

SERVICE BULLETIN

ELECTRICAL POWER — BATTERY
BATTERY CELL CAN DEVELOP A SHORT CIRCUIT
MARATHON DOCUMENT NUMBER 32364-01

1. Summary

This Service Bulletin changes the "classic" ELDEC BA36-01 (Marathon 32364-001) Micro Maintenance 7-75M³ 120 Nickel-Cadmium Battery into BA36-01 MOD A. It replaces the BA36-01 Battery cells with an improved cell design that greatly reduces the chance of a cell short-circuit failure.

This Service Bulletin modifies the BA36-01 Battery by replacement of the old 75M³ 120 Cell (Marathon P/N 32495-001) with the new 75M³ 120 MOD A Cell (Marathon P/N 32495-002). After the changes from this Service Bulletin are made, the modified Battery will be re-identified by adding "A" to the MOD STATUS block on the nameplate.

2. Planning Information

A. Effectivity

This service bulletin applies to the ELDEC Part Number BA36-01 Battery that is used on the Boeing 717-200 and MD-90 aircraft.

The serial numbers affected are: 9904574 and below.

Batteries that are in production, or inventory with serial numbers above 9904574, will have this modification included at Marathon Power Technologies Company.

B. Concurrent Requirements

None.

C. Reason

(1) Problem

The ELDEC BA36-01 (Marathon 32364-001) Battery has a higher than expected shorted-cell failure rate. The result can be reduced effectiveness of the remaining good cells, excessive heating during a charge/discharge cycle and damage to the remaining good cells through excessive heat and excessive overcharge. The excessive overcharge is due to a higher per-cell voltage on the remaining good cells when one cell has a short-circuit failure.

As of the date of this Service Bulletin, there are 272 BA36-01 Batteries in the field that have 25 confirmed failures because of shorted cells. There is no evidence of a specific load profile that causes more failures than another.

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(2) Cause

The cell short-circuit is caused by higher than expected plate swelling during charge/discharge cycles. As the plates swell, the Inter-Electrode Distance (IED) is reduced, sometimes to the point where one plate touches another plate that results in a localized short with excessive heat.

(3) Solution

The 75M³ 120 cell has been redesigned as follows:

- Decrease plate active material loading to decrease plate swelling during cycling for increased reliability.
- Decrease plate count to increase Inter Electrode Distance (IED) for increased reliability.
- Increase plate surface area to maintain capacity performance requirements.
- Decrease tab length to maintain power performance requirements.

D. Description

The affected assemblies are given below.

AFFECTED ASSEMBLIES		
NEW ASSEMBLY	NOMENCLATURE	MADE FROM ASSEMBLY
BA36-01 MOD A	Battery	BA36-01
75M ³ 120 MOD A	Cell	32495-002

E. Compliance

Marathon recommends compliance at a convenient maintenance interval or when the unit is returned for maintenance of any type.

Compliance with this Service Bulletin is necessary if this problem is found in a Battery.

F. Approval

The repairs and modifications herein comply with all applicable FAR's, and do not change the basis for recertification.

G. Manpower

Approximately 2.0 man-hours are necessary to disassemble and replace the old cells with new cells. Approximately 17 hours are necessary to commission charge the new cells, most of which

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is automated. Periodic checks on cell voltages and water level will be necessary throughout the commission charge procedure.

H. **Weight and Balance**

The weight of the BA36-01 MOD A Battery will be less than one pound greater than that of the "classic" battery.

I. **Electrical Load Data**

Not changed.

J. **Software Accomplishment Summary**

Not applicable.

K. **References**

IPL BA36-01 7-75M³ 120 NI-CD Battery (LRU Parts List).

L. **Other Publications Affected**

CMM 24-34-05.

M. **Interchangeability or Inter-mixability of Parts**

- **Cells:** Old 75M³ 120 Cells (Marathon P/N 32495-001) and new 75M³ 120 MOD A Cells (Marathon P/N 32495-002) shall not be mixed within a BA36-01 Battery. The new cells must be installed as a seven-cell set, and shall not be intermixed with the old cells.
- **Batteries:** BA36-01 Batteries and BA36-01 MOD A Batteries can be connected together to form one 21-cell aircraft battery.

