

Small /Heavy Component Ergonomics

Part I: Locomotive Starters



BUILDING AMERICA[®]

2011 RSI/CMA, Minneapolis

Electric Starter



Electric Starters Installed



Air Starter



Air Starter Installed



Starter Summary

- **Electric starter weighs 76 pounds**
 - Two per locomotive in most applications
- **Air starter weighs 69 pounds**
 - One per locomotive in most applications to date
- **Both are small enough to be carried in two hands**
- **Usage has increased dramatically with application of automatic engine start/stop systems**
 - Start cycles have increased as much as 6 to 8 times
 - Preventive starter changeouts on UP have increased from every three years to annually on auto start/stop units

Problem Statement

- **Manual lifting has been used to handle and install this part for decades**
- **UP has had some recent success in improving safety**
- **Injuries have and will continue to be an issue unless better methods and equipment are identified**
 - **Back injuries due to lifting and twisting**
 - **Drops, falls when ascending, descending, walking with part**
 - **Pinch points during starter removal and installation**
 - **Longer term stress-strain injuries from repeated handling**

Current State: Warehouse Storage



**12 Starters Per Layer, 2-3 Layers per Pallet
Often Stored on the Floor**



**Pallets Not Always Accessible From Above,
Requires Reaching, Pulling, and Twisting to
Retrieve**

Current State: Bad Order Removal



Location of Starters on Locomotive is Low and Somewhat Obstructed by Car Body Crane (When Available) Used During Removal and Installation

Current State: Removal From Box, Strapping



**Starters Often Rolled From Box
Onto Floor To Facilitate Strapping**

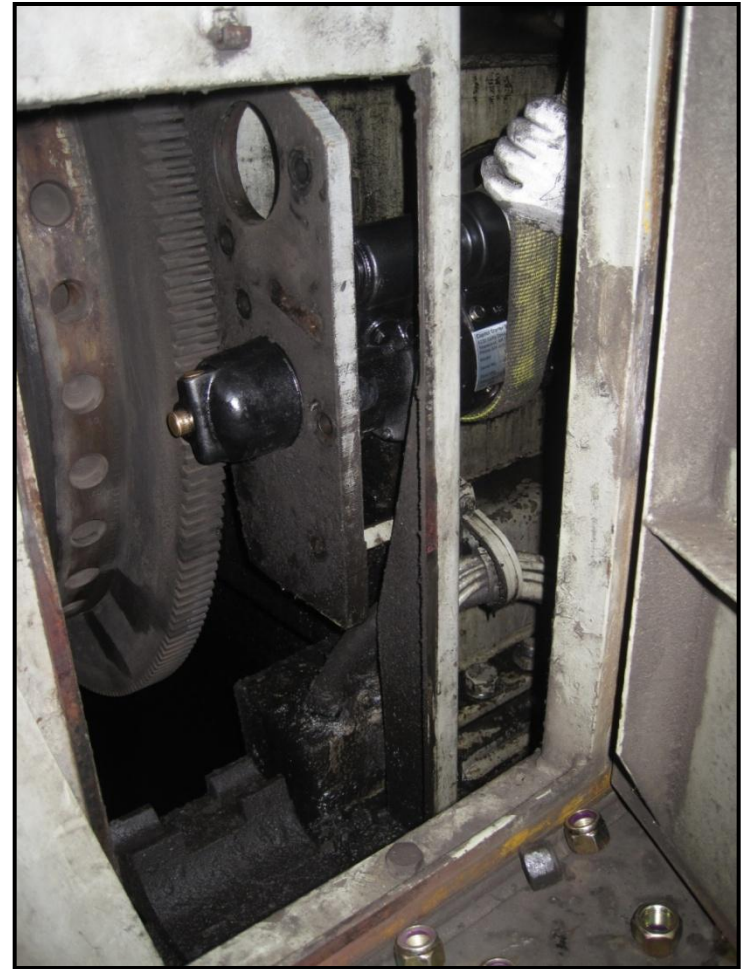


**One End Picked Up Off Floor To Get Lifting
Strap Around Starter and Solenoid**

Current State: Installation



Starter Pushed Into Car Body And Aligned In Starter Bracket



Two People Required To Start, Torque Mounting Bolts Once Inserted Into Bracket

Current State: Core Return



Bad Order Core Tagged And Often Returned In Original Packaging



Bad Orders May Also Be Returned Loose With Two Or More Per Pallet

Alternate Method – With Portable Crane



Weighs Less Than 40 Pounds
Lift Capacity Is 700-900 Pounds
Requires Mount Applied to Handrail Stanchion



