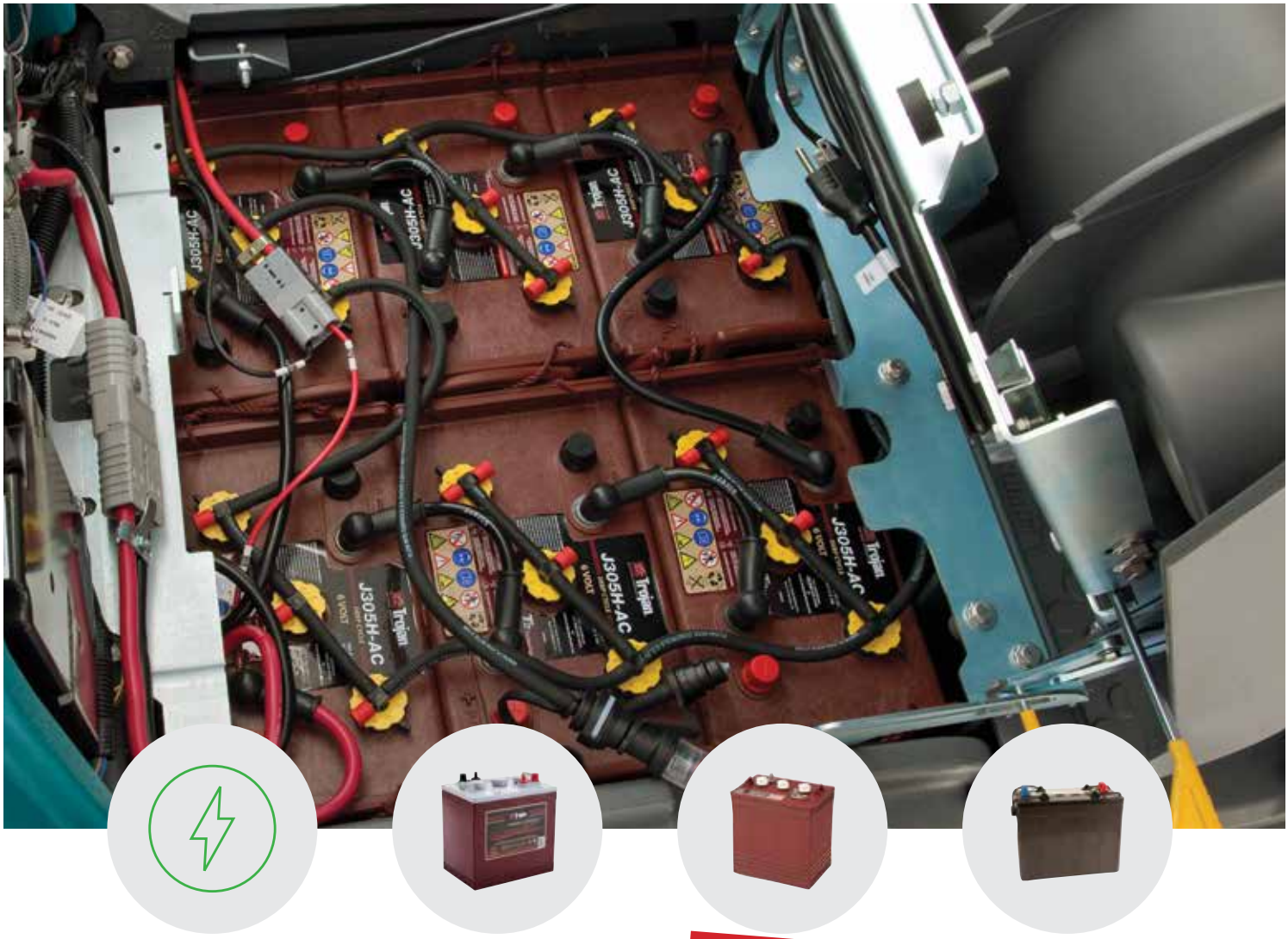
Battery Charging



NOT ACCEPTABLE

PAST PRACTICES BASED ON OLD TECHNOLOGIES:

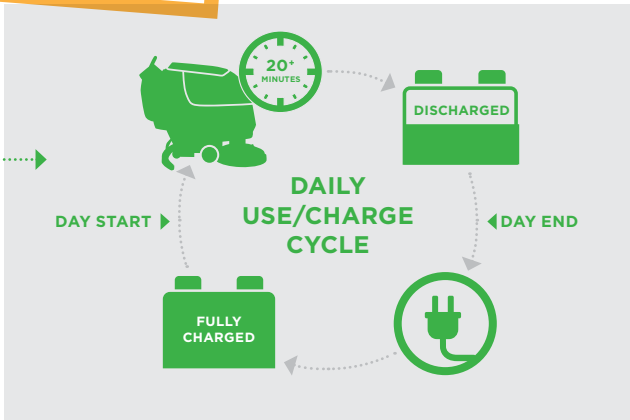
- ✖ Lead Acid Batteries (Flooded, AGM, GEL) must be fully discharged prior to charging.
- ✖ Opportunity charging Lead Acid Batteries is an acceptable practice.
- ✖ Run the batteries multiple days if you only use it a few minutes per day. Storing the batteries in a partially charged state is fine as long as you charge them once they reach a fully discharged state (80% Depth of Discharge).
- ✖ Do not leave your charger plugged in for a prolonged period of time (weekends, or weeks at a time).
- ✖ Every time you charge batteries, you have used up one charge cycle.
- ✖ Batteries have a limited number of charge cycles, once that limit is reached the batteries are no longer good and need to be replaced.

