

# **Substitution of Nickel-Cadmium batteries in power tools**

## **Nickel-Cadmium versus Nickel-Metallhydrid**

Robert Bosch GmbH  
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# Nickel-Cadmium versus Nickel-Metallhydrid

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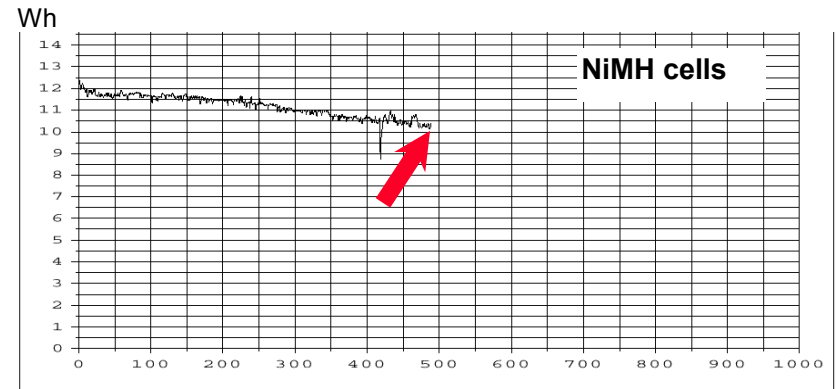
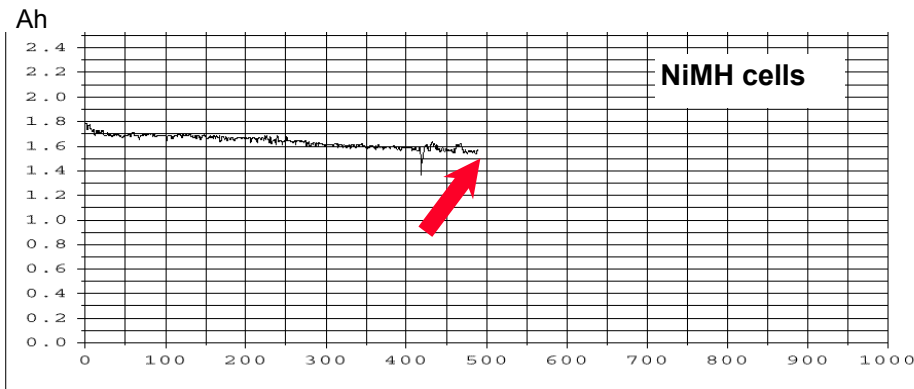
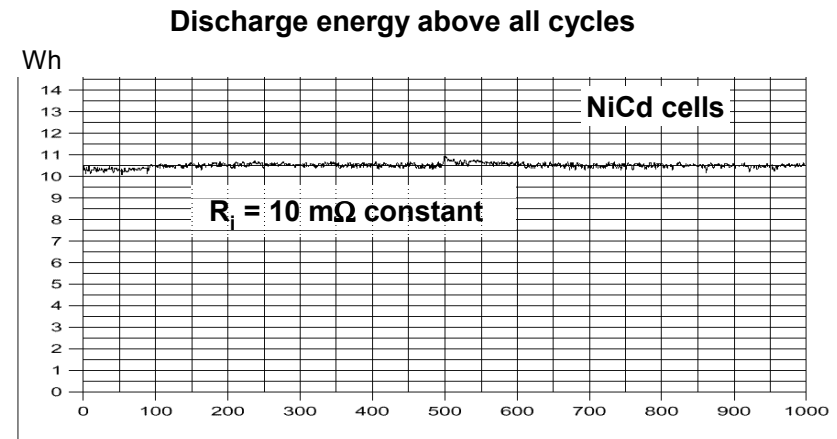
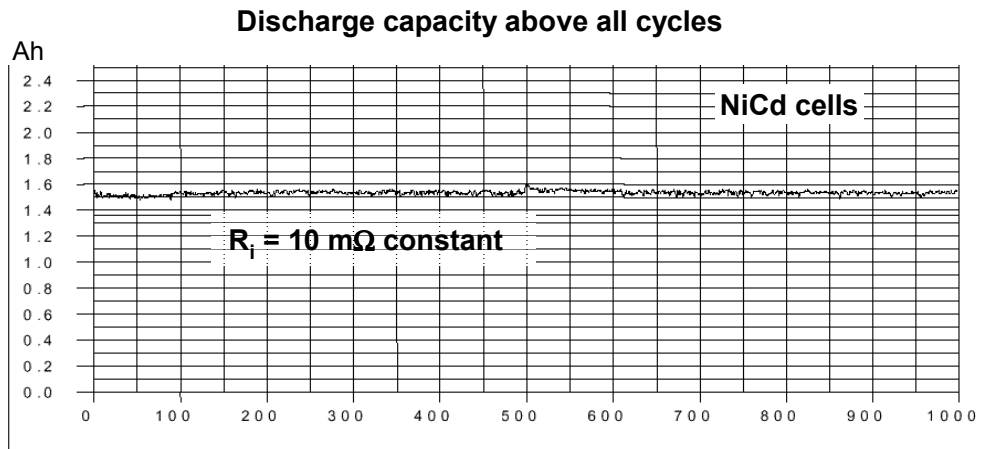
# Nickel-Cadmium versus Nickel-Metallhydrid

## 1. General technical statements

- NiMH batteries cannot save the charged energy over a longer time period. They reach on average only approx. 45% of the life duration of NiCd batteries.
- NiMH batteries have a higher energy reserve only in the new condition. After about 150 discharge cycles the results are fallen below the results of NiCad.
- The initial capacity of the NiMH batteries breaks down fast relatively (after 10 min).
- NiMH react very sensitive at temperatures over 40 C. Consequences are reduced capacity and life time.
- With higher power demand, current intensities over 20 A and low temperature less 0 C, NiMH batteries are usable only with strong capacity loss.
- NiMH batteries react very sensitive at overcharging and also excessive discharging.
- NiMH batteries reach in the direct comparison only approx. 30% of the charge and discharge cycles of NiCd batteries.
- At loads over 20 A a voltage drop up to 20% arises at NiMH batteries per cell.
- At great current load (over 40 A) NiMH cells run out opposite NiCd cells fundamentally earlier.  
Result: shorter life time of NiMH cells.
- NiMH batteries are by approx. 25-30 % more expensive than NiCd batteries at the moment.
- The different components of the NiMH cells aren't usable completely at the moment.

# Nickel-Cadmium versus Nickel-Metallhydrid

## Life time test by Bosch



- Measuring ends because the power is below 80%
- $R_i$  increases from  $10 \text{ m}\Omega$  to  $15 \text{ m}\Omega$  after 500 cycles

Example: A cordless screwdriver has always few Rpm

# Nickel-Cadmium versus Nickel-Metallhydrid

## Further measuring results

*(without graphs)*

### ↗ Capacity at temperatures below 0 C

measuring temperature: - 18 C

NiCd capacity: 93%

NiMH capacity: no function

➡ **Working with NiMh below -10 C is not possible !**

### ↗ Characteristic after self-discharge by longer storage

NiCad:

- After repeated charging/discharging NiCd is regenerated on the original state.
- NiCad is still powerful after more than 1.000 cycles.

NiMH:

- After repeated charging/discharging NiMH is not regenerated on the original state.
- NiMH is no longer powerful after more than 300 - 400 cycles.

# Servicecentre power tools

## **Repairservice** (since 1985)

- **Repairservice for Bosch, Skil and Dremel power tools in Germany, Netherland und Belgium**
- **1.400 repairs per day**
- **approx. 12% are cordless tool repairs**

## **Recyclingservice** (since 1993)

- **The service was started in 1993 named as Recyclingcentre power tools and Bosch is the operator.**
- **The recycling centre power tools is an common german system of the power tool manufacturers.**
- **It presents with 23 brands more than 90% of the market volume in Germany.**
- **Power tools, gardening tools, measuring tools and batteries are collected and recycled**
- **In accordance to the german battery ordinance the system is working as collecting system for power tool batteries since 1998**



