The New Hitec Chargers

Benchmark

Hugh Bright with a reminder on the basic facts of life of a nicad, its charging regime and a review of the latest in field chargers from 'Hitec'.

Probably the least understood, the most important item in our gear and more often than not the most abused is the nicad. It wins for us, puts the silverware on the sideboard and what do we do? Feed it with a large number of amps in a short space of time and stuff it back into the car without letting it catch its breath and it's off to work again- reminds me of the early days of marriage but that's another story! It's not generally known that the first nicad was developed by Junger in 1899 as a secondary cell as an alternative to the existing 'wet' systems. But it wasn't until the late forties that a practical economic fully sealed rechargeable system was achieved. These are historical facts but what of the so called facts today?

Fact or Fiction?

At times when reading other articles I am still surprised at the amount of mythology that exists. A lot of it I suspect comes about because the authors have taken something out of context and 'bent' the facts to suit their own experience usually with pushing nicad high current discharge far beyond what the original designer intended.

Fact No.1. A fully charged nicad cannot produce more than 1.2v per cell on load.

Myth. If the voltage is read prior to loading a nicad it will appear to be around 1.4v or more and from this it's concluded that a higher voltage can be achieved by long term charging. Most modern meters put an insignificant load on a battery when used and the reading obtained agrees with the now familiar discharge graph curve which shows a 'knee' at the start of the discharge which quickly flattens into the straight line discharge voltage of around 1.2v. once a significant load is applied. This straight line discharge is probably the most important advantage of the nicad as it ensures a constant current throughout most of the discharge cycle. But this comes at a price because the voltage will remain virtually constant for about 80% of the discharge capacity and then start to fall very quickly to the point of battery failure. The price we pay is that unless you have a very sophisticated measuring device to monitor the very slight change in discharge voltage you have very little warning as to when the equipment is going to fail. It is for this reason that nicad checkers should be used very thoughtfully as they cannot indicate a precise point in the discharge cycle other than the point of imminent failure. From all of this it can be seen that there is no benefit to be obtained in overcharging. Far better to charge using a charger with auto shut down with the system going into trickle charge mode. High current overcharging will ultimately damage a nicad.

Myth. Any nicad will ultimately suffer from memory effect.

Fact No.2. The so called Memory Effect only occurs when a cell is repeatedly charged and discharged with only a shallow discharge and then subjected to a deep discharge. What happens is the operating voltage declines with consequent decrease of capacity. RC equipment which is subjected to repeated short session use will ultimately suffer from Memory Effect. However, equipment repeatedly used for long periods where the nicads are almost totally discharged will not suffer as the user is doing what I have often advised - cycling. Nevertheless as part of an annual maintenance routine a controlled discharge cycle and capacity analysis is to be recommended. In the majority of cases of Memory Effect a single deep discharge will restore a nicad to full capacity.

Myth. There is no need to upgrade a nicad pack to higher mA/hrs when more servos, i.e. load is added to a system. The only effect is to reduce the operating time.

Fact No.3. This is one of the more dangerous myths as prolonged overloading of a nicad pack will quickly destroy one or more of its cells. High current discharge generates heat which in turn generates gas which can be released by the cell's safety valve only in extreme circumstances. Repeated 'venting' will ultimately destroy the cell. Discharge current in a RX/servo etc., system needs to be controlled just the same as when cycling a nicad. By this I mean that linkages and mechanical pivots etc., need to be free but not sloppy so that they do not add load and increased current to the system. One should aim for a smooth operating system so that the current drawn from the pack is within its capacity. In this way you avoid voltage fluctuations which can affect the operation of the RX itself.

The Charging Regime

All nicads are charged at a constant current. This current is the capacity divided by ten -C/10 and is always the manufacturers recommendation. As the chemistry reacts inside the cell the voltage across it slowly rises to usually just over a volt above the cells nominal. For instance a 7.2V pack this would be about 8.4V. This is a plateau voltage and will remain at this level as the charge progresses. As the cell approaches maximum capacity the voltage starts to rise again to a point when it falls ever so slightly. This is the Delta peak. With a standard charger the constant current is set at C/10 which is 'trickle' charging so that when cell reaches full capacity no great harm occurs if it is left on charge. However, if the charging current is substantially increased for the whole charging cycle once the cell reaches full capacity this larger current, which has already caused the cell temperature to rise, will greatly increase the temperature to a point where it will vent and could in the worst case explode.

All three modelling disciplines have in the past suffered environmental noise problems from IC powered models which spurred the development of electric power and the need to charge nicads quickly between heats in all three - hence the availability of 'field chargers' using a 12V car 'wet' battery as the power source. These chargers ideally have to fulfil definite parameters.