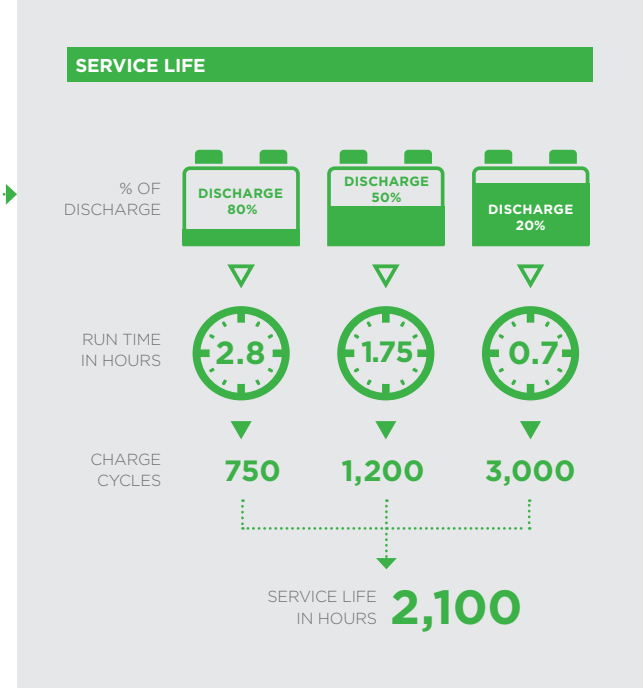
Turn over to see best practices based on **NEW technologies** ▶

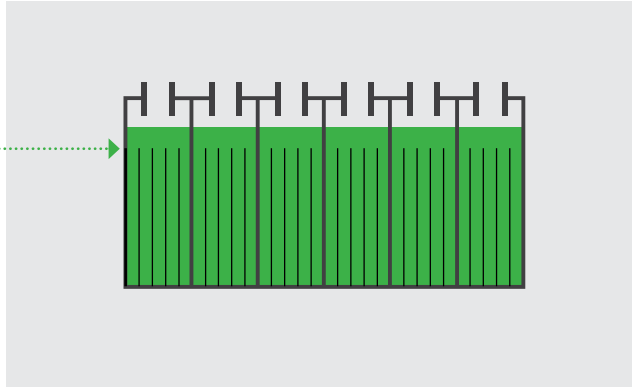
BEST PRACTICES BASED ON NEW TECHNOLOGIES:

ACCEPTABLE

- ✓ In order to maximize the life of Lead Acid Batteries (Flooded, AGM, GEL) the batteries should be charged every day after 20 minutes or more of usage. This means, at the end of each day when the machines use is completed for that day. Before usage the following day, the machine must be plugged in and charged until the charger indicates the batteries are **FULLY charged**. Failure to allow the batteries to fully charge before the next use will diminish the life of the batteries.
- ✓ Unless designed specifically for opportunity charging, with the correct charger, **Lead Acid Batteries should never be opportunity charged**, meaning plugged in for a short period of time, and not allowed to fully charge the batteries. It will negatively impact the life of the batteries.
- ✓ **The batteries should never be stored in a discharged state.** Some of today's machines place parasitic loads on the batteries. Even when the machine's key is in the "OFF" position, there are electrical components drawing upon the batteries energy. To maximize the batteries life they must be charged each day after daily use is completed. Again, do not stop charging the batteries until it has gone through its full charge cycle as indicated by the charger.
- ✓ New charger technology **allows** the batteries and charger to be plugged in over a weekend or a week. The charger will shut off once the full charge on a batteries is reached. Also, some of the newer chargers can monitor the batteries and turn back on as the batteries requires a charge. Often going into "trickle charge" mode.
- ✓ **Not all charge cycles are equal.** A charge cycle replacing 20% of a battery's capacity versus a charge cycle replacing 80% of a battery's capacity do not both count as the same charge cycle.
- ✓ We want to change focus to Service Life instead of Cycle Life going forward to help explain this more fully. Batteries are only capable of storing and dispersing a limited amount of energy over their life. How you use and replace that energy is up to the user and their specific application.
- ✓ On Flooded batteries, **check the fluid level in each cell at least once a week prior to charging the batteries**. Verify the top of the lead plates is not visible above the fluid level. Add distilled water as required to cover the top of the lead plates. Caution, do NOT overfill. Fluid volume increases during a charge cycle and can overflow from the battery. Prior to a charge, add only enough distilled water to cover the lead plates.
- ✓ After a complete charge is indicated by the charger, **check the fluid level in each cell** and confirm they are all filled to the correct level. Add distilled water as required.
- ✓ On Flooded batteries, **check the fluid level at least once per week**. Add distilled water as required after the batteries have been fully recharged.
- ✓ **Do not** charge Lead Acid Batteries more than once per 24 hour period.
- ✓ Charge the batteries in a **well ventilated area** to prevent possible gas buildup.







Best practices shared apply to all Nobles machines. Please note that equipment older than 5 years may not have all functionality mentioned.

The key to maximum performance and life in any Lead Acid Battery is ensuring they are **properly maintained** and **charged**.