Goal

- **Eliminate manual, single person lifts when handling small/heavy parts**
- **Reduce the number of lifts to the minimum required**
- **Eliminate location to location, person to person variability in handling practices**

Remedies

- **Clear communication, visual cues**
 - Warnings on product, packaging, warehouse bins, paperwork, etc.
 - Job briefings/risk assessments
- **Standard work practices**
 - Always involve two people in the repair
 - Always change with an overhead or portable crane
- **Mechanization of process.**
 - Lift assists, other tooling
 - Packaging changes to facilitate handling (room for slings, integrated lifting straps)

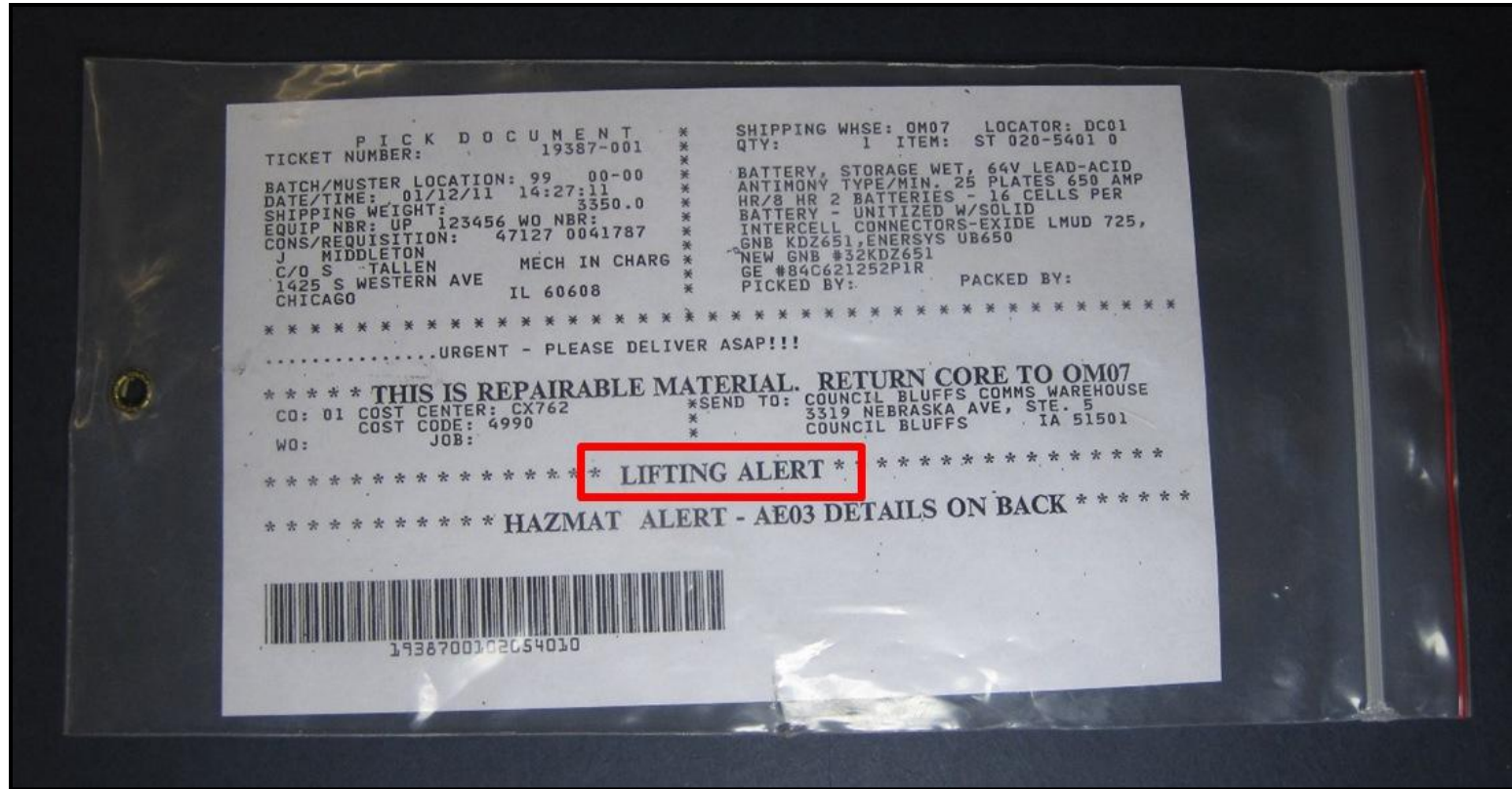
Package Labeling



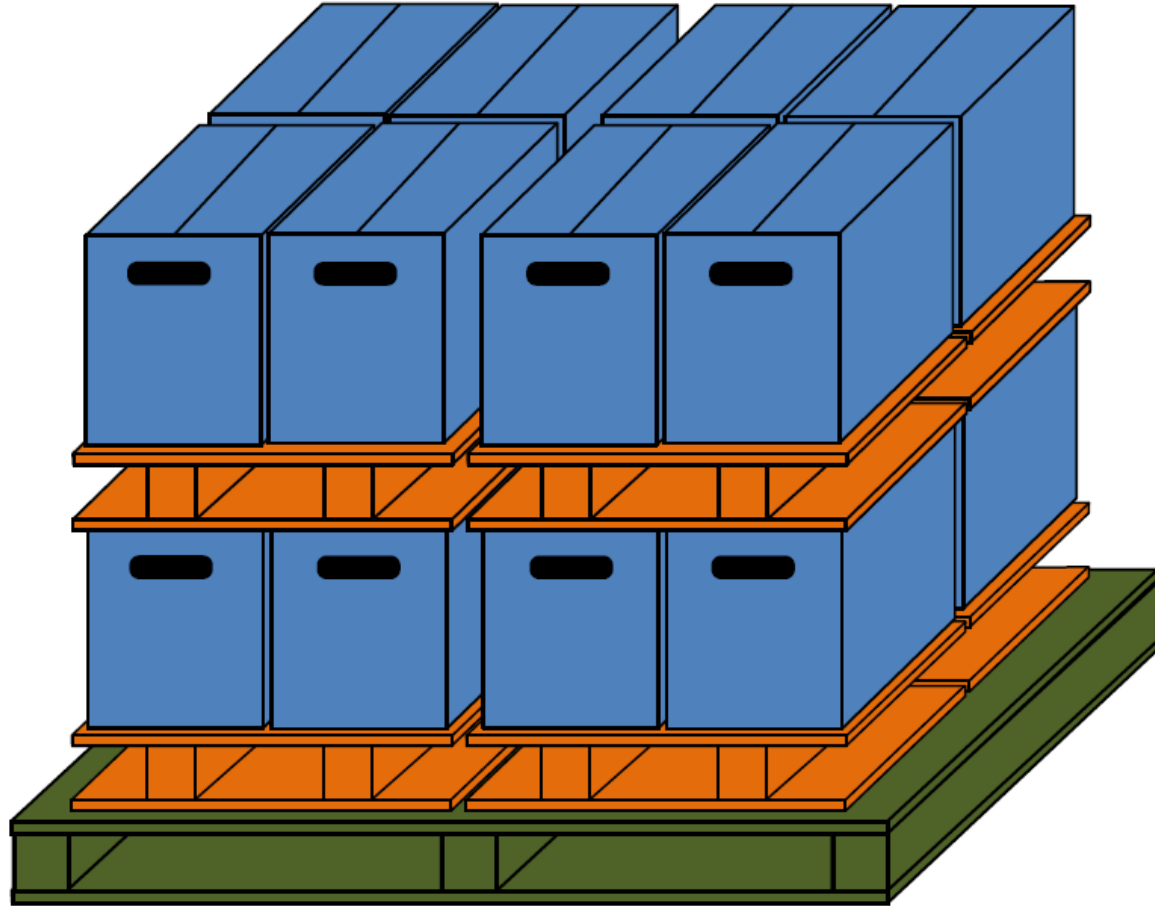
Bin Labeling



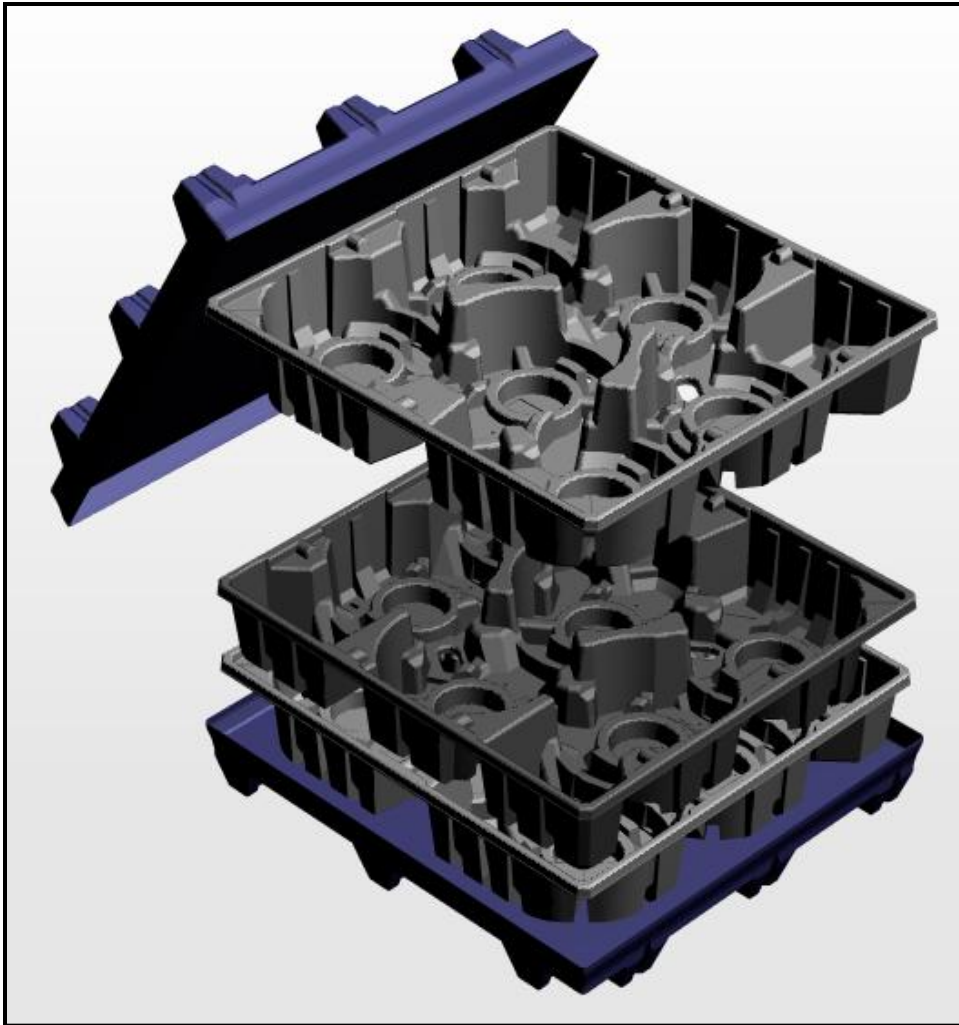
Paperwork (Pick Ticket) Alert



Two-at-a-Time Handling (Quarter Pallets)



Crane Accessible, Returnable Packaging



Lift Cart/Tables



Second Shelf Storage, Slide Onto Forks



Dedicated Tooling



Other Small/Heavy Components

- **Air Brake Components**
- **Water & Fuel Pumps**
- **Governors**
- **Cab Seats/Glass/Toilets/Heaters**
- **Contactors/Controllers/Electrical Panels**
- **Knuckles**
- **Handbrakes**
- **Shocks & Dampers**
- **Slip Rings**
- **Genset Choppers & Starting Batteries**

Additional Considerations

- **Best way to handle small/heavy components is to NOT handle them at all.**
 - Can the component be made lighter or eliminated?
 - Can the work be done less frequently or not at all?
- **Disagreements regarding risk of small/heavy parts are common.**
 - Need standard, quantitative tools for assessing the risk.
- **Training and auditing are keys to success.**

Conclusion

- **Handling starters continues to present opportunities for safety improvements in railroad shops and warehouses.**
- **Any or all of the potential remedies will help contribute to our goal of zero injuries**
- **Injuries are preventable with standardization of best practices, training and proper equipment**
- **Lessons-learned with respect to starter handling will apply to other small/heavy components**