3. **Material Information**

A. **Material — Price and Availability**

BA36-01 Batteries returned to Marathon for warranty repair will be modified to the MOD A configuration at no charge to the customer. BA36-01 Batteries returned that are out of warranty can be upgraded to MOD A configuration at list price. The customer must pay the shipment costs to return the unit(s) to Marathon for this modification. Marathon estimates a turnaround time of 14 days for units returned for this modification.

B. **Industry Support Information**

Not applicable.

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C. Material Necessary for Each Component

Material to be Purchased

New P/N	Key Word	Old P/N	Qty	Unit List Price	Special Instructions/Disposition
32495-002	Cell 75M ³ 120	32495-001	7 cells	\$215.00 each cell	* Return to Marathon

* Marathon does not charge a recycling fee but the customer must pay shipping charges. See Section 5.C., Shipping Address.

D. Material Necessary for Each Spare

Material to be Purchased

New P/N	Key Word	Old P/N	Qty	Unit List Price	Special Instructions/Disposition
32495-002	Cell 75M ³ 120	32495-001	7 cells	\$215.00 each cell	* Return to Marathon

* Marathon does not charge a recycling fee but the customer must pay shipping charges. See Section 5.C., Shipping Address.

E. Re-identified Parts

The new 75M³ 120 MOD A Cells (Marathon P/N 32495-002) do not require re-identification.

The modified BA36-01 Battery will be re-identified by adding "A" to the MOD STATUS block on the nameplate.

F. Tooling — Price and Availability

No special tooling is required for this modification.

4. Accomplishment Instructions

A. Look at the enclosure nameplate of the Battery to make sure the part number is a BA36-01. Also look at the MOD STATUS block to make sure that the block is blank.

B. If the part number and MOD STATUS are correct, remove the BA36-01 Battery from the aircraft in accordance with the Aircraft Maintenance Manual.

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- C. If the capability exists for testing and repairing BA36-01 Batteries, the screening test that follows can be done to find a cell or cells that might be damaged as described in the Summary section of this Service Bulletin:
- (1) Discharge the battery module at 40 A to 7.0 V.
 - (2) Charge each 7-cell battery module at 40 A for 2.5 hours.
 - (3) Decrease charge rate to 8 A. Continue charging for 4 hours, level cell electrolyte using the syringe with the green tip to add de-ionized water.
 - (4) Decrease charge rate to 4 A and continue charging for an additional 16 hours, level cell electrolyte using the syringe with the blue tip to add de-ionized water.
 - (5) After one Hour rest, measure each cell for Open Circuit Voltage (O.C.V.). The **O.C.V. must be 1.32 V or greater**. If the O.C.V. voltage of any cell is less than 1.32 V, the test has failed and all seven (7) cells are recommended for replacement.
 - (6) Discharge the battery module at 37.5 A to 7.0 V.
 - (7) Two (2) hours into the discharge at 37.5 A, the **Discharge Voltage must be 1.10 V or greater**. If the Discharge Voltage of any cell is less than 1.10 V after 2 hours, the test has failed and all seven (7) cells are recommended for replacement.
 - (8) Attach a Resistance-Discharge/ Short-Out Clip (R.D.S.O.C.) across each cell for 16 hours. After the 16 hour discharge period, remove the R.D.S.O.C. clips.
 - (9) Charge each battery module at 7.5 A for 12 minutes. Measure and record the O.C.V. of each cell.
 - (10) Rest Open Circuit (no load or test equipment connected to the Battery) for 24 hours. Measure and record the O.C.V. of each cell. **Each cell O.C.V. must be greater than 1.10 volts**. If the O.C.V. voltage of any cell is less than or equal to 1.10 V, the test has failed and it is recommended that to replace all seven (7) cells.
- D. If the battery is suspected of having a shorted cell or reduced capacity, or if the screening test shows a shorted cell or reduced battery capacity, return the Battery to Marathon for repair and incorporation of this Service Bulletin. See Section 5.C., Shipping Address.
- E. If the capability exists for testing and repairing BA36-01 Batteries, and if the operator chooses to do the modification procedures in the field to the Battery that are given in this Service Bulletin, please use the procedures that follow for proper disassembly, modification, and assembly instructions.

NOTE: If the operator chooses to do the modification procedures in the field to the Battery that are given in this Service Bulletin, any remaining warranty on the Battery is no longer applicable.

