MAINTENANCE & SERVICE INSTRUCTION SHEET

Water Less® / Perfect Plus™ / Ironclad® Batteries





HAWKER

Water Less

perfect plus

IRONCLAD



1 BATTERY DISCONNECT

Disconnect the electrical connection between the battery and the vehicle by separating the plugs.



2 REMOVE BATTERY COVER

Leave watering plugs closed.



3 LEVEL INDICATOR

Open standard watering plugs and check the electrolyte level. Visually check float indicator of the aquamatic plug. Do not fill water before the charge; only refill if level is below electrodes.



| ((((,,))) | | | | | |
|---|--|--|--|--|--|
| Tricolour LED | Blue LED | | | | |
| Green blinking - hardware OK | Rapid blinking - wireless identification | | | | |
| Blue rapid blinking - wireless identification | Slow blinking - voltage balance warning | | | | |
| Red blinking - temperature warning > 55° C | OFF - Flashing - electrolyte level is OK | | | | |
| | Light is constantly on - electrolyte level is low - Add water! | | | | |

Water Less

| Level indicator | Action | | | | | |
|--|-------------------------|--|--|--|--|--|
| Grey housing: (2 - 3) PzMB | | | | | | |
| Green LED is lit continuously | Electrolyte level is OK | | | | | |
| Green LED is off | Add water | | | | | |
| Blue housing: (2 - 10) PzM and (4 - 11) PzMB | | | | | | |
| Green LED flashing | Electrolyte level is OK | | | | | |
| Green / Orange LED flashing | Warning status | | | | | |
| Red LED flashing | Add water | | | | | |



perfect plus IRONCLAD

| Level indicator | Action | | | | |
|-------------------------------|-------------------------|--|--|--|--|
| Grey housing: (2 - 3) | PzMB | | | | |
| Green LED is lit continuously | Electrolyte level is OK | | | | |
| Red LED flashing | Add water | | | | |
| | | | | | |



4 CONNECT CHARGER PLUG

Connect (EC) electrolyte circulation system (if connector w/o integrated air supply).



5 SWITCH ON CHARGER

Check if the charger has been switched on. Charge the battery.



6 ADD WATER

Water topping up should be carried out 20 minutes before the end of charge or immediately after charging.

| Add water if necessary. See item 3 and table for water level indication. | Add water until the "max." mark is reached. Alternatively, connect the Aquamatic tube and see if all plugs show "max." indication. |
|--|--|





*LED - level indicator option *Aquamatic option *Wi-iQ° - monitoring device option *EC - electrolyte circulation option **IMPORTANT**

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ONLY SWITCH OFF CHARGER

Switch off charger, then disconnect it. If EC is connected, disconnect that too. Check final values if necessary.





Clean the battery and extract liquid from inside the container.



8 EQUALIZING CHARGE

Carry out weekly equalizing charge.



(4) EXCHANGE AEROMATIC FILTER

Check air pump function.



9 INSPECT FOR DAMAGE

Visually inspect all the battery components for mechanical damage (particularly charging plug and cables).



15 REQUEST SERVICE

If significant changes or cell differences are found, request further maintenance from the Service department.



10 MEASURE CELL VOLTAGES

Monitoring cell voltages is essential for maintaining battery health and lifespan.



11 MEASURE ELECTROLYTE GRAVITIES AND TEMPERATURE

If over 45°C, leave to cool down.



12 MEASURE INSULATION VALUE

Must be at least 50 Ω per V of nominal voltage.



*LED - level indicator option *Aquamatic option *Wi-iQ* - monitoring device option *EC - electrolyte circulation option

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IMPORTANT

Topup interval guidance on page 3

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FLOODED BATTERY TECHNOLOGY

| * STEP DAILY | | | | | | | | | | | | |
|-----------------------------|---|--|--|---|--|---|---|--|--|--|---|--|
| STEP | DAILY | | WEEKLY | | MONTHLY | | | ANNUALLY | | | | |
| | Water Less [*] | Perfect Plus [™] | Ironclad° | Water Less® | Perfect Plus [™] | Ironclad° | Water Less [®] | Perfect Plus [™] | Ironclad° | Water Less® | Perfect Plus [™] | Ironclad* |
| Battery disconnect | Х | Х | Х | | | | | | | | | |
| Remove battery cover | X | X | X | | | | | | | | | |
| Level indicator | X | X | X | | | | | | | | | |
| Connect charger plug | X | X | X | | | | | | | | | |
| Switch on charger | X | X | Х | | | | | | | | | |
| Add water (if necessary) | X | X | Х | X | X | Х | X | | | | | |
| Switch off charger | Х | X | Х | | | | | | | | | |
| Equalizing charge | | | | X | X | Х | | | | | | |
| Visually inspect for damage | | | | X | X | Х | | | | | | |
| Measure cell voltages | | | | | | | X | X | Х | | | |
| Measure electrolyte gravity | | | | | | | X | X | Х | | | |
| Measure electrolyte temp. | X | X | Х | | | | | | | | | |
| Measure insulation valve | | | | | | | | | | Х | X | Х |
| Clean battery | | | | | | | | | | Х | Х | Х |
| Exchange aeromatic filter | | | | | | | | | | Х | Х | Х |
| Call service department* | X | X | Х | | | | | | | | | |
| | Battery disconnect Remove battery cover Level indicator Connect charger plug Switch on charger Add water (if necessary) Switch off charger Equalizing charge Visually inspect for damage Measure cell voltages Measure electrolyte gravity Measure insulation valve Clean battery Exchange aeromatic filter | Battery disconnect X Remove battery cover X Remove b | Water Less' Perfect Plus Battery disconnect X X X Remove battery cover X X X Level indicator X X X Connect charger plug X X X Switch on charger X X X Add water (if necessary) X X Switch off charger X X X Switch off charger X X X Weasure cell voltages Measure electrolyte gravity Measure insulation valve Clean battery Exchange aeromatic filter Call service department* X X X | Water Less Perfect Plus™ Ironclad® Rattery disconnect X X X X X X X X X X X X X X X X X X X | Water Less' Battery disconnect X X X X Remove battery cover X X X X X Add water (if necessary) X X X X X X X X X X X X X | Water Less' Plus" Ironclad Water Less' Plus" Battery disconnect X X X X X Bemove battery cover X X X X X Bemove battery cover X X X X X Bemove battery cover X X X X X X Below battery cover X X X X X X X X X X X X X X X X X X X | Water Less' Pius Ironclad Vater Plus Ironclad Cattery disconnect X | Water Less' Price Ironclad Water Less' Plus Ironclad Ironclad Ivonclad Ironclad Iron | Water Less' Plus" Ironclad Less' Plus" Ironclad Less' Plus" Ironclad Water Plus" Ironclad Less' Plus" Ironclad Water Plus" Ironclad Less' Plus" Ironclad Matery Country Co | Water Less' Plus Ironclad Water Plus Ironclad Water Plus Ironclad Water Plus Ironclad Plus Ironclad Plus Ironclad Ironcl | Water Less' Plus Ironclad Water Perfect Less' Plus Ironclad Water Plus Ironclad Water Less' Plus Ironclad | Water Less Pellus Ironclad Less Pellus Ironclad Less Pellus Ironclad Less Pellus Ironclad Perfect Less Pellus Ironclad Ironclad Pellus Ironclad I |

^{*}if required.

TOPPING UP INTERVALS - WATER LESS® AND WATER LESS® 20

| Interval | with the charger / charging factor |
|--|---|
| 2 weeks in three-shift operation ^[1] | 50 Hz, Cf ⁽⁴⁾ 1.2 |
| 4 weeks in one-shift operation ^[2] | 50 Hz, Cf ⁽⁴⁾ 1.2 |
| 5 weeks in three-shift operation ^[1] | HF ^[5] , Cf ^[4] 1.10 |
| 8 weeks in one-shift operation ^[2] in three-shift operation ^[1] | HF ^[5] , Cf ^[4] 1.10 HF ^[5] +EC ^[3] Cf ^[4] 1.07 |
| 12 weeks in three-shift operation ^[1] | 50 Hz, HF ^[5] , Wi-iΩ, Cf ^[4] 1.04 |
| 13 weeks in one-shift operation ^[2] | HF ^[5] +EC ^[3] Cf ^[4] 1.07 |
| 20 weeks in one-shift operation ^[2] | 50 Hz, HF ^[5] , Wi-iΩ, Cf ^[4] 1.04 |

- Oycle number can be reduced in three shift operation at high temperatures
- **2** With 80% DoD, 5 days/week at the battery temperatures of 30°C
- 3 Electrolyte circulation
- 4 Charging factor
- 6 High Frequency



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