1. Charge quickly.
2. Charge safely.
3. Charge to full capacity.
4. Avoid long term damage to the cells.
5. Cover a wide range of 'pack' voltages.
6. Automatic in use to prevent user error.

'hitec' have come up with two field chargers which successfully meet all five parameters plus several other attractive features - the CG-330 and CG335. One of the problems of field charging is the problem of the source battery volts falling as it is 'emptied'. Many solid state chargers have a very narrow input voltage range which causes the whole charging cycle to become erratic when the input volts fall from twelve to below eleven volts. Not so either of the 'hitecs'. The manufacturer claims that they will continue to work between nine and fifteen volts. My bench tests revealed a range of 9.4V to 15V. This is most satisfactory but there is one warning. Don't use the battery in your car because if you have a long and heavy session the car won't start on nine volts! Both models use the same 140 mm x 120 mm x 50 mm enclosure and novel heatsink which has the name 'hitec' cast into it! The 330 is the simplified version with one output for 4-24 cells @ a charge rate of 0.5A to 5A and a Glow Battery single cell charger output of 1.1A which will take a standard glow plug connection socket. The 4-24 cells output current is varied by a rotary adjustment around a dial numbered 0.5 - 1 to 5A. Input is via heavy duty croc clips and output via 4 mm terminal posts which will also accept 4 mm plugs. Five red and green LED's and a START button completes the control panel. In use it's simplicity itself. All outputs and inputs are polarity protected against inadvertent connection with either audible or a visual warning. Once any connection errors are corrected the 'Glow' battery charge will start automatically and its green LED will indicate charge complete. Any number of cells either in packs or connected in series as shown in the Instruction Manual are connected to the 4 mm terminal posts and the minimum charge rate selected using the CURRENT(A) rotary control. Pressing the START button will illuminate a steady green LED. The rotary control must now select a value within three minutes. Always select the lowest value possible to prolong your battery's life and never unless it's unavoidable charge TX & RX batteries above the 0.5A rate. Further bear in mind that most transmitters have a polarity diode between the charging socket and the TX battery. It's better to charge the battery outside the TX for this reason and the inevitable heat rise in the pack if you charge at a high amperage. The 335 works in the same way with an additional 4 mm '4 CELL' plus LED output which initially starts at 500 mAH dropping to 250 mAH as the battery reaches full capacity. There is no automatic or peak charge cut-off on this output so consequently it must never be left unattended and the charge terminated after one hour or if the pack becomes warm.

The other difference is the digital read-out of the 335. This makes for accurate setting of the charge current.

Conclusions

On both models the 4-24 cell output and the Glow output are 'pulse' chargers with Delta peak cut offs and a maximum charge time of 65 minutes so they satisfy the safety requirements. The pulse rate is sensibly set below 1K cycles which keeps the temperature at a reasonable level. It's no use just test charging a pack without first cycling it a number of times on an Analyser, to check its optimum capacity using a normal charging regime. This was done on a number of 7.2V 1500 mAH and 1800 mAH packs so that a capacity base line could be established. These were then 'fast charged' at various charge currents and then discharged/analysed over three cycles each pack. The charge current was monitored independently on both chargers which confirmed the accuracy of the 335 digital read-out and the approx. settings on the 330 which surprisingly was reasonably accurate. Of the four packs used only one failed to reach its nominal capacity - 1700 instead of 1800 mAH. The other three all reached a capacity above their nominal. Funnily enough as I could not discharge/analyse the four in series (24 cell test) when done individually the rogue cell came up trumps. The other outputs all performed as expected. My power source was two 6V 8 Ahr sealed lead acid batteries in series giving me 13.8V at the start falling to 9.4V when the LOW BATTERY WARNING Led came up red. It started to turn yellow at around 10V. Only one wart. The charging green Led does not extinguish when Delta peak is reached as the manual states, and the system goes into trickle charge. It blinks which is also the indication when something is wrong. I checked with Amerang who confirmed that the manual is incorrect. Anyway I much prefer the 'blinking' mode as in fact charging is still taking place. Both are supplied with a comprehensive manual, apart from the above, which for a change coming from the Far East is very well written. Congratulations Amerang. Altogether two fine pieces of charging equipment and worthy of a place in anybody's kit at around £59.99 mrp for the 330 and £69.99 mrp for the 335. Of the two the 335 is much to be preferred for another £10. From any good model shop or from the Importer Amerang Ltd., Commerce Way, Lancing, West Sussex. BN15 8TE. Tel: 01903 765496. Fax: 01903753643. So - in the heat of the moment - May your fast charged packs never fail your RC force! RRCI

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