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1. Disassembly, Modification, and Assembly

This section gives the procedures that are necessary for an experienced shop mechanic to disassemble, modify, and assemble batteries with no specialized training. Component part locations are shown in Figures 1 or 2, as applicable.

WARNING: REMOVE RINGS, WATCHES, AND OTHER JEWELRY FROM HANDS AND ARMS DURING MAINTENANCE OF THE BATTERY. THE BATTERY GIVES A VERY HIGH CURRENT WHEN IT IS IN A SHORT-CIRCUIT CONDITION THAT CAN CAUSE SEVERE BURNS.

WARNING: WEAR PROTECTIVE CLOTHING AND EYE PROTECTION DURING MAINTENANCE OF THE BATTERY. THE ELECTROLYTE CAN CAUSE BURNS IF IT MAKES CONTACT WITH THE SKIN OR THE EYES.

WARNING: EXERCISE EXTREME CARE WHEN WORKING AROUND THE BATTERY. DO NOT USE METAL BRUSHES OR METAL BRUSH SUPPORTS: ANY OF THESE MAY CAUSE AN ELECTRICAL SHORT WHICH CAN RESULT IN SKIN BURNS AND DAMAGE TO THE BATTERY.

CAUTION: DO NOT DO DISASSEMBLY ON NI-CD BATTERIES IN THE SAME AREA AS LEAD-ACID BATTERIES. DO NOT DO DISASSEMBLY ON NI-CD BATTERIES WITH TOOLS THAT ARE USED FOR LEAD-ACID BATTERIES. THIS COULD DAMAGE THE BATTERY.

CAUTION: DO THE BATTERY DISASSEMBLY PROCEDURE EXACTLY. DO NOT USE EXCESSIVE FORCE TO REMOVE CELLS FROM THE MARKED CAN ASSEMBLY. FAILURE TO FOLLOW THE INSTRUCTIONS IN THIS SECTION OR EXCESSIVE FORCE CAN PERMANENTLY DAMAGE A CELL AND THE BATTERY.

CAUTION: MAKE SURE THE SCREWS THAT FASTEN THE INTER-CELL AND END-CELL CONNECTORS TO THE CELL TERMINALS ARE NOT BINDING AS THEY ARE REMOVED. SCREWS THAT ARE FORCIBLY REMOVED CAN DAMAGE THE CELL.

2. Disassembly Procedure (Figures 1 and 2)

This procedure gives instructions to partially disassemble the battery and remove the cells. Only disassemble the battery to the extent necessary to replace the cells. Special tools are required for disassembly (ref. SPECIAL TOOLS, FIXTURES, AND EQUIPMENT, CMM 24-34-05, Marathon Document Number CMM32364).

- (a) Remove the marked cover assembly (70) from the battery. If necessary, remove the tape that holds the vent dust cover (80) on the cover vent line to remove the vent dust cover (80).
- (b) Before disassembling the battery, make sure that all cells are completely discharged as follows:

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- (1) Connect a digital voltmeter across the terminals of each cell (60) to monitor cell voltage. Start the measurement with cell number one (electrically, the most positive cell in the battery). End the measurement with cell number seven (electrically the most negative cell in the battery).

NOTE: For maintenance instructions, the cell (60) number sequence starts with the cell that is connected to the positive terminal of the receptacle assembly (170). This cell is called number one. From cell number one, in a counter-clockwise sequence, the cell that is connected to it is number two. The cell that is connected to the negative terminal of the receptacle assembly (170) is number seven.