## **Spare part service** (since 1985)

- **World wide service for the brands Bosch, Skil, Dremel, ATCO and Qualcast**

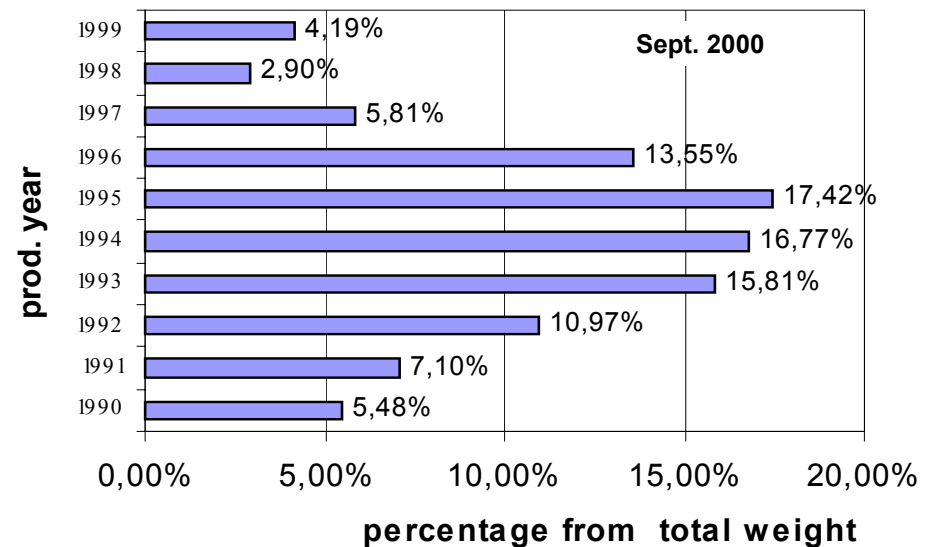
# Servicecentre power tools

## Some figures (Febr. 2001)

- **Sold NiCad batteries in 2000:** approx. **1.300 tons (total p.t. market)**  
**470 tons (Bosch)**
- **Guarantee cases at batteries**  
**More than 90% of all guarantee cases concerns NiMH batteries**
- **Average age of collected and recycled NiCd batteries**

The diagram shows the share of collected Bosch batteries in dependence of their production year.

The complete quantity of collected NiCd batteries was 37 tons in 2000. Since 1998 the annual quantity of collected NiCd batteries rises from year to year by approx. 30%.



# Market situation in the field cordless tools

## Employment

- Total 15.000 employees worldwide → 6.200 employees in Europe  
→ 3.000 employees in Germany
- 10 locations in Europe: Germany (5) with the headquarter in Leinfelden, Switzerland (2), Netherlands, UK, Italy

## Cordless tool segment (Bosch details)

- It is the most essential growth segment, the actual growth rate is over 10% and also expected in the same level for the next years
- The cordless tool segment has 25% sales share in the complete power tool sales in Europe
- More than 50% of total (worldwide) sold cordless tools are sold in Europe
- More than 70% of the employment in the segment Cordless tools is placed in Europe
- The range of applications becomes more and more wide, beside drills and hammers applications like circular saws, jigsaws, sanders, planes are new
- NiMH is placed on the market by Bosch since 1998
- NiMH share is minor, less than 10%, and decreases further
- NiMH cells are more expensive than NiCd cells, approx. 30-40% for purchase
- Total costs for the customers are 2-3 times more because of the shorter lifetime and the higher purchase costs

# Consequences of a ban on NiCd batteries

**Because of quality, technical and economic faults Bosch has changed his strategy back to NiCd.**

## **Consequences of a ban on NiCd batteries**

A ban will initiate a technology step back strategy either to NiMH or to corded tools with the following consequences:

**→ major safety issues**

high current applications lead to an increased risk for internal damage for NiMH cells

→ this internal damage leads to frequent replacement, dissatisfaction of endusers

Cordless tools operate on low voltage DC (3,6 - 24 Volt) while corded tools operate with high voltage AC (220 - 230 Volt)

→ major safety security for people and equipment

**→ endangering employment in Europe because of the costs for NiMH cells and economics of production**