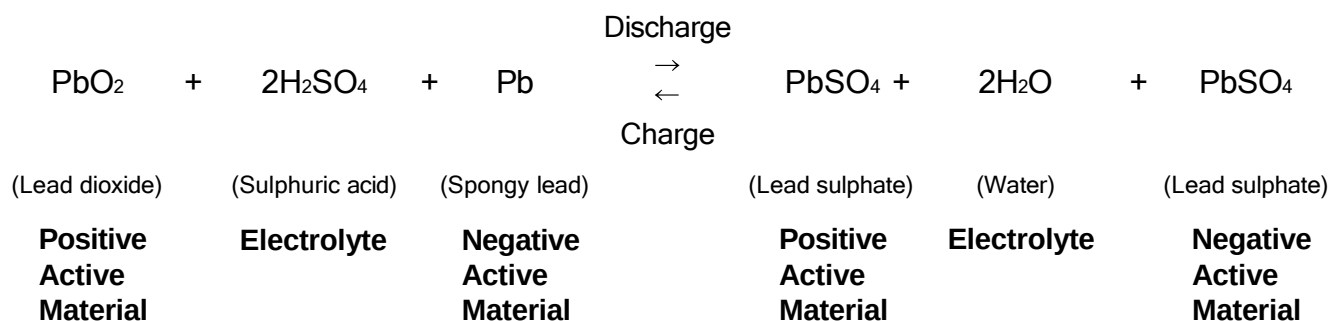
| Parts                      | Material of Construction                                                                                      | Functions                                                                                                                                                        |
|----------------------------|---------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Positive & Negative Plates | · Pasted type plate in which special lead-calcium alloy grids are pasted with active material.                | · Retain sufficient capacity.<br>· Maintain capacity performance for long period of time (long life performance).<br>· Minimize self-discharge.                  |
| Separator                  | · Mat made of glass fibres (microporous material) with low internal resistance and excellent heat resistance. | · Prevents short circuit between positive and negative plates.<br>· Retains electrolyte.<br>· Prevents active material from shedding by pressing plate surfaces. |

| Parts             | Material of Construction                                                                                                                                                                                                                                                                                                                                                                                             | Functions                                                                                                                                                                                                                                                                                               |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Electrolyte       | <ul style="list-style-type: none"> <li>Gelled sulphuric acid.</li> </ul>                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>Causes electro motive reaction in positive and negative active material.</li> </ul>                                                                                                                                                                              |
| Container & Cover | <ul style="list-style-type: none"> <li>ABS synthetic resin, Flame Retardant (UL94-V0 Class)</li> </ul>                                                                                                                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>Accommodates plate group consisting of positive and negative plates and separators.</li> <li>Retains sufficient mechanical strength to withstand battery internal pressure.</li> </ul>                                                                           |
| Safety Valve      | <ul style="list-style-type: none"> <li>Synthetic rubber with excellent acid resistance and little deterioration by aging.</li> <li>In cap shape.</li> </ul>                                                                                                                                                                         | <ul style="list-style-type: none"> <li>Releases gas if cell internal pressure rises abnormally high and normalizes internal pressure.</li> <li>Prevents ingress of oxygen.</li> </ul>                                                                                                                   |
| Vent Plug         | <ul style="list-style-type: none"> <li>Vent plug provided with built-in ceramic filter.</li> </ul>                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>Prevents ignition entering battery.</li> <li>Prevents acid fumes from escaping from the battery.</li> </ul>                                                                                                                                                      |
| Terminal          |  <ul style="list-style-type: none"> <li>Made of lead alloy integrally moulded with terminal post.</li> <li>Terminal section employs dual complete seal construction of sealing compound.</li> <li>The sealing compound is colorless. Polarity is distinguished by red (positive) and black (negative) sealing labels.</li> </ul> | <ul style="list-style-type: none"> <li>Terminal with a large and non welded sectional area enhances high rate discharge characteristics and reliability.</li> <li>Perfect seal is given at a terminal sealing section.</li> <li>Facilitates fixing of connecting bars and take-off terminal.</li> </ul> |

# APPLICATION MANUAL

## 5 CHEMICAL REACTION AND SEALING MECHANISM

The chemical reaction taking place in a lead-acid storage battery is as shown in the following formula:



At discharge, lead dioxide in positive plates and spongy lead in negative plates react with sulphuric acid in the electrolyte and gradually transform into lead sulphate, during which the sulphuric acid concentration decreases.

Conversely, when the battery is charged, the positive and negative active materials which had been turned into lead sulphate gradually revert to lead dioxide and spongy lead respectively, releasing the sulphuric acid absorbed in the active materials, during which the sulphuric acid concentration increases, as shown in Fig.2.

When battery charging approaches its final stage, the charging current is consumed solely for electrolytic decomposition of water in the electrolyte, resulting in generation of oxygen gas from positive plates and hydrogen gas from negative plates. The generated gas will escape from the battery causing a decrease of the electrolyte, thereby requiring occasional water replenishment.

However, YUASA UXL Batteries utilize the characteristics of spongy lead, or negative active material, which is very active in moist conditions and reacts very quickly with oxygen, thereby suppressing the decrease of water eliminating the need of water replenishment.

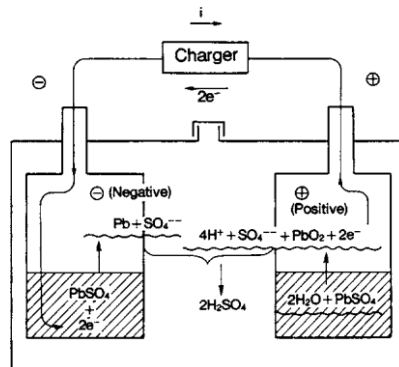
The process of charging from its beginning to the final stage is identical with that of conventional batteries as shown in Fig.2.

After the final stage of charging or under overcharge condition, the charging energy is consumed for electrolytic decomposition of water, and the positive plates generate oxygen gas which reacts with the spongy lead in negative plates and the sulphuric acid in electrolyte, turning a part of negative plates into a discharged condition, thus suppressing the hydrogen gas generation from negative plates.

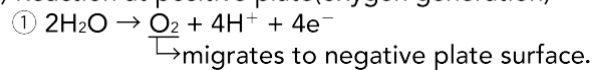
The part of negative plates which had turned to discharged condition through reaction with oxygen gas is then reverted to original spongy lead by subsequent charging. Thus, a negative plate keeps equilibrium between the amount which turns into spongy lead by charging and the amount of spongy lead which turns into lead sulphate through absorbing the gas generated from positive plate, which makes it possible for the battery to be of a sealed type.

The chemical reaction which takes place after the final stage of charging or under overcharge condition is as shown in Fig.3, and the reaction formula is described in the next page.

Fig. 2: Reaction from Beginning of Charge to Before the Final Stage

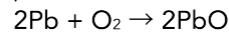


(1) Reaction at positive plate (oxygen generation)

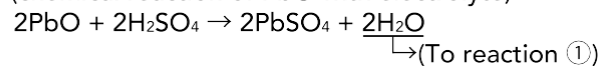


(2) Reaction at negative plate

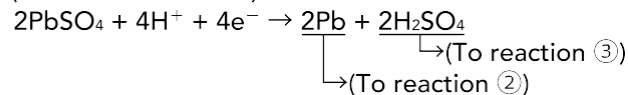
$\textcircled{2}$  (chemical reaction of spongy lead with oxygen)



$\textcircled{3}$  (chemical reaction of PbO with electrolyte)



$\textcircled{4}$  (Reduction of PbSO<sub>4</sub>)



Total reaction at negative plate

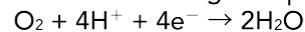
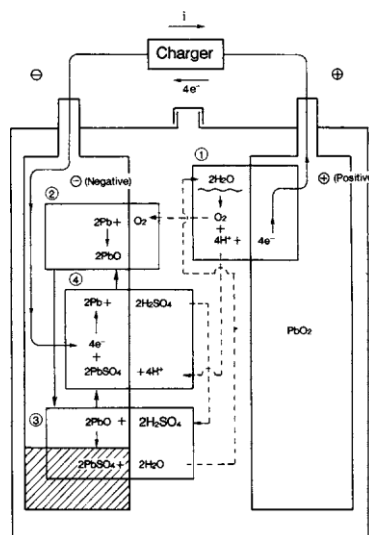


Fig. 3: Reaction after Final Stage of Charge



As described above, the oxygen gas generated from the positive plates reacts quickly with the active material in charged condition in the negative plates and returns to water causing very little loss thereof, thus making it possible to build the battery in a sealed construction.

# APPLICATION MANUAL

## 6 GENERAL SPECIFICATIONS

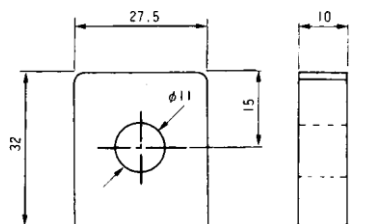
| Battery Model | Nominal Voltage (V) | Capacity(Ah)*                       |                              | Approx. Dimensions (±3mm) |       |        |                | Approx. Weight kgs (±3%) | Terminal |
|---------------|---------------------|-------------------------------------|------------------------------|---------------------------|-------|--------|----------------|--------------------------|----------|
|               |                     | 10HR Rated Capacity (To 1.80V/cell) | 3HR Capacity (To 1.70V/cell) | Length                    | Width | Height | Overall Height |                          |          |
| UXL220-2FR    | 2                   | 200                                 | 168.9                        | 170                       | 106   | 330    | 362            | 15.1                     | A        |
| UXL330-2FR    | 2                   | 300                                 | 253.5                        | 170                       | 150   | 330    | 362            | 21.6                     | A        |
| UXL440-2FR    | 2                   | 400                                 | 337.8                        | 241                       | 171   | 330    | 362            | 30.3                     | A        |
| UXL550-2FR    | 2                   | 500                                 | 423                          | 241                       | 171   | 330    | 362            | 35.9                     | A        |
| UXL550-2FRi   | 2                   | 500                                 | 423                          | 241                       | 171   | 330    | 339            | 34.8                     | B        |
| UXL880-2FR    | 2                   | 800                                 | 675.6                        | 471                       | 171   | 330    | 362            | 60.1                     | A        |
| UXL1100-2FR   | 2                   | 1000                                | 846                          | 471                       | 171   | 330    | 362            | 71.1                     | A        |
| UXL1100-2FRi  | 2                   | 1000                                | 846                          | 471                       | 171   | 330    | 339            | 69.2                     | B        |

\* Temperature: 25 °C (77 °F)

### Terminals

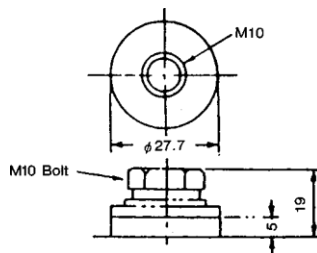
(Standard Type)

**A**

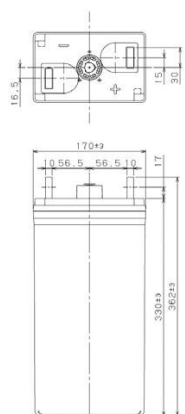


(Optional Type)

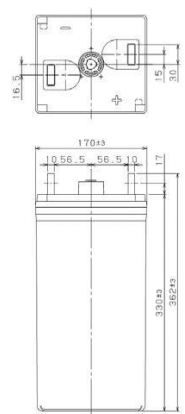
**B**



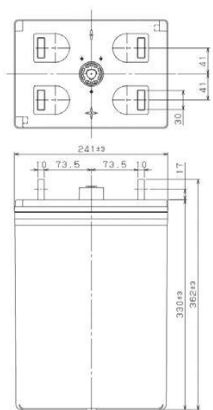
## 7 OUTLINE DRAWINGS



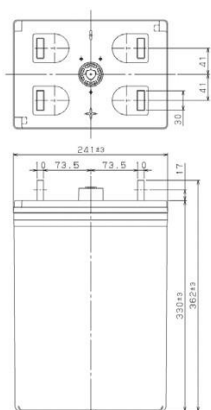
**UXL220-2FR**



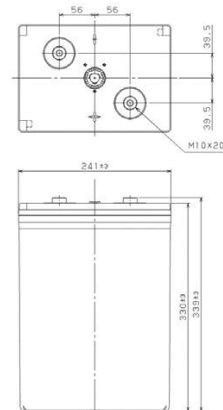
**UXL330-2FR**



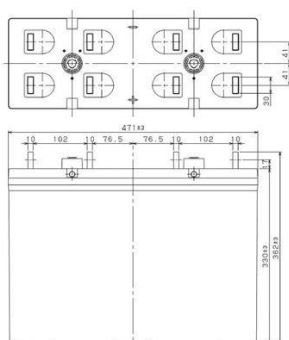
**UXL440-2FR**



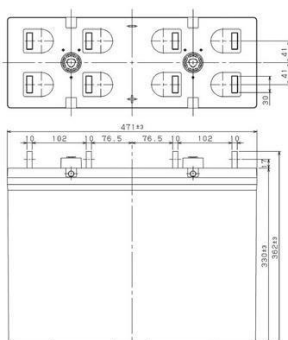
**UXL550-2FR**



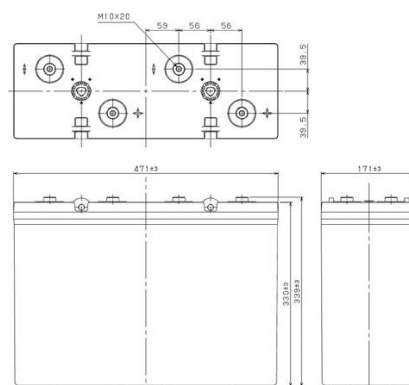
**UXL550-2FRi**



**UXL880-2FR**



**UXL1100-2FR**



**UXL1100-2FRi**

# APPLICATION MANUAL

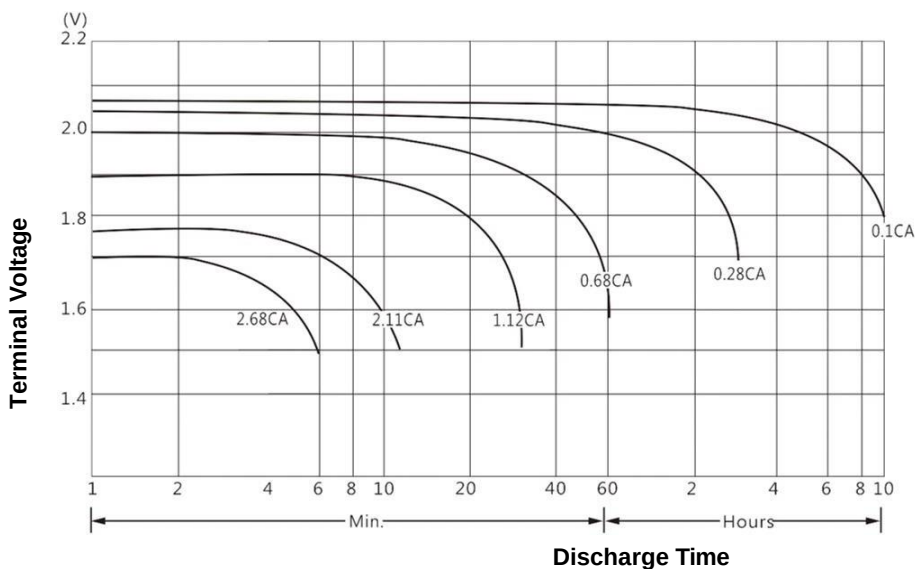
## 8 DISCHARGING

### 8-1 Discharge Characteristics

Discharge capacity varies depending on the discharge current(hour rate). The smaller the discharge current, the more the capacity increases, and the larger the discharge current, the less the capacity.

Rated capacity is defined as discharge capacity at 10 hour rate current to F.V. 1.80 V/cell at 25°C( 77°F). Fig.4a show the constant current discharge characteristics of batteries when they are discharged to the final discharge voltage at various discharge currents at 25°C.

Fig. 4a.: Discharge Characteristic Curves at 25°C



The symbol "C" expresses the nominal capacity of the battery measured at a 10-hour discharge rate.

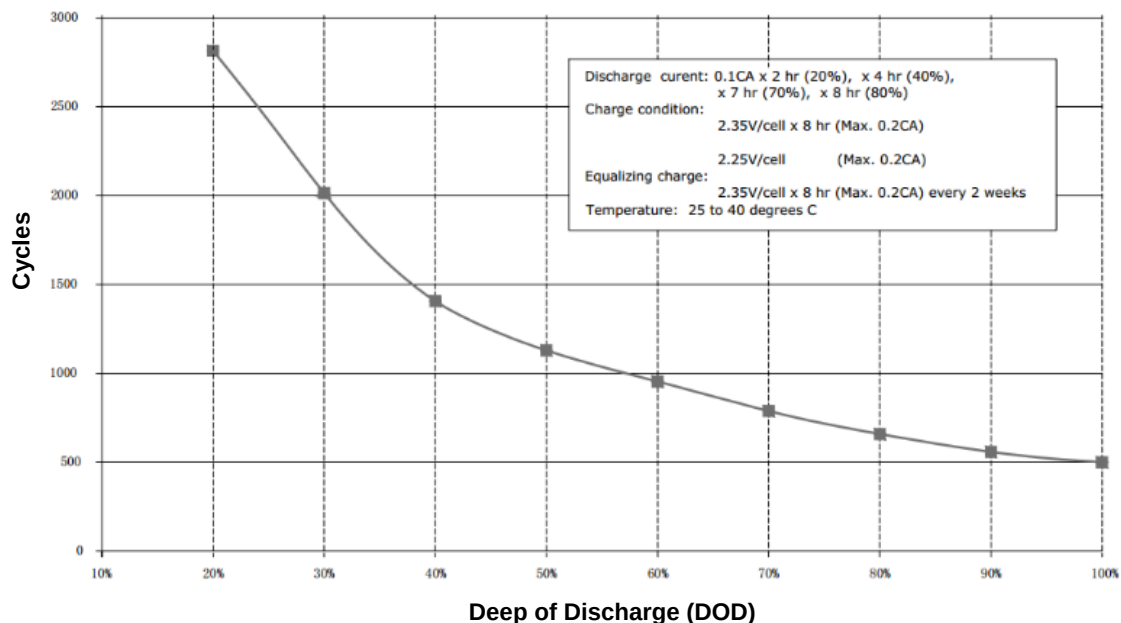
Example:

Discharge current: 0.1CA

Battery model: UXL550-2FRi (500Ah/10HR)

Discharge amps.  $\rightarrow 0.1 \times 500 = 50$  Amps

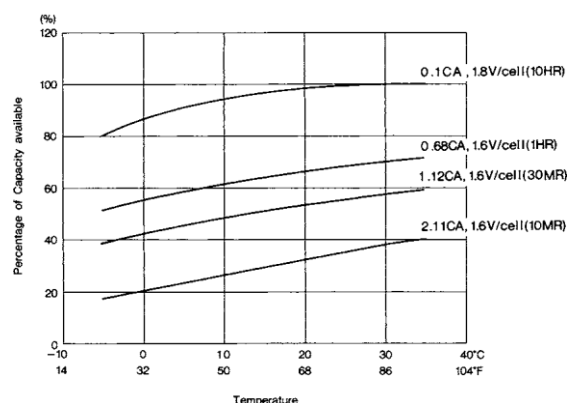
Fig 4b. Relationship between DOD and Cycles



## 8-2 Temperature Effects in Relation to Battery Capacity

At higher temperatures, the electrical capacity that can be taken out of a battery increases. At lower temperatures, the electrical capacity that can be taken out of a battery decreases. Fig.5 show the temperature effects in relation to battery capacity.

Fig. 5: Temperature and Discharge Capacity



## 8-3 Relationship of Discharge Current to Final Discharge Voltage

Generally speaking, in the case of a high current discharge the rate of chemical reaction in the battery discharged to a considerably low voltage is relatively small. However, a long continuous low current discharge will so increase lead sulfate ( $PbSO_4$ ) formed through chemical reaction that the expanded volume of this product may cause distortion and shedding of active materials and bending of plates.

Discharging a lead-acid storage battery beyond the final discharge voltage (overdischarging) must be avoided as practicably as possible because, as described above, the overdischarge obtains only a small additional capacity and possibly damages the battery.

Table 2 gives the final discharge voltage of various batteries.

Table 2. Relationship of Discharge Current to Final Discharge Voltage

| Discharge Current (A)                    | Final Discharge Voltage (V/Battery) |
|------------------------------------------|-------------------------------------|
| 0.1C or below, or intermittent discharge | 1.90                                |
| 0.1C or current close to it              | 1.80                                |
| 0.16C or current close to it             | 1.75                                |
| 0.23C or current close to it             | 1.70                                |
| 0.6C or current close to it              | 1.60                                |
| From 0.6C to 3C                          | 1.50                                |
| Current in excess of 3C                  | 1.30                                |

"C" stands for discharge current equivalent to the rated capacity at 10 hour rate.

# APPLICATION MANUAL

## 8-4 Performance Data at 25°C (77°F)

### Constant Current

Ampares to F.V.1.60 Volts Per Cell

| Time<br>Battery Model | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h  | 2h  | 3h    | 5h  | 8h   | 10h  | 12h  | 24h  |
|-----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----|-------|-----|------|------|------|------|
| UXL220-2FR            | 702   | 541   | 426    | 345    | 294    | 253    | 227    | 204    | 185    | 171    | 140 | 83  | 60.6  | 40  | 26   | 21.1 | 17.7 | 9.2  |
| UXL330-2FR            | 1053  | 811   | 638    | 517    | 441    | 380    | 341    | 306    | 278    | 256    | 210 | 125 | 90.9  | 60  | 39   | 31.6 | 26.5 | 13.8 |
| UXL440-2FR            | 1404  | 1082  | 852    | 690    | 588    | 506    | 454    | 408    | 370    | 342    | 280 | 167 | 121.2 | 80  | 52   | 42.2 | 35.4 | 18.4 |
| UXL550-2FR            | 1754  | 1351  | 1064   | 862    | 735    | 633    | 568    | 510    | 463    | 427    | 350 | 208 | 152   | 100 | 64.9 | 52.6 | 44.2 | 22.9 |
| UXL550-2FRi           | 1244  | 1094  | 894    | 750    | 654    | 570    | 517    | 469    | 431    | 401    | 333 | 208 | 152   | 100 | 64.9 | 52.6 | 44.2 | 22.9 |
| UXL880-2FR            | 2808  | 2164  | 1704   | 1380   | 1176   | 1012   | 908    | 816    | 740    | 684    | 560 | 333 | 242.4 | 160 | 104  | 84.4 | 70.8 | 36.8 |
| UXL1100-2FR           | 3509  | 2702  | 2128   | 1724   | 1471   | 1266   | 1136   | 1020   | 926    | 855    | 699 | 417 | 303   | 200 | 130  | 105  | 88.5 | 45.9 |
| UXL1100-2FRi          | 2490  | 2189  | 1788   | 1500   | 1309   | 1139   | 1034   | 938    | 861    | 804    | 664 | 417 | 303   | 200 | 130  | 105  | 88.5 | 45.9 |

Ampares to F.V.1.63 Volts Per Cell

| Time<br>Battery Model | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h  | 2h  | 3h    | 5h    | 8h   | 10 h | 12h  | 24h  |
|-----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----|-------|-------|------|------|------|------|
| UXL220-2FR            | 656   | 506   | 408    | 333    | 278    | 244    | 217    | 200    | 180    | 167    | 137 | 82  | 59.7  | 39.2  | 26   | 21.1 | 17.7 | 9.2  |
| UXL330-2FR            | 984   | 759   | 612    | 500    | 417    | 366    | 326    | 300    | 270    | 250    | 205 | 123 | 89.6  | 58.8  | 39   | 31.6 | 26.5 | 13.8 |
| UXL440-2FR            | 1312  | 1012  | 816    | 666    | 556    | 488    | 434    | 400    | 360    | 334    | 274 | 164 | 119.4 | 78.4  | 52   | 42.2 | 35.4 | 18.4 |
| UXL550-2FR            | 1639  | 1266  | 1020   | 833    | 694    | 610    | 543    | 500    | 450    | 417    | 342 | 205 | 149   | 98    | 64.9 | 52.6 | 44.2 | 22.9 |
| UXL550-2FRi           | 1163  | 1025  | 857    | 725    | 618    | 549    | 494    | 460    | 419    | 392    | 325 | 205 | 149   | 98    | 64.9 | 52.6 | 44.2 | 22.9 |
| UXL880-2FR            | 2624  | 2024  | 1632   | 1332   | 1112   | 976    | 868    | 800    | 720    | 668    | 548 | 328 | 238.8 | 156.8 | 104  | 84.4 | 70.8 | 36.8 |
| UXL1100-2FR           | 3279  | 2532  | 2041   | 1667   | 1389   | 1220   | 1087   | 1000   | 901    | 833    | 685 | 410 | 299   | 196   | 130  | 105  | 88.5 | 45.9 |
| UXL1100-2FRi          | 2326  | 2051  | 1714   | 1450   | 1236   | 1098   | 989    | 920    | 838    | 783    | 651 | 410 | 299   | 196   | 130  | 105  | 88.5 | 45.9 |

Ampares to F.V.1.65 Volts Per Cell

| Time<br>Battery Model | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h  | 2h  | 3h    | 5h   | 8h   | 10h  | 12h  | 24h  |
|-----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----|-------|------|------|------|------|------|
| UXL220-2FR            | 656   | 506   | 408    | 333    | 278    | 244    | 217    | 200    | 180    | 167    | 137 | 82  | 59.7  | 39.2 | 26   | 21.1 | 17.7 | 9.2  |
| UXL330-2FR            | 938   | 732   | 588    | 484    | 414    | 361    | 323    | 291    | 265    | 246    | 203 | 121 | 88.2  | 57.7 | 39   | 31.3 | 26.5 | 13.8 |
| UXL440-2FR            | 1250  | 976   | 784    | 646    | 552    | 482    | 430    | 388    | 354    | 328    | 270 | 162 | 117.6 | 77   | 52   | 41.6 | 35.4 | 18.4 |
| UXL550-2FR            | 1563  | 1220  | 980    | 806    | 690    | 602    | 538    | 485    | 442    | 410    | 338 | 202 | 147   | 96.2 | 64.9 | 52.1 | 44.2 | 22.9 |
| UXL550-2FRi           | 1109  | 988   | 823    | 701    | 614    | 542    | 490    | 446    | 411    | 385    | 321 | 202 | 147   | 96.2 | 64.9 | 52.1 | 44.2 | 22.9 |
| UXL880-2FR            | 2500  | 1952  | 1568   | 1292   | 1104   | 964    | 860    | 776    | 708    | 656    | 540 | 324 | 235.2 | 154  | 104  | 83.2 | 70.8 | 36.8 |
| UXL1100-2FR           | 3125  | 2439  | 1961   | 1613   | 1379   | 1205   | 1075   | 971    | 885    | 820    | 676 | 403 | 294   | 192  | 130  | 104  | 88.5 | 45.9 |
| UXL1100-2FRi          | 2217  | 1976  | 1647   | 1403   | 1227   | 1085   | 978    | 893    | 823    | 771    | 642 | 403 | 294   | 192  | 130  | 104  | 88.5 | 45.9 |

# UXL SERIES

## Constant Current

Ampares to F.V.1.67 Volts Per Cell

| Battery Model \ Time | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h  | 2h  | 3h    | 5h    | 8h    | 10h  | 12h  | 24h  |
|----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----|-------|-------|-------|------|------|------|
| UXL220-2FR           | 588   | 465   | 381    | 313    | 270    | 238    | 211    | 190    | 175    | 162    | 133 | 80  | 57.6  | 38.1  | 25.6  | 20.6 | 17.7 | 9.2  |
| UXL330-2FR           | 882   | 698   | 571    | 469    | 405    | 357    | 316    | 286    | 262    | 243    | 200 | 120 | 86.5  | 57.1  | 38.5  | 30.9 | 26.5 | 13.8 |
| UXL440-2FR           | 1176  | 930   | 762    | 626    | 540    | 476    | 422    | 380    | 350    | 324    | 266 | 159 | 115.2 | 76.2  | 51.2  | 41.2 | 35.4 | 18.4 |
| UXL550-2FR           | 1471  | 1163  | 952    | 781    | 676    | 595    | 526    | 476    | 437    | 405    | 333 | 199 | 144   | 95.2  | 64.1  | 51.5 | 44.2 | 22.9 |
| UXL550-2FRi          | 1089  | 942   | 800    | 679    | 602    | 536    | 479    | 438    | 406    | 381    | 316 | 199 | 144   | 95.2  | 64.1  | 51.5 | 44.2 | 22.9 |
| UXL880-2FR           | 2352  | 1860  | 1524   | 1252   | 1080   | 952    | 844    | 760    | 700    | 648    | 532 | 319 | 230.4 | 152.4 | 102.4 | 82.4 | 70.8 | 36.8 |
| UXL1100-2FR          | 2941  | 2326  | 1905   | 1563   | 1351   | 1190   | 1053   | 952    | 873    | 810    | 654 | 392 | 282   | 189   | 127   | 102  | 88.5 | 45.9 |
| UXL1100-2FRi         | 2176  | 1884  | 1600   | 1360   | 1202   | 1071   | 958    | 876    | 812    | 761    | 634 | 398 | 288   | 190   | 128   | 103  | 88.5 | 45.9 |

Ampares to F.V.1.70 Volts Per Cell

| Battery Model \ Time | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h  | 2h  | 3h    | 5h    | 8h    | 10h  | 12h  | 24h  |
|----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----|-------|-------|-------|------|------|------|
| UXL220-2FR           | 541   | 444   | 364    | 303    | 260    | 230    | 204    | 187    | 172    | 160    | 131 | 78  | 56.3  | 37.7  | 25.3  | 20.4 | 17.7 | 9.2  |
| UXL330-2FR           | 811   | 667   | 545    | 455    | 390    | 345    | 306    | 280    | 259    | 240    | 196 | 118 | 84.5  | 56.6  | 38    | 30.6 | 26.5 | 13.8 |
| UXL440-2FR           | 1082  | 888   | 728    | 606    | 520    | 460    | 408    | 374    | 344    | 320    | 262 | 157 | 112.6 | 75.4  | 50.6  | 40.8 | 35.4 | 18.4 |
| UXL550-2FR           | 1351  | 1111  | 909    | 758    | 649    | 575    | 510    | 467    | 431    | 400    | 327 | 196 | 141   | 94.3  | 63.3  | 51   | 44.2 | 22.9 |
| UXL550-2FRi          | 1000  | 900   | 764    | 659    | 578    | 518    | 464    | 430    | 401    | 376    | 311 | 196 | 141   | 94.3  | 63.3  | 51   | 44.2 | 22.9 |
| UXL880-2FR           | 2164  | 1776  | 1456   | 1212   | 1040   | 920    | 816    | 748    | 688    | 640    | 524 | 314 | 225.2 | 150.8 | 101.2 | 81.6 | 70.8 | 36.8 |
| UXL1100-2FR          | 2703  | 2222  | 1818   | 1515   | 1299   | 1149   | 1020   | 935    | 862    | 800    | 654 | 392 | 282   | 189   | 127   | 102  | 88.5 | 45.9 |
| UXL1100-2FRi         | 2000  | 1800  | 1527   | 1318   | 1156   | 1034   | 928    | 860    | 802    | 752    | 621 | 392 | 282   | 189   | 127   | 102  | 88.5 | 45.9 |

Ampares to F.V.1.75 Volts Per Cell

| Battery Model \ Time | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h  | 2h  | 3h    | 5h    | 8h   | 10h  | 12h  | 24h  |
|----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----|-------|-------|------|------|------|------|
| UXL220-2FR           | 473   | 404   | 333    | 284    | 247    | 220    | 196    | 179    | 167    | 154    | 127 | 76  | 54.8  | 36.7  | 25   | 20.2 | 17.5 | 9.2  |
| UXL330-2FR           | 709   | 606   | 500    | 426    | 370    | 330    | 294    | 268    | 250    | 231    | 190 | 113 | 82.2  | 55    | 37.5 | 30.3 | 26.3 | 13.8 |
| UXL440-2FR           | 946   | 808   | 666    | 568    | 494    | 440    | 392    | 358    | 334    | 308    | 254 | 151 | 109.6 | 73.4  | 50   | 40.4 | 35   | 18.4 |
| UXL550-2FR           | 1182  | 1010  | 833    | 709    | 617    | 550    | 490    | 446    | 417    | 385    | 316 | 189 | 137   | 91.7  | 62.5 | 50.5 | 43.9 | 22.9 |
| UXL550-2FRi          | 875   | 818   | 700    | 617    | 549    | 495    | 446    | 410    | 388    | 362    | 300 | 189 | 137   | 91.7  | 62.5 | 50.5 | 43.9 | 22.9 |
| UXL880-2FR           | 1892  | 1616  | 1332   | 1136   | 988    | 880    | 784    | 716    | 668    | 616    | 508 | 302 | 219.2 | 146.8 | 100  | 80.8 | 70   | 36.8 |
| UXL1100-2FR          | 2364  | 2020  | 1667   | 1418   | 1235   | 1099   | 980    | 893    | 833    | 769    | 633 | 377 | 274   | 183   | 125  | 101  | 87.7 | 45.9 |
| UXL1100-2FRi         | 1749  | 1636  | 1400   | 1234   | 1099   | 989    | 892    | 822    | 775    | 723    | 601 | 377 | 274   | 183   | 125  | 101  | 87.7 | 45.9 |

# APPLICATION MANUAL

## Constant Current

Ampares to F.V.1.80 Volts Per Cell

| Battery Model \ Time | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h  | 2h  | 3h    | 5h   | 8h   | 10h | 12h  | 24h  |
|----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----|-------|------|------|-----|------|------|
| UXL220-2FR           | 400   | 357   | 303    | 260    | 230    | 206    | 189    | 171    | 157    | 148    | 121 | 73  | 54.1  | 35.7 | 24.4 | 20  | 17.2 | 9.2  |
| UXL330-2FR           | 600   | 536   | 455    | 390    | 345    | 309    | 283    | 256    | 236    | 222    | 182 | 109 | 81.1  | 53.6 | 36.6 | 30  | 25.8 | 13.8 |
| UXL440-2FR           | 800   | 714   | 606    | 520    | 460    | 412    | 378    | 342    | 314    | 296    | 242 | 145 | 108.2 | 71.4 | 48.8 | 40  | 34.4 | 18.4 |
| UXL550-2FR           | 1000  | 893   | 758    | 649    | 575    | 515    | 472    | 427    | 394    | 370    | 303 | 182 | 135   | 89.3 | 61   | 50  | 42.9 | 22.9 |
| UXL550-2FRi          | 780   | 723   | 637    | 565    | 512    | 464    | 430    | 393    | 366    | 348    | 288 | 182 | 135   | 89.3 | 61   | 50  | 42.9 | 22.9 |
| UXL880-2FR           | 1600  | 1428  | 1212   | 1040   | 920    | 824    | 756    | 684    | 628    | 592    | 484 | 290 | 216.4 | 42.8 | 97.6 | 80  | 68.8 | 36.8 |
| UXL1100-2FR          | 2000  | 1786  | 1515   | 1299   | 1149   | 1031   | 943    | 855    | 787    | 741    | 606 | 364 | 270   | 179  | 122  | 100 | 85.8 | 45.9 |
| UXL1100-2FRi         | 1560  | 1447  | 1273   | 1130   | 1023   | 928    | 858    | 787    | 732    | 697    | 576 | 364 | 270   | 179  | 122  | 100 | 85.8 | 45.9 |

Ampares to F.V.1.85 Volts Per Cell

| Battery Model \ Time | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h  | 2h  | 3h  | 5h    | 8h   | 10h  | 12h  | 24h  |
|----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----|-----|-------|------|------|------|------|
| UXL220-2FR           | 286   | 267   | 238    | 215    | 194    | 177    | 160    | 148    | 135    | 127    | 108 | 67  | 50  | 32.8  | 22.7 | 18.9 | 16.2 | 8.7  |
| UXL330-2FR           | 429   | 400   | 357    | 323    | 291    | 265    | 240    | 222    | 203    | 191    | 162 | 100 | 75  | 49.2  | 34.1 | 28.3 | 24.3 | 13   |
| UXL440-2FR           | 572   | 534   | 476    | 430    | 388    | 354    | 320    | 296    | 270    | 254    | 216 | 133 | 100 | 65.6  | 45.4 | 37.8 | 32.4 | 17.4 |
| UXL550-2FR           | 714   | 667   | 595    | 538    | 485    | 442    | 400    | 370    | 338    | 318    | 270 | 167 | 125 | 82    | 56.8 | 47.2 | 40.5 | 21.7 |
| UXL550-2FRi          | 557   | 540   | 500    | 468    | 432    | 398    | 364    | 340    | 314    | 299    | 257 | 167 | 125 | 82    | 56.8 | 47.2 | 40.5 | 21.7 |
| UXL880-2FR           | 1144  | 1068  | 952    | 860    | 776    | 708    | 640    | 592    | 540    | 508    | 432 | 267 | 200 | 131.2 | 90.8 | 75.6 | 64.8 | 34.8 |
| UXL1100-2FR          | 1429  | 1333  | 1190   | 1075   | 971    | 885    | 800    | 741    | 676    | 637    | 541 | 333 | 250 | 164   | 114  | 94   | 81.1 | 43.3 |
| UXL1100-2FRi         | 1115  | 1080  | 1000   | 935    | 864    | 797    | 728    | 682    | 629    | 599    | 514 | 333 | 250 | 164   | 114  | 94   | 81.1 | 43.3 |

Ampares to F.V.1.90 Volts Per Cell

| Battery Model \ Time | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h  | 2h  | 3h   | 5h    | 8h   | 10h  | 12h  | 24h  |
|----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----|------|-------|------|------|------|------|
| UXL220-2FR           | 217   | 208   | 190    | 174    | 157    | 146    | 136    | 127    | 119    | 113    | 96  | 61  | 45.5 | 30.8  | 21.1 | 17.7 | 15.2 | 8.1  |
| UXL330-2FR           | 326   | 313   | 286    | 261    | 236    | 219    | 204    | 191    | 179    | 169    | 144 | 91  | 68.2 | 46.2  | 31.6 | 26.6 | 22.8 | 12.2 |
| UXL440-2FR           | 434   | 416   | 380    | 348    | 314    | 292    | 272    | 254    | 238    | 226    | 192 | 121 | 91   | 61.6  | 42.2 | 35.4 | 30.4 | 16.2 |
| UXL550-2FR           | 543   | 521   | 476    | 435    | 394    | 365    | 340    | 318    | 298    | 282    | 240 | 152 | 114  | 76.9  | 52.6 | 44.3 | 38   | 20.3 |
| UXL550-2FRi          | 424   | 422   | 400    | 378    | 351    | 329    | 309    | 293    | 277    | 265    | 228 | 152 | 114  | 76.9  | 52.6 | 44.3 | 38   | 20.3 |
| UXL880-2FR           | 868   | 832   | 760    | 696    | 628    | 584    | 544    | 508    | 476    | 452    | 385 | 242 | 182  | 123.2 | 84.4 | 70.8 | 60.8 | 32.4 |
| UXL1100-2FR          | 1087  | 1042  | 952    | 870    | 787    | 730    | 680    | 637    | 595    | 565    | 481 | 303 | 227  | 154   | 105  | 88.5 | 75.9 | 40.6 |
| UXL1100-2FRi         | 848   | 844   | 800    | 757    | 700    | 657    | 619    | 586    | 553    | 531    | 457 | 303 | 227  | 154   | 105  | 88.5 | 75.9 | 40.6 |

# UXL SERIES

## Constant Watts

Watts Per Cell to F.V.1.60 Volts Per Cell

| Battery Model \ Time | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h   | 2h  | 3h  | 5h  | 8h   | 10h  | 12h   | 24h  |
|----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|------|-----|-----|-----|------|------|-------|------|
| UXL220-2FR           | 1128  | 896   | 723    | 603    | 524    | 457    | 413    | 372    | 340    | 315    | 261  | 159 | 116 | 77  | 51   | 41.5 | 34.9  | 18.1 |
| UXL330-2FR           | 1692  | 1344  | 1085   | 905    | 786    | 685    | 619    | 559    | 510    | 472    | 391  | 239 | 174 | 115 | 76.5 | 62.2 | 52.3  | 27.1 |
| UXL440-2FR           | 2256  | 1792  | 1446   | 1206   | 1048   | 914    | 826    | 744    | 680    | 630    | 522  | 318 | 232 | 154 | 102  | 83   | 69.8  | 36.2 |
| UXL550-2FR           | 2819  | 2240  | 1809   | 1509   | 1310   | 1142   | 1032   | 931    | 850    | 787    | 652  | 398 | 290 | 192 | 128  | 104  | 87.2  | 45.2 |
| UXL550-2FRi          | 2000  | 1814  | 1520   | 1313   | 1166   | 1028   | 939    | 857    | 791    | 740    | 619  | 398 | 290 | 192 | 128  | 104  | 87.2  | 45.2 |
| UXL880-2FR           | 4512  | 3584  | 2892   | 2412   | 2096   | 1828   | 1652   | 1488   | 1360   | 1260   | 1044 | 636 | 464 | 308 | 204  | 166  | 139.6 | 72.4 |
| UXL1100-2FR          | 5639  | 4481  | 3617   | 3017   | 2619   | 2285   | 2065   | 1862   | 1700   | 1574   | 1304 | 796 | 580 | 384 | 255  | 207  | 174   | 90.4 |
| UXL1100-2FRi         | 4001  | 3630  | 3038   | 2625   | 2331   | 2057   | 1879   | 1713   | 1581   | 1480   | 1239 | 796 | 580 | 384 | 255  | 207  | 174   | 90.4 |

Watts Per Cell to F.V.1.63 Volts Per Cell

| Battery Model \ Time | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h   | 2h  | 3h  | 5h  | 8h   | 10h  | 12h   | 24h  |
|----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|------|-----|-----|-----|------|------|-------|------|
| UXL220-2FR           | 1073  | 852   | 686    | 588    | 502    | 442    | 397    | 365    | 333    | 310    | 254  | 154 | 113 | 76  | 51.0 | 41.5 | 34.9  | 18.1 |
| UXL330-2FR           | 1609  | 1278  | 1029   | 882    | 753    | 663    | 596    | 548    | 500    | 465    | 381  | 231 | 170 | 114 | 76.5 | 62.2 | 52.3  | 27.1 |
| UXL440-2FR           | 2146  | 1704  | 1372   | 1176   | 1004   | 884    | 794    | 730    | 666    | 620    | 508  | 308 | 226 | 152 | 102  | 83   | 69.8  | 36.2 |
| UXL550-2FR           | 2681  | 2131  | 1715   | 1470   | 1256   | 1105   | 993    | 912    | 835    | 774    | 635  | 386 | 283 | 190 | 128  | 104  | 87.2  | 45.2 |
| UXL550-2FRi          | 1902  | 1726  | 1441   | 1279   | 1118   | 995    | 904    | 839    | 777    | 728    | 603  | 386 | 283 | 190 | 128  | 104  | 87.2  | 45.2 |
| UXL880-2FR           | 4292  | 3408  | 2744   | 2352   | 2008   | 1768   | 1588   | 1460   | 1332   | 1240   | 1016 | 616 | 452 | 305 | 204  | 166  | 139.6 | 72.4 |
| UXL1100-2FR          | 5363  | 4262  | 3430   | 2939   | 2512   | 2211   | 1986   | 1824   | 1669   | 1548   | 1270 | 771 | 566 | 381 | 255  | 207  | 174   | 90.4 |
| UXL1100-2FRi         | 3805  | 3452  | 2881   | 2557   | 2236   | 1990   | 1807   | 1678   | 1552   | 1455   | 1207 | 771 | 566 | 381 | 255  | 207  | 174   | 90.4 |

Watts Per Cell to F.V.1.65 Volts Per Cell

| Battery Model \ Time | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h   | 2h  | 3h  | 5h  | 8h   | 10h  | 12h   | 24h  |
|----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|------|-----|-----|-----|------|------|-------|------|
| UXL220-2FR           | 1035  | 829   | 680    | 574    | 499    | 439    | 394    | 357    | 326    | 305    | 254  | 154 | 113 | 74  | 51.0 | 41   | 34.9  | 18.1 |
| UXL330-2FR           | 1553  | 1244  | 1019   | 861    | 748    | 658    | 590    | 536    | 491    | 457    | 381  | 231 | 170 | 112 | 76.5 | 61.6 | 52.3  | 27.1 |
| UXL440-2FR           | 2070  | 1658  | 1360   | 1148   | 998    | 878    | 788    | 714    | 652    | 610    | 508  | 308 | 226 | 149 | 102  | 82   | 69.8  | 36.2 |
| UXL550-2FR           | 2589  | 2073  | 1699   | 1435   | 1247   | 1097   | 984    | 893    | 819    | 761    | 635  | 386 | 283 | 186 | 128  | 103  | 87.2  | 45.2 |
| UXL550-2FRi          | 1837  | 1679  | 1427   | 1248   | 1110   | 987    | 895    | 822    | 762    | 715    | 603  | 386 | 283 | 186 | 128  | 103  | 87.2  | 45.2 |
| UXL880-2FR           | 4140  | 3316  | 2720   | 2296   | 1996   | 1756   | 1576   | 1428   | 1304   | 1220   | 1016 | 616 | 452 | 298 | 204  | 164  | 139.6 | 72.4 |
| UXL1100-2FR          | 5178  | 4146  | 3398   | 2870   | 2494   | 2194   | 1968   | 1786   | 1638   | 1522   | 1270 | 771 | 566 | 372 | 255  | 205  | 174   | 90.4 |
| UXL1100-2FRi         | 3674  | 3358  | 2854   | 2497   | 2220   | 1975   | 1791   | 1643   | 1523   | 1431   | 1207 | 771 | 566 | 372 | 255  | 205  | 174   | 90.4 |

# APPLICATION MANUAL

## Constant Watts

Watts Per Cell to F.V.1.67 Volts Per Cell

| Time<br>Battery Model | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h   | 2h  | 3h  | 5h  | 8h   | 10h   | 12h   | 24h  |
|-----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|------|-----|-----|-----|------|-------|-------|------|
| UXL220-2FR            | 987   | 801   | 669    | 563    | 489    | 434    | 387    | 352    | 323    | 302    | 254  | 154 | 113 | 74  | 50.0 | 40.6  | 34.9  | 18.1 |
| UXL330-2FR            | 1481  | 1201  | 1003   | 844    | 733    | 651    | 580    | 528    | 486    | 452    | 381  | 231 | 170 | 112 | 75   | 60.9  | 52.3  | 27.1 |
| UXL440-2FR            | 1974  | 1602  | 1338   | 1126   | 978    | 868    | 774    | 704    | 646    | 604    | 508  | 308 | 226 | 149 | 100  | 81.2  | 69.8  | 36.2 |
| UXL550-2FR            | 2468  | 2002  | 1671   | 1406   | 1222   | 1085   | 967    | 879    | 810    | 753    | 635  | 386 | 283 | 186 | 125  | 102   | 87.2  | 45.2 |
| UXL550-2FRi           | 1826  | 1622  | 1404   | 1223   | 1088   | 977    | 880    | 809    | 753    | 708    | 603  | 386 | 283 | 186 | 125  | 102   | 87.2  | 45.2 |
| UXL880-2FR            | 3948  | 3204  | 2676   | 2252   | 1956   | 1736   | 1548   | 1408   | 1292   | 1208   | 1016 | 616 | 452 | 298 | 200  | 162.4 | 139.6 | 72.4 |
| UXL1100-2FR           | 4937  | 4003  | 3343   | 2813   | 2444   | 2170   | 1933   | 1757   | 1619   | 1506   | 1270 | 771 | 566 | 372 | 250  | 203   | 174   | 90.4 |
| UXL1100-2FRi          | 3653  | 3242  | 2808   | 2447   | 2175   | 1953   | 1759   | 1616   | 1506   | 1416   | 1207 | 771 | 566 | 372 | 250  | 203   | 174   | 90.4 |

Watts Per Cell to F.V.1.70 Volts Per Cell

| Time<br>Battery Model | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h   | 2h  | 3h  | 5h  | 8h    | 10h   | 12h   | 24h  |
|-----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|------|-----|-----|-----|-------|-------|-------|------|
| UXL220-2FR            | 932   | 775   | 630    | 548    | 473    | 421    | 376    | 346    | 320    | 298    | 247  | 150 | 109 | 73  | 49.8  | 40.2  | 34.9  | 18.1 |
| UXL330-2FR            | 1399  | 1162  | 945    | 822    | 709    | 632    | 564    | 519    | 480    | 447    | 370  | 225 | 163 | 109 | 74.8  | 60.3  | 52.3  | 27.1 |
| UXL440-2FR            | 1864  | 1550  | 1260   | 1096   | 946    | 842    | 752    | 692    | 640    | 596    | 494  | 300 | 218 | 146 | 99.6  | 80.4  | 69.8  | 36.2 |
| UXL550-2FR            | 2331  | 1937  | 1575   | 1370   | 1182   | 1053   | 940    | 864    | 800    | 745    | 617  | 376 | 271 | 182 | 125   | 100.5 | 87.2  | 45.2 |
| UXL550-2FRi           | 1725  | 1569  | 1323   | 1192   | 1052   | 948    | 855    | 795    | 744    | 700    | 586  | 376 | 271 | 182 | 125   | 100.5 | 87.2  | 45.2 |
| UXL880-2FR            | 3728  | 3100  | 2520   | 2192   | 1892   | 1684   | 1504   | 1384   | 1280   | 1192   | 988  | 600 | 436 | 292 | 199.2 | 160.8 | 139.6 | 72.4 |
| UXL1100-2FR           | 4662  | 3874  | 3150   | 2740   | 2364   | 2106   | 1880   | 1728   | 1600   | 1490   | 1234 | 751 | 543 | 365 | 249   | 201   | 174   | 90.4 |
| UXL1100-2FRi          | 3450  | 3138  | 2646   | 2384   | 2104   | 1895   | 1711   | 1590   | 1488   | 1401   | 1172 | 751 | 543 | 365 | 249   | 201   | 174   | 90.4 |

Watts Per Cell to F.V.1.75 Volts Per Cell

| Time<br>Battery Model | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h   | 2h  | 3h  | 5h  | 8h    | 10h   | 12h   | 24h  |
|-----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|------|-----|-----|-----|-------|-------|-------|------|
| UXL220-2FR            | 827   | 715   | 602    | 515    | 453    | 407    | 364    | 334    | 313    | 289    | 240  | 145 | 106 | 71  | 48.8  | 39.8  | 34.7  | 18.1 |
| UXL330-2FR            | 1241  | 1073  | 904    | 773    | 679    | 610    | 546    | 501    | 469    | 433    | 360  | 218 | 159 | 107 | 73    | 59.7  | 52.1  | 27.1 |
| UXL440-2FR            | 1654  | 1430  | 1204   | 1030   | 906    | 814    | 728    | 668    | 626    | 578    | 480  | 290 | 212 | 142 | 97.6  | 79.6  | 69.4  | 36.2 |
| UXL550-2FR            | 2068  | 1788  | 1506   | 1288   | 1131   | 1016   | 909    | 835    | 781    | 722    | 600  | 363 | 265 | 178 | 122   | 99.5  | 86.7  | 45.2 |
| UXL550-2FRi           | 1530  | 1448  | 1265   | 1121   | 1007   | 914    | 827    | 768    | 726    | 679    | 570  | 363 | 265 | 178 | 122   | 99.5  | 86.7  | 45.2 |
| UXL880-2FR            | 3308  | 2860  | 2408   | 2060   | 1812   | 1628   | 1456   | 1336   | 1252   | 1156   | 960  | 580 | 424 | 285 | 195.2 | 159.2 | 138.8 | 72.4 |
| UXL1100-2FR           | 4136  | 3576  | 3012   | 2576   | 2262   | 2032   | 1818   | 1670   | 1562   | 1444   | 1200 | 726 | 530 | 356 | 244   | 199   | 174   | 90.4 |
| UXL1100-2FRi          | 3061  | 2897  | 2530   | 2241   | 2013   | 1829   | 1654   | 1536   | 1453   | 1357   | 1140 | 726 | 530 | 356 | 244   | 199   | 174   | 90.4 |

# UXL SERIES

## Constant Watts

Watts Per Cell to F.V.1.80 Volts Per Cell

| Battery Model \ Time | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h   | 2h  | 3h  | 5h  | 8h    | 10h   | 12h   | 24h  |
|----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|------|-----|-----|-----|-------|-------|-------|------|
| UXL220-2FR           | 720   | 648   | 553    | 475    | 424    | 383    | 351    | 320    | 297    | 280    | 231  | 140 | 105 | 70  | 47.9  | 39.4  | 33.9  | 18.1 |
| UXL330-2FR           | 1080  | 972   | 830    | 712    | 637    | 575    | 529    | 480    | 445    | 419    | 347  | 211 | 157 | 104 | 71.9  | 59.1  | 50.8  | 27.2 |
| UXL440-2FR           | 1440  | 1296  | 1106   | 950    | 848    | 766    | 702    | 640    | 594    | 560    | 462  | 280 | 210 | 139 | 95.8  | 78.8  | 67.8  | 36.2 |
| UXL550-2FR           | 1800  | 1621  | 1383   | 1187   | 1061   | 958    | 878    | 800    | 742    | 699    | 577  | 351 | 262 | 174 | 120   | 98.5  | 84.5  | 45.1 |
| UXL550-2FRi          | 1404  | 1313  | 1162   | 1033   | 944    | 862    | 799    | 736    | 690    | 657    | 548  | 351 | 262 | 174 | 120   | 98.5  | 84.5  | 45.1 |
| UXL880-2FR           | 2880  | 2592  | 2212   | 1900   | 1696   | 1532   | 1404   | 1280   | 1188   | 1120   | 924  | 560 | 420 | 278 | 191.6 | 157.6 | 135.6 | 72.4 |
| UXL1100-2FR          | 3600  | 3242  | 2766   | 2374   | 2122   | 1916   | 1756   | 1600   | 1484   | 1398   | 1155 | 702 | 524 | 347 | 240   | 197   | 169   | 90.2 |
| UXL1100-2FRi         | 2808  | 2626  | 2323   | 2065   | 1889   | 1724   | 1598   | 1472   | 1380   | 1314   | 1097 | 702 | 524 | 347 | 240   | 197   | 169   | 90.2 |

Watts Per Cell to F.V.1.85 Volts Per Cell

| Battery Model \ Time | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h   | 2h  | 3h  | 5h    | 8h    | 10h   | 12h   | 24h  |
|----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|------|-----|-----|-------|-------|-------|-------|------|
| UXL220-2FR           | 529   | 497   | 445    | 405    | 364    | 335    | 305    | 283    | 259    | 244    | 208  | 130 | 98  | 64.6  | 44.8  | 37.4  | 32.1  | 17.2 |
| UXL330-2FR           | 793   | 745   | 668    | 607    | 546    | 503    | 457    | 424    | 388    | 367    | 312  | 195 | 146 | 96.8  | 67.2  | 56    | 48.1  | 25.7 |
| UXL440-2FR           | 1058  | 994   | 890    | 810    | 728    | 670    | 610    | 566    | 518    | 488    | 416  | 260 | 195 | 129.2 | 89.6  | 74.8  | 64.2  | 34.4 |
| UXL550-2FR           | 1321  | 1242  | 1114   | 1011   | 910    | 838    | 762    | 707    | 647    | 611    | 520  | 325 | 244 | 161   | 112   | 93.5  | 80.2  | 43   |
| UXL550-2FRi          | 1030  | 1006  | 936    | 880    | 810    | 754    | 693    | 650    | 602    | 574    | 494  | 325 | 244 | 161   | 112   | 93.5  | 80.2  | 43   |
| UXL880-2FR           | 2116  | 1988  | 1780   | 1620   | 1456   | 1340   | 1220   | 1132   | 1036   | 976    | 832  | 520 | 390 | 258.4 | 179.2 | 149.6 | 128.4 | 68.8 |
| UXL1100-2FR          | 2642  | 2484  | 2228   | 2022   | 1820   | 1676   | 1524   | 1414   | 1294   | 1222   | 1040 | 650 | 488 | 322   | 224   | 187   | 161   | 85.7 |
| UXL1100-2FRi         | 2061  | 2012  | 1872   | 1759   | 1620   | 1508   | 1387   | 1301   | 1203   | 1149   | 988  | 650 | 488 | 322   | 224   | 187   | 161   | 85.7 |

Watts Per Cell to F.V.1.90 Volts Per Cell

| Battery Model \ Time | 1 min | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min | 40 min | 45 min | 1h  | 2h  | 3h  | 5h    | 8h    | 10h   | 12h   | 24h  |
|----------------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|-----|-----|-----|-------|-------|-------|-------|------|
| UXL220-2FR           | 414   | 397   | 364    | 333    | 303    | 282    | 263    | 246    | 231    | 219    | 187 | 119 | 89  | 60.8  | 41.8  | 35.2  | 30.2  | 16.1 |
| UXL330-2FR           | 621   | 595   | 546    | 499    | 455    | 423    | 395    | 370    | 346    | 329    | 284 | 179 | 134 | 91.2  | 62.8  | 52.9  | 45.4  | 24.3 |
| UXL440-2FR           | 828   | 794   | 728    | 666    | 606    | 564    | 526    | 492    | 462    | 438    | 374 | 238 | 178 | 121.6 | 83.6  | 70.4  | 60.4  | 32.2 |
| UXL550-2FR           | 1036  | 992   | 909    | 832    | 758    | 705    | 658    | 616    | 577    | 548    | 468 | 303 | 224 | 152   | 105   | 88.2  | 75.6  | 40.4 |
| UXL550-2FRi          | 808   | 804   | 764    | 724    | 675    | 635    | 599    | 567    | 537    | 515    | 445 | 303 | 224 | 152   | 105   | 88.2  | 75.6  | 40.4 |
| UXL880-2FR           | 1656  | 1588  | 1456   | 1332   | 1212   | 1128   | 1052   | 984    | 924    | 876    | 748 | 476 | 356 | 243.2 | 167.2 | 140.8 | 120.8 | 64.4 |
| UXL1100-2FR          | 2071  | 1985  | 1818   | 1664   | 1516   | 1410   | 1316   | 1232   | 1154   | 1096   | 936 | 596 | 447 | 306   | 209   | 176   | 151   | 80.8 |
| UXL1100-2FRi         | 1615  | 1608  | 1527   | 1448   | 1349   | 1269   | 1198   | 1133   | 1073   | 1030   | 889 | 596 | 447 | 306   | 209   | 176   | 151   | 80.8 |

# APPLICATION MANUAL

## 8-5 Internal Resistance

The internal resistance(Impedance) of a battery is the lowest when the battery is in a fully charged

state. Table 3 shows the internal resistance of UXL Batteries at the end of charge.

**Table 3: Internal Resistance of UXL Batteries at 25 °C(77 °F)**

| Model        | Internal Resistance |    |
|--------------|---------------------|----|
| UXL220-2FR   | ≤0.60               | mΩ |
| UXL330-2FR   | ≤0.55               | mΩ |
| UXL440-2FR   | ≤0.60               | mΩ |
| UXL550-2FR   | ≤0.55               | mΩ |
| UXL550-2FRi  | ≤0.32               | mΩ |
| UXL880-2FR   | ≤0.60               | mΩ |
| UXL1100-2FR  | ≤0.55               | mΩ |
| UXL1100-2FRi | ≤0.32               | mΩ |

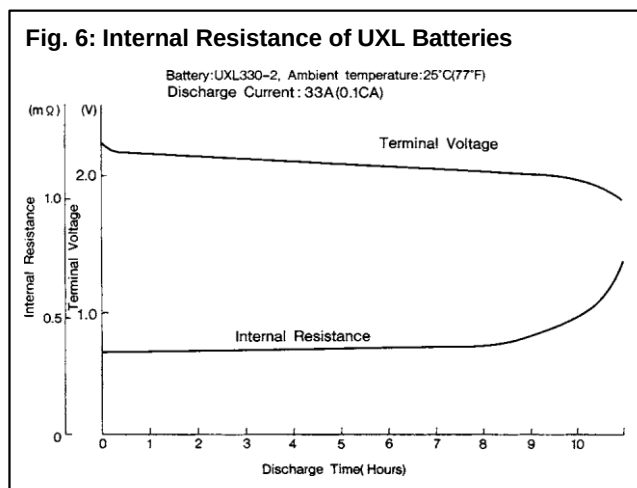
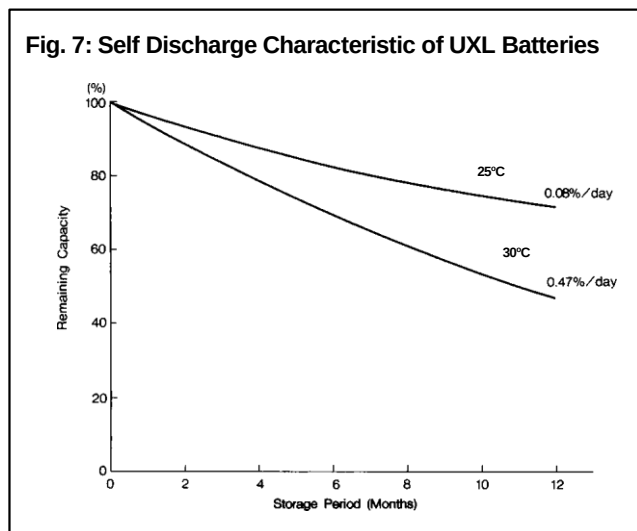


Fig.6 shows the internal resistance of an UXL Battery measured through a 1000Hz AC bridge.

## 8-6 Self-Discharge Characteristics



The rate of self-discharge is about 0.08% per day (2.4% per month) when the battery is left standing at 25 °C. As shown in Fig.7 in storage for one year at 25 °C, the capacity decrease is about 29%. This low rate of self-discharge is because of the use of lead-calcium alloy which is one-fourth to one-fifth that of a battery using lead-antimony alloy.

The higher the temperature, the more the self-discharge, and therefore storage for a long period at elevated temperature should always be avoided.

## 9 CHARGING

### 9-1 Charging Characteristics

Floating charge voltage must be kept at a value high enough to compensate for the battery's self-discharge to keep the battery in a fully charged condition at all times but low enough to minimize life deterioration due to possible overcharge.

The optimum charge voltage for YUASA UXL Battery is 2.23V per cell under normal temperature condition (25 °C (77°F)).

The YUASA UXL Battery requires no equalizing charge.

This is because of its low self-discharge rate resulting in a minimal variation among the cells in a battery bank and float charge at sufficient voltage to maintain it in a fully charged condition.

Recovery charge after the battery has been discharged can be carried out at the float charge voltage of 2.23V/cell.

Fig. 8 shows the charging characteristics at a constant current( 0.1CA ) and a constant voltage (2.23V/cell) after discharge of 50% and

100% of the 10HR rated capacity.

The time required to complete the charging varies by the amount of the previous discharge, initial charge current and temperature.

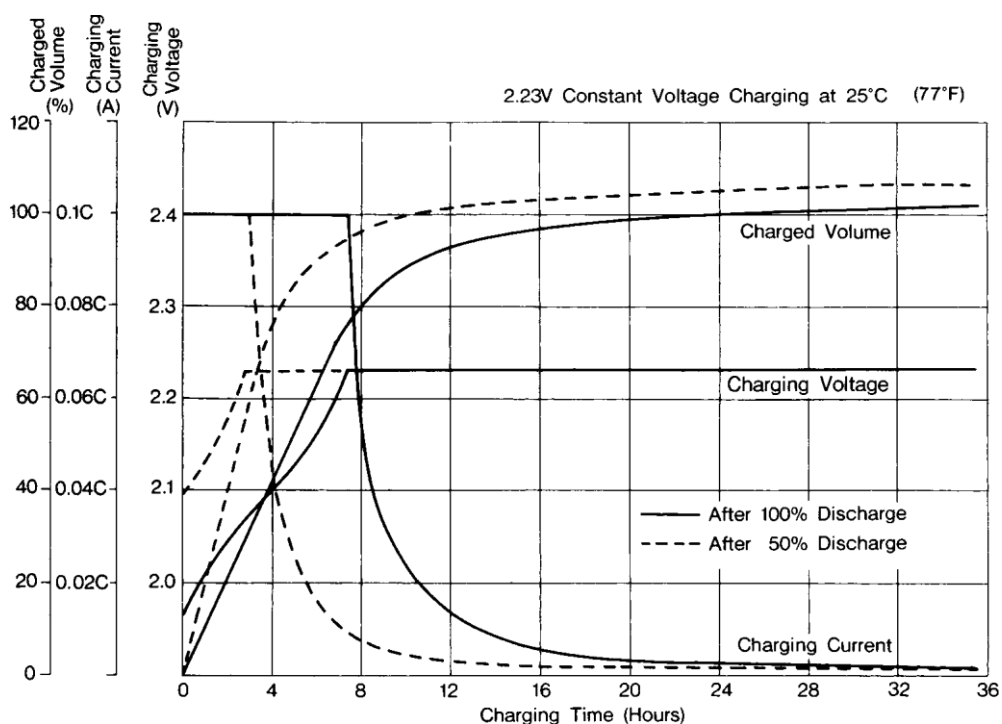
As shown in Fig.8 charging a fully discharged battery by constant current and constant voltage of 0.1CA and 2.23V respectively at 25 °C will put back more than 100% of the previous discharge in 24 hours.

Since the battery does not restrict the size of initial charge current, making it larger will shorten the time for a charge of more than 100%.

Fig.9 shows the relationship of charge voltage and current at float charge with gas recombination efficiency.

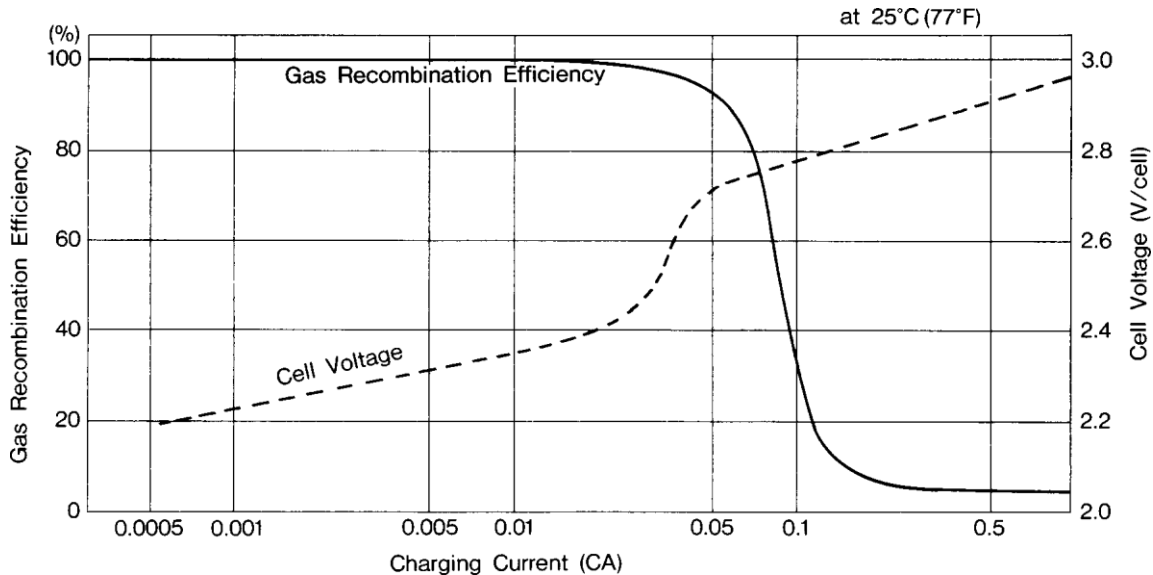
If the battery is charged at a voltage of 2.23V per cell, a trickle current just necessary to maintain the battery in fully charged condition will flow at the final stage of charging, and the gas recombination efficiency is maintained at nearly 100%. The final stage current will increase when the temperature is high, and decrease when low.

Fig. 8: Charging characteristics



# APPLICATION MANUAL

**Fig. 9: Gas Recombination Efficiency**



## 9-2 Charging Voltage

The charging voltage shall be 2.23 volts per cell at 25 °C.

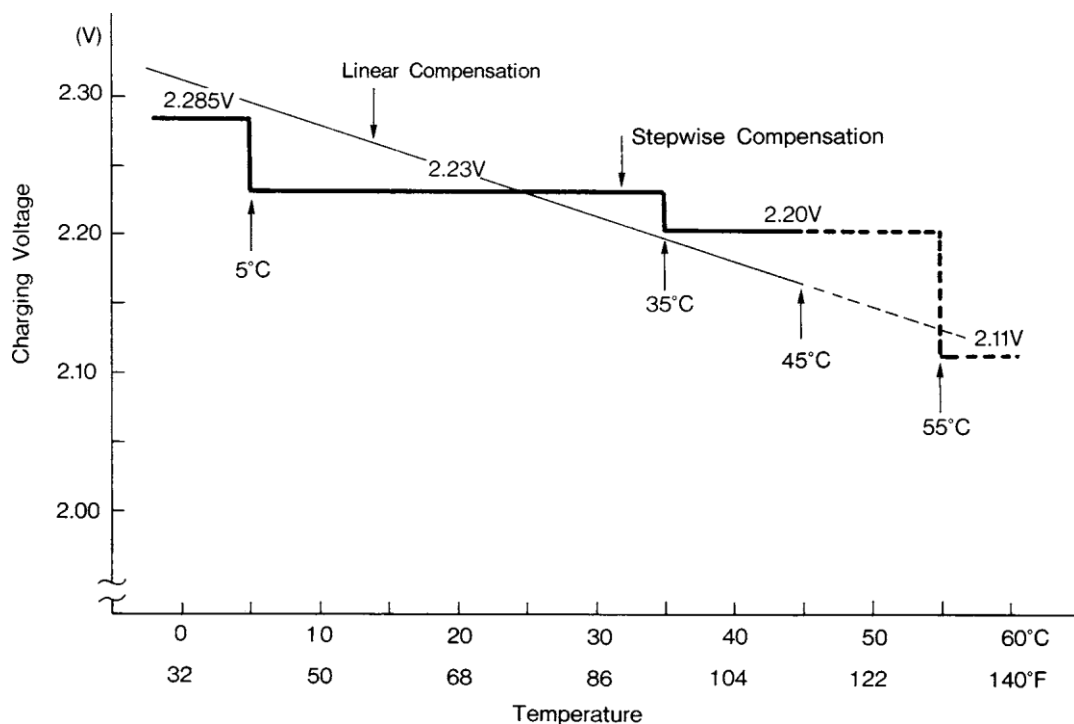
However, as the average ambient temperature rises, charging voltage should be reduced to prevent overcharge.

Accordingly, the recommended compensation

factor is  $-3\text{mV}/^{\circ}\text{C}/\text{cell}$  at 25 °C of standard centre point.

Fig.10 shows relationship between battery temperature and recommended charging voltage in accordance with Linear Compensation and Stepwise Compensation.

**Fig. 10: Relationship between Temperature and Charging Voltage**



## 10 LIFE CHARACTERISTICS

At the recommended operating temperature of 5°C-25 °C and under optimum float conditions, the service life is expected to be 20 years.

The length of float charge life is influenced by discharge frequency, discharge depth, float charge voltage and service environment.

At normal float charge voltage(2.23V per cell), the gas absorption mechanism described previously will have the negative plates absorb the gas generated in the battery returning it into water and, therefore, capacity decrease due to electrolyte depletion will not occur.

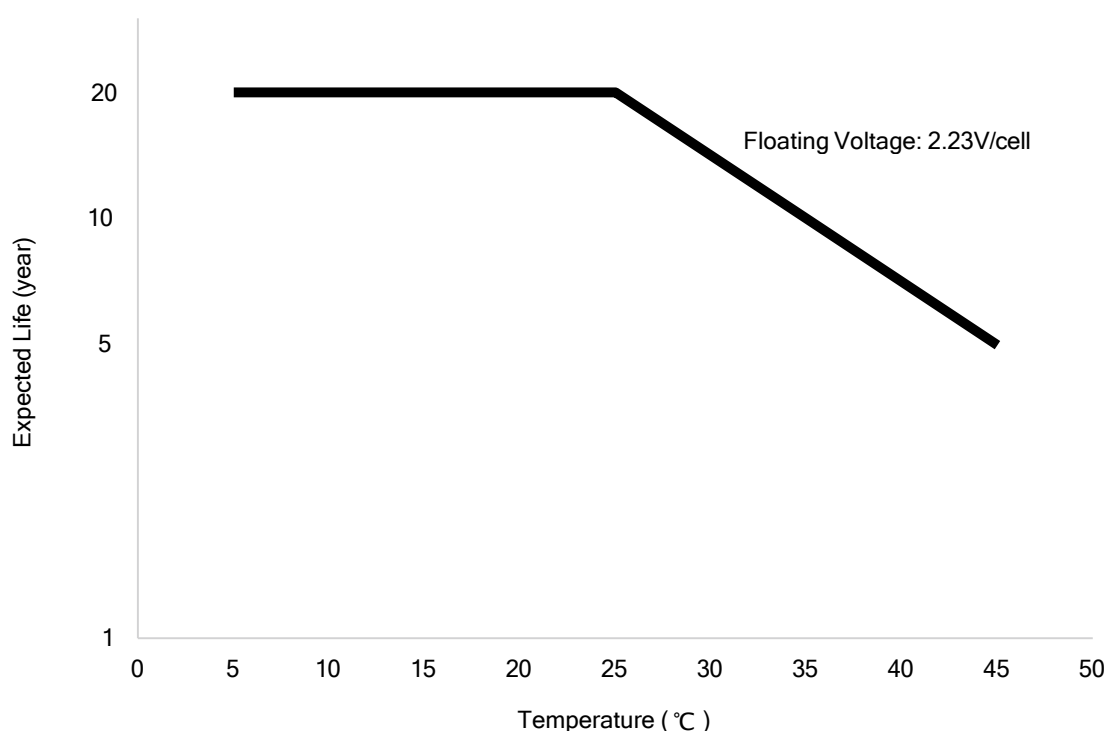
Corrosion speed will be accelerated as the temperature rises, making the life shortened. Also the higher the charge current, the faster the corrosion, therefore it is necessary to float-charge

the battery at the proper voltage. The float charge voltage should always be set at 2.23V per cell, using a battery charger with voltage accuracy of  $\pm 2\%$  or better.

As the result of an accelerated life test by high temperature 20 years floating charge life was estimated.

Although the battery life in actual service will vary depending on temperatures and other operating conditions, the 20 years designed Life of YUASA UXL Battery under normal operating conditions (e.g. total discharge amount per month is less than the rated capacity and used under temperatures of 5°C-25°C) can be estimated as shown in Fig.11 when the above test data and life characteristics of conventional stationary lead-acid batteries are taken into account.

Fig. 11: Relationship between temperature and expected life



# APPLICATION MANUAL

## 11 INSPECTION AND MAINTENANCE

Refer to the instruction manual for full details on handling the batteries.

### 11-1 Receiving

The battery is delivered in a fully charged condition. Please note the following points before installation.

Ignitable gases may be generated from the storage battery. Provide sufficient ventilation and keep the battery away from sparks and naked flame.

Upon arrival, inspect for any damage to the packages, and then unpack them carefully being

careful not to damage the battery.

Perform the unpacking at a place adjacent to the battery installation location. Take out the battery by supporting it at the bottom, not by lifting the terminals. Be careful that the seal may be disrupted if the battery is moved with force imposed on the terminals.

After unpacking, check the quantity of accessories and the appearance.

### 11-2 Installation

(1) After verifying no abnormality in the battery, install it on the prescribed location (e.g. cubicle or battery stand)

(2) Do not install the storage battery at an angle of more than 90 degrees from the upright position. Failure to do so may result in electrolyte leakage, a fire or even an explosion.

(3) If the battery is to be accommodated in a cubicle, place it at the lowest part of the cubicle whenever it is practicable.

(4) Always avoid installing the battery close to a heat source (such as a transformer).

(5) Since a storage battery may generate ignitable gases, avoid installing close to any item that produces sparks (such as switch fuses).

(6) Before making connections, polish the joint surfaces of the battery terminals to bright metal by a wire brush.

(7) When a multiple number of batteries are used, first make the inter-battery connections in a correct manner, and then connect the battery to the charger or the load.

In these cases, the positive (+) pole of the storage battery should be securely connected to the positive (+) terminal of the charger or the load, and negative (-) to negative (-).

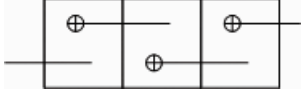
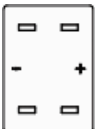
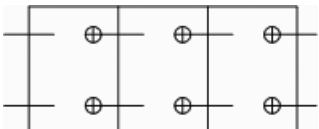
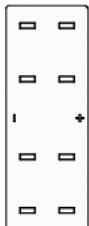
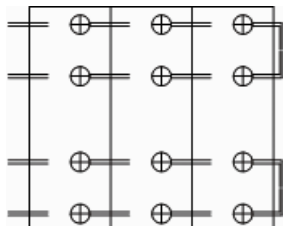
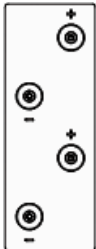
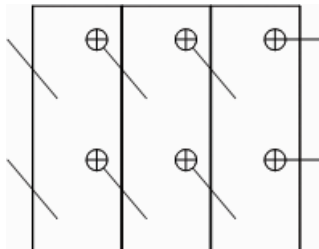
If the storage battery and the charger are connected erroneously, the charger will be damaged. Be sure not to make an erroneous connection.

The tightening torque for each connecting bolt and nut shall be in accordance with Table 4.

**Table 4: Tightening Torque for Connecting Bolt and Nuts**

| Applicable Battery       | Bolt Diameter | Tightening Torque Nm(Kgf·cm) |
|--------------------------|---------------|------------------------------|
| UXL220-2FR ~ UXL1100-2FR | M10           | 14.7 ~ 19.6 (150 ~ 200)      |

## 11-3 Connection

| Battery Model             | Internal Construction                                                               | External Connection                                                                  | Connector                 | Bolt $\phi$ |
|---------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------|-------------|
| UXL220-2FR<br>UXL330-2FR  |    |    | Lead Plated<br>Copper Bar | M10         |
| UXL550-2FRi               |    |    |                           |             |
| UXL440-2FR<br>UXL550-2FR  |  |  |                           |             |
| UXL880-2FR<br>UXL1100-2FR |  |  |                           |             |
| UXL1100-2FRi              |  |  |                           |             |

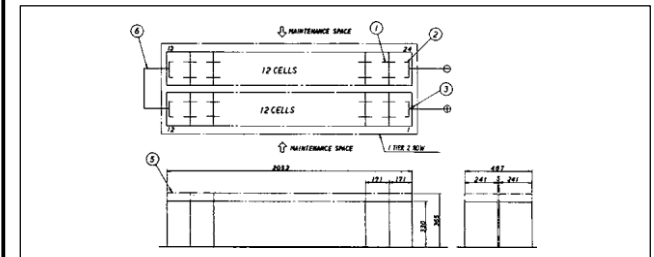
Note) UXL1100-2 and UXL880-2 has the plate groups divided into two independent groups in the container. The groups are interconnected externally to produce the specified capacity. For measuring voltage of each cell, read a voltmeter connected across positive and negative terminals adjacently positioned.

# APPLICATION MANUAL

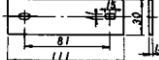
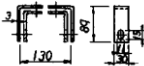
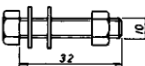
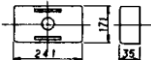
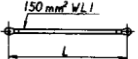
Connecting method varies by total battery voltage, layout and many other factors. Therefore, in case you may have questions on the connecting method, refer to the supplementary information or just ask us or the Yuasa agent for details. Below are the examples of UXL550-2FR~UXL1100-2FR connections into 48 volts set as shown in Table 5.

### Table 5: Examples of Battery Connections (48 Volts set)

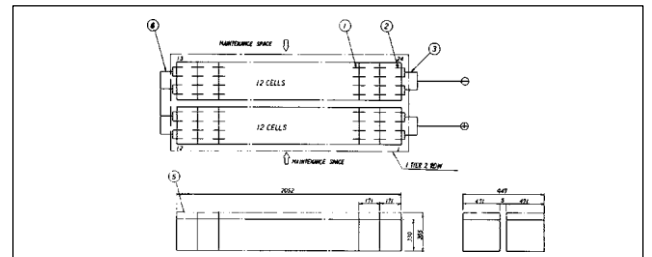
## UXL550-2FR



## PARTS LIST FOR ONE SET

| No. | NOMENCLATURE         | OUT LINE APPROX.(mm)                                                                | MATERIAL                             | Q'TY              | REMARKS |
|-----|----------------------|-------------------------------------------------------------------------------------|--------------------------------------|-------------------|---------|
| 1   | INTER-CELL CONNECTOR |   | LEAD-PLATED COPPER                   | 88                |         |
| 2   | SIDE-CELL CONNECTOR  |  | LEAD-PLATED COPPER                   | 4 SETS            |         |
| 3   | LEADING TERMINAL     |  | LEAD-PLATED COPPER                   | 4                 |         |
| 4   | BOLT, NUT WASHER     |  | LEAD-PLATED BRASS                    | 108<br>+3<br>SETS |         |
| 5   | CONNECTOR COVER      |  | SYNTHETIC RESIN                      | 24                |         |
| 6   | CONNECTING CABLE     |  | SYNTHETIC RESIN & LEAD-PLATED COPPER | 1                 | L=550   |

**UXL1100-2FR**



## PARTS LIST FOR ONE SET

[illegible]

## 11-4 Maintenance

In order to prevent battery troubles, inspect the battery regularly in the following manner and keep records.

### (1) Monthly Inspection

| What to inspect                           | Method                             | Standard spec.                              | Measures in case of irregularity                      |
|-------------------------------------------|------------------------------------|---------------------------------------------|-------------------------------------------------------|
| Total Battery Voltage During Float Charge | Measure total voltage by voltmeter | Float charge voltage × number of batteries. | Adjust to float charge voltage × number of batteries. |

### (2) Six-Month Inspection

| What to inspect                                  | Method                                                                                           | Standard spec.                                                               | Measures in case of irregularity                                                                                                                         |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 Total Battery Voltage During Float Charge      | Measure total voltage by voltmeter of class 0.5 or better.                                       | Total battery voltage shall be (float charge voltage × number of batteries). | Adjust if voltage value is outside standard.                                                                                                             |
| 2 Individual battery voltage during float charge | Measure individual battery voltage by voltmeter of class 0.5 or better.                          | within $2.23 \pm 0.1V$ /cell (5 ~ 35°C)<br>Fig.10 for details.               | If cell voltage is outside standard, Check the movement of the cell Voltage for 1-2 months. If it does not come back inside standard, please contact us. |
| 3 Appearance                                     | Check for damage or leakage at container and cover.                                              | -                                                                            | If leakage is found verify the cause. For container and cover having cracks, the battery shall be replaced.                                              |
|                                                  | Check for contamination by dust, etc.                                                            | -                                                                            | If contaminated, clean with wet cloth.                                                                                                                   |
|                                                  | Check for rust in the cubicle, battery stand, connecting plates, connecting wires and terminals. | -                                                                            | Perform cleaning, rust preventive treatment, painting of touch up.                                                                                       |

### (3) One-Year Inspection

Following inspection shall be added to six-month inspection.

| What to inspect  | Method                  | Standard spec.   | Measures in case of irregularity |
|------------------|-------------------------|------------------|----------------------------------|
| Connecting Parts | Tighten bolts and nuts. | Refer to Table 4 | -                                |

# APPLICATION MANUAL

## 11-5 Supplementary Charge

- (1) Part of the battery capacity will have been lost due to self-discharge during transportation or storage. Give supplementary charge before putting into service.
- (2) The supplementary charge should be given by the following conditions before putting into service.

**Table 6: Condition of Supplementary Charge**

| Storage Period       | Charge Voltage per cell | Charge Time      |
|----------------------|-------------------------|------------------|
| Not more than 1 year | 2.23V/cell              | More than 3 days |
|                      | 2.28V/cell              | 2~3 days         |
|                      | 2.35V/cell              | 2 days           |
| 1 ~ 2 years          | 2.23V/cell              | More than 6 days |
|                      | 2.28V/cell              | 5 days           |
|                      | 2.35V/cell              | 4 days           |

## 11-6 Daily Maintenance and Handling

### Discharge

- (1) Final discharge voltage is as shown in Table 2. Do not allow the battery terminal voltage to fall below this level.
- (2) Do not leave the battery in a discharged condition. Recharge it immediately. Also when the battery has been over-discharged by mistake, recharge it immediately.
- (3) Maximum permissible discharge current is 6C<sub>A</sub> Amps. for 5sec. or less. Do not exceed above level or it may abuse battery.

### Charge

#### (1) Float Charge

Float charge voltage shall be maintained across the terminals constantly at the values shown in Table 7.

The effects of too high or too low a floating charge voltage are as follows:

Too high for extended period(over-charge): shortens life.

Too low for extended period(under-charge): may not satisfy load or cause variances in battery voltage.

#### (2) Recovery Charge

Recovery charge is achieved with the same set voltage as floating charge shown in Table 7. While initial charge current is not specially specified, if shortening of the charging time(capacity recovery within 24 hours) is sought, 0.1C<sub>A</sub>-0.25C<sub>A</sub> amperes would be appropriate.

#### (3) Temperature compensation

In actual use in indoor applications (5°C to 25°C), it is not necessary to compensate the charging voltage(2.23V/cell).

When the batteries are operated at lower than 5 °C or higher than 25°C it is recommended to compensate the charging voltage as specified below.

The recommended compensation factor for the batteries is -3mV/°C/cell. The temperature compensation shall be made at the basis of 25°C which is the standard centre point for the batteries.

#### (4) Cautions During Charge

(a) If the charge current exceeds 0.05C<sub>A</sub> at the final stage of charge, the storage battery may be permanently damaged in appearance, performance and life. Pay special attention to charging voltage.

(b) The applied battery charger should be the one provided with automatic constant voltage equipment having drooping characteristics.

If a charger other than this type is applied, consult with us prior to use.

**Table 7: Charge Voltage (@25oC)**

| Charge method | Charge Voltage (V/cell)                             | Current limit (A)           |
|---------------|-----------------------------------------------------|-----------------------------|
| Float charge  | Applicable range: 2.20~2.30V<br>Optimum: 2.23±0.01V | Maximum: 0.25C <sub>A</sub> |
| Cyclic charge | Applicable range: 2.30~2.45V<br>Optimum: 2.35±0.01V | Optimum: 0.1C <sub>A</sub>  |

## 11-7 Storage

- (1) When you wish to store the battery, disconnect it from the charger and load, and store it, if possible, at dry location with low temperature.
- (2) If batteries are stored for a long period, give a supplementary charge before service.

## 11-8 Cautions

- (1) Clean the battery with wet cloth. Never have the battery splashed or deposited with oils or organic solvents such as gasoline and paint thinner, nor have it cleaned with cloths impregnated with these materials.  
  
Avoid dusting by "Cloth duster" or cleaning by dry cloth (particularly chemical textile) as they will generate static electricity which is dangerous.
- (2) A storage battery may generate ignitable gases. Never place near a naked flame or short circuit the battery.
- (3) Do not attempt to dismantle the storage battery. If sulphuric acid is deposited due to mechanical damage on to skin or clothes, wash immediately with water. If splashed into the eyes, wash with a large amount of fresh water and get immediate medical attention.
- (4) A storage battery is liable to rupture if thrown into fire. Avoid such conduct at all times.
- (5) To obtain maximum service life, the ripple current at R.M.S. should be regulated within 0.1C<sub>A</sub>.
- (6) When the storage battery is to be mounted in a container or bag, a ventilation opening should be provided. A cubicle containing the battery and a storage battery room should be provided with sufficient ventilation.
- (7) One may get an electric shock if one touches an electrically conductive part. Be sure to wear rubber gloves before inspection or maintenance work.
- (8) Apply lightly a rust preventive agent for leadacid stored batteries on connections of the storage battery.
- (9) Permissible temperature range of battery use is -15°C~45°C, but use at 5°C~25°C range is recommended for longer service life.
- (10) When 4 or more battery groups will be used in parallel connection, consult with us prior to use.
- (11) Mixed use of batteries with different capacities, different histories and of different manufacturer is liable to cause damages to the battery or to the equipment.  
Consult with us if such necessity is present.



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