- (2) Use a battery charger/discharger that is set to discharge and discharge the battery at 40 A to 1.0 volt per cell (ref. TESTING AND FAULT ISOLATION, CMM 24-34-05, Marathon Document Number CMM32364).
- (3) Set the battery charger/discharger to discharge the battery at 10 A to approximately 0.5 volts per cell. Continue to discharge the cells.
- (4) Attach a resistance-discharge/short-out clip (RDSOC) to each cell as it reaches 0.5 volts. Continue to monitor cell voltage until each cell goes to 0.0 volts.
- (5) After the battery has been discharged, remove the RDSOC.
- (c) If the tops of the cells have a white powder on them, clean the battery (ref. CLEANING, CMM 24-34-05, Marathon Document Number CMM32364). If the tops of the cells have electrolyte on them, clean the battery (ref. CLEANING).
- (d) Remove the screws (90), washers (100), and washers (110) to remove the inter-cell connectors (40 and 50) and the end-cell connectors (120 and 130).
- (e) Use the vent cap wrench to loosen, but don't remove, the vent caps (65) of the cells to be removed.
- (f) Use the cell puller to remove the cell (60). Always tighten the cell puller to the cells and use an even, straight-up pull to remove the cells from the battery. If the cells are difficult to remove, use a syringe to put about 5 cc of de-ionized water along side each cell as a lubricant.
- (g) Pull and remove cells one and two from the battery, which gives access to the temperature sensor assembly (190) plate. Move the plate away from cell three and continue to remove the cells.
- (h) Use the vent cap wrench to tighten the vent cap (65) of each cell that has been removed. Send the cells to Marathon to be recycled (ref. paragraph 5.C. for shipping instructions).
- (i) Remove and retain (for assembly) the loose shims (30) from the battery.

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3. Modification Procedure

Replace the seven old 75M³ 120 Cells (Marathon P/N 32495-001) with the seven new 75M³ 120 MOD A Cells (Marathon P/N 32495-002). Use the Assembly Procedure that follows to install the new cells and to re-assemble the battery.

4. Assembly Procedure (Figures 1 and 2)

This procedure gives instructions to install the new cells and to assemble the battery. Special tools are required for assembly (ref. SPECIAL TOOLS, FIXTURES, AND EQUIPMENT, CMM 24-34-05, Marathon Document Number CMM32364). Component part locations are shown in Figure 1 or 2, as applicable.

WARNING: MAKE SURE THAT ALL ELECTRICAL CONNECTIONS AND FASTENERS ARE TIGHT AND ARE AT THE CORRECT TORQUE VALUE (REF. FITS AND CLEARANCES, CMM 24-34-05). ONE LOOSE CONNECTION CAN PERMANENTLY DAMAGE A BATTERY AND CAN CAUSE AN EXPLOSION.

CAUTION: DO THE BATTERY ASSEMBLY PROCEDURE EXACTLY. DO NOT USE EXCESSIVE FORCE AND DO NOT USE A HAMMER TO INSTALL CELLS INTO THE MARKED CAN ASSEMBLY. FAILURE TO FOLLOW THE INSTRUCTIONS IN THIS SECTION OR EXCESSIVE FORCE CAN PERMANENTLY DAMAGE A CELL AND THE BATTERY.

CAUTION: MAKE SURE THE SCREWS THAT FASTEN THE INTER-CELL AND END-CELL CONNECTORS TO THE CELL TERMINALS ARE NOT DAMAGED, CROSS-THREADED, OR BINDING. ALWAYS USE THE CORRECT PARTS AND THE CORRECT TORQUE VALUE DURING INSTALLATION OF NEW CELLS. THE WRONG PARTS OR INCORRECT TORQUE VALUES CAN CAUSE DAMAGE TO THE CELL.

- (a) Prior to cell (60) installation, lightly polish the cell terminal surfaces with a Scotchbrite pad and wipe clean with a cloth.

CAUTION: THE OLD 75M³ 120 CELLS (MARATHON P/N 32495-001) AND THE NEW 75M³ 120 MOD A CELLS (MARATHON P/N 32495-002) SHALL NOT BE MIXED WITHIN A BA36-01 BATTERY. THE NEW CELLS MUST BE INSTALLED AS A SEVEN-CELL SET, AND SHALL NOT BE MIXED WITH THE OLD CELLS.

CAUTION: MAKE SURE THE POLARITY (NEGATIVE TO POSITIVE) OF EACH CELL IS CORRECT FOR ITS POSITION IN THE BATTERY AS IT IS INSERTED INTO THE MARKED CAN ASSEMBLY. IF THE CELLS ARE CONNECTED IN REVERSE POLARITY (NEGATIVE TO NEGATIVE OR POSITIVE TO POSITIVE), IT COULD DAMAGE THE CELLS.

- (b) Install the new cells (60) into the marked can assembly (10) as follows:

CAUTION: DO NOT PINCH THE TWO WIRES THAT COME FROM THE TEMPERATURE SENSOR ASSEMBLY BETWEEN THE CELLS,

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THE RECEPTACLE ASSEMBLY, AND THE MARKED CAN ