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Battery Room Best Practices

The battery room is an integral part of the day-day operations, and it is imperative to include its layout in the original floor plan of any warehouse. The location of the battery room should minimize the time spent traveling to and from the battery room and work areas. If the industrial lift truck fleet is dispersed throughout the warehouse or distribution center (DC), a centrally located battery room would be most efficient. For companies where industrial lift truck usage is primarily isolated to a specific area, it is recommended to locate the battery room near the area of highest usage. In larger environments, multiple battery rooms should be considered.

The Battery Room

The battery room should be located in an area that allows adequate space for traffic flow in and out of the room. Traffic aisles should be wide enough to allow industrial lift trucks to pass one another as required and should stay clear of obstructions. The size of the battery room is important. The planned area must be sufficient for the size of fleet it is servicing and should allow room for expected future growth.

The battery room must have adequate electrical service and should be located near a main power feed, as distance from the power feed will increase costs. Chargers, ventilation, heating, cooling, and battery handling equipment all require electricity and should be considered when calculating the power requirements for the battery room. Plumbing, including drainage, will also be needed inside the battery room for battery filling and washing, as well as safety eye washes and showers.

Battery Handling Equipment

Weight is a significant safety concern with industrial lift truck batteries. Incorporating handling equipment to move, store, and maintain the batteries must be a priority in the planning of any battery room. Even the smallest battery fleet should have battery handling equipment available for maintenance purposes.

The ideal battery changer will efficiently handle battery changes as often as required. Eliminating a line of industrial lift trucks waiting for changes, increases productivity. Considerations for selecting the appropriate battery handling equipment include:

• Overhead Extraction vs. Side Extraction

• Daily number of battery change-outs

• Space available for the system

Overhead Extraction

A fork attachment and lifting beam along with sufficient charging racks and/or service stands are suitable for the following applications:

1. Fleets requiring overhead extraction

2. Limited battery changes

3. Removal for maintenance

As an alternative, a small portable gantry crane would increase efficiency by eliminating the need for a second available industrial lift truck. Larger systems requiring multiple changes per day would benefit from a track mounted, powered gantry crane.

Side Extraction

For fleets with side extraction, choices are similar, but more options are available. Small park and charge operations may only require a manual transfer carriage and battery service stand for battery maintenance purposes. Multi-shift operations with a small fleet and minimal battery changes per day may find that a powered transfer carriage will make the battery changing process more efficient and then the manual transfer carriage.

For maximum efficiency in larger fleet operations, a fully powered Operator Aboard Battery Extractor will be required. Operator Aboard Battery Extractors are available in multi-level systems. Deciding which system is right depends on space availability and the number of batteries to be stored. Ceiling height of the battery room may eliminate some options. Depending on the charger quantities, specifications, and stackability, the system layout may require additional charger storage stands. Increasing the system height can save between 10% and 50% of floor space.

It is common for an industrial lift truck and battery fleet to consist of multiple types and sizes. It is important that the battery handling equipment is designed to safely transport all of the batteries in your fleet. The following chart may assist in determining the proper BHS equipment according to the number of stored batteries in the warehouse.

BHS Equipment Application Guide

Stored Batteries	***BHS Equipment Recommendation***	***Change-out Time***	***Type of Extraction***
1 - 99	BE-SL (Single Level)	2-3 Minutes	Operator Aboard Side Extraction
100 - 149	BE-DS (Double Stack)	2-3 Minutes	Operator Aboard Side Extraction
150 - 299	BE-TS (Triple Stack)	2-3 Minutes	Operator Aboard Side Extraction
300 +	BE-QS (Quad Stack)	2-3 Minutes	Operator Aboard Side Extraction
Up to 50 Batteries	MBE (Mobile Battery Extractor)	3-5 Minutes	Side Extraction
15 - 18	ATC (Automatic Transfer Carriage)	3-5 Minutes	Side Extraction
2 - 3	BTC(Battery Transfer Carriage)	5-8 Minutes	Side Extraction

Maintenance

Daily inspections by trained operators along with Planned Maintenance are vital to the battery handling equipment's functionality and operator's safety. Any defects or damage found during the inspection should be addressed prior to operation. All fluid levels should be checked and filled accordingly as well. Frequent inspections support the prevention of system malfunctions while Planned Maintenance, such as lubrication and cleaning, ensure proper system operation. It is imperative that all battery handling equipment sustain a scheduled maintenance program. The battery handling equipment's owner and operator manual should be referenced for maintenance checklists and intervals. In addition, the BHS Service School is offered as an excellent tool to advance the knowledge of the battery handling equipment's operators and technicians.

Battery Room Floors

The floor of the battery room should be code approved flooring which resists acid damage. Consult applicable building codes and regulations issued by the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the National Fire Protection Association (NFPA), and others. The BHS Operator Aboard Battery Extractor operates on a fixed travel path that requires a defined specification.

An uneven floor in a fixed travel path causes vibration, flexing, and stress on equipment resulting in decreased productivity of the Operator Aboard Battery Extractor. Lift heights of battery extractor systems magnify the effect of an uneven floor. As elevation increases, so does the amount of flex and strain on the machine. A floor with an appropriate F-min rating provides for safe and proper operation of your equipment. Consequently, you will save money with fewer repairs, fewer parts purchased, less downtime, and less potential for personal injury or equipment damage.

A single number, F-min, is used to measure the floor flatness and levelness for defined traffic paths. F-min rating results from four different F-numbers representing the floor's longitudinal levelness, longitudinal flatness, transverse levelness, and transverse flatness. The floor is measured along the exact travel path that each wheel of the Operator Aboard Battery Extractor follows. Changes in elevation along each wheel path are used to determine whether the floor meets the specified F-min requirements. Any area of the path that falls outside of the specification is identified for correction as part of the measurement process. As systems increase in height, any defects in the floor further amplify both static and dynamic shifts of the load while traveling.

Floor Specifications

IPP is dedicated to customer service before, during, and after the sale. In keeping with this commitment, IPP offers floor inspections on all man-on-board battery extractor environments prior to installation to address any issues limiting the productivity of your battery extractor system.

Defined Traffic Floor Requirements for Battery Extractor Travel Path

American Concrete Institute 117 (ACI 360)		UK Concrete Society Technical Report 34 (TR34)
Machine Type	**Fmin**	
SL, DS	40	CAT 2
TS	60	CAT 1
QS	85	SUPERFLAT

Batteries

It is important to properly maintain industrial batteries by watering, washing, and repairing as required. Proper water levels must be maintained to maximize the battery life. Under watering the battery allows the lead plates to be exposed to air, which causes the plates to sulfate and lose capacity. Lost capacity means shorter run times and lost cycles, as well as lost time due to additional battery changes. Over watering can cause a boil over which reduces the battery's capacity. Multiple boil overs will eventually decrease the life of a battery by six months or more. In addition, boil overs create hazards when the water and acid expelled from the battery run onto the battery stands and floor. If not promptly cleaned, the water will evaporate leaving a highly acidic residue which can cause structural damage to stands and equipment as well as pitting in floors. Watering should be done with deionized or distilled water. Dissolved minerals found in most tap water can cause battery damage, reducing the battery's life. Water deionizers, such as

the BHS WDS-1, electrostatically remove dissolved impurities from tap water making it safe for battery watering. There are several water level indicators available to alert operators when watering is required. When watering is required, a single point watering system makes watering a quick and easy process. Many of these systems also have an automatic shutoff preventing accidental overfill.

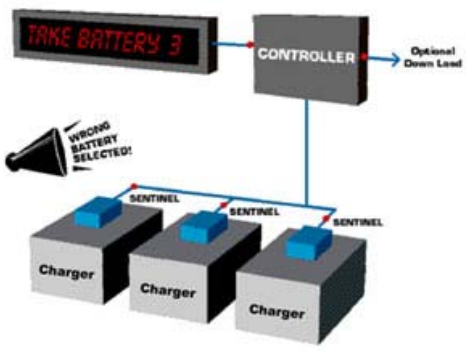
Regular washing of the batteries minimizes short circuits, reduces energy loss, and minimizes tray corrosion. Batteries should be inspected regularly for broken or damaged connectors, worn or damaged contact tips, and cut or worn cables. Any issues found must be repaired immediately.

Improper battery rotation is a leading cause of reduced battery run time and reduced battery life. Tests have shown that when battery selection is left to an operator, thirty percent of batteries will be underutilized while another 20% will be over utilized. Underutilized batteries will lose capacity due to corrosion on the plates. Over utilized batteries do not have time to cool and become over-heated, causing corrosion which leads to a shortened life. Proper rotation of all batteries is required in order to ensure maximum battery life and run time. Selecting the battery that has the longest cool down time ensures proper rotation.

Battery Management

First-in-first-out systems, such as BHS' FleetTracker, select the next available battery based on the battery's time on the rack. The battery which has been on the rack the longest will be logically selected, as it is the battery which has had the longest cool time after charging. This type of system requires no input from the chargers or the batteries, so there is no additional wiring, or modules to connect. The system can track multiple battery types. The addition or removal of batteries, racks, or trucks can be done simply at any time. The FleetTracker system also alerts operators when batteries require equalization, washing, or watering based on parameters set by the user during setup. Unauthorized use of the extractor can be prevented by requiring a user to login to the FleetTracker in order to activate machine travel. All transactions are recorded and all information is available for review in a variety of reports. These reports track battery and truck usage, maintenance intervals, and operator performance. Review of the battery and truck usage may identify shortages or overages in fleet availability. This allows the battery room to be "right-sized", avoiding costly wastes of time, space, and energy.

Charger monitoring systems, like the iBOS battery management system, utilize the same first-in-first-out theory, but do so by monitoring the charge state of all of the batteries on charge. Remote modules on each charger monitor charger output and queue the batteries in the order charging was completed. Again, the battery with the longest cool down time is shown as the next available. If no batteries have completed charge, batteries are displayed in order of most fully charged. By monitoring the charger output, the iBOS can also alert operators when a charger does not come on, when chargers shut off prior to the battery reaching an 80% charge, or other issues. The iBOS also monitors energy usage and provides many reports on the utilization of the battery fleet.



Regardless of the system chosen, ensuring that batteries are properly rotated, even by simply recording information manually, will not only increase the lifespan of the batteries but also the overall efficiency of the battery room.

Charger Storage

To save floor space and comply with OSHA regulations, chargers should be mounted to shelves or stands designed for that purpose. Many charger layout variations are available depending on the size of the fleet and space requirements. The chargers must be mounted securely in all four corners, regardless of the quantity. Chargers can often be stacked, but it is important to follow all manufacturer's instructions and recommendations. Manufacturer's instructions must also be followed when spacing the chargers to allow adequate ventilation during use.

When positioning battery charger cabinets, consideration should be given to the charger DC cable lead length. It is important to design the battery charger layout in a manner that enables the charger DC cable leads to connect to the battery, yet ensures that the charger manufacturer DC cable lead length specification is not exceeded.

Accommodations should be made for charger maintenance during the design of the battery room layout. The incorporation of a catwalk and/or multi-level charger shelves into the overall system design allows for easy accessibility to the chargers.

Safety

Safety equipment is essential in the design and planning of the battery room. Proper planning is necessary in order to provide a safe and productive environment for those operating and maintaining the equipment. Hydrogen gas can reach dangerous levels in the warehouse. It may be required to install hydrogen gas detectors which will activate ventilation and alarms when this occurs. Installation of emergency wash equipment is imperative. Personal protective equipment must be available to machine operators and maintenance personnel. This equipment includes acid-resistant face shield, goggles, gloves and apron. Nonconductive tools for maintenance must also be supplied. It is necessary to keep spill kits on site to control spills of dangerous materials such as battery acid.

Personnel

As part of all safety programs, it is important that warehouse management properly train personnel. Operators must be trained on the proper operation of the battery handling equipment. This training includes daily inspections which help to determine that the equipment is in proper operating condition and safe for use. Personnel must also be trained on the use of the personal protective equipment. Appropriate signage denoting locations of safety equipment must be present. Other signage marking travel paths, pedestrian warnings and other safety related information are also recommended.

The proper training and management of the battery handling equipment is crucial in determining its lifespan and efficiency. It is recommended to assign a dedicated battery handling equipment operator to manage all industrial lift truck battery change-outs as well as the battery handling equipment's maintenance. A dedicated operator is responsible for performing the daily inspections, planned maintenance, and all repairs thus heightening his or her familiarity with the battery handling equipment and its functions. Implementation of a dedicated operator increases productivity and ensures the battery handling equipment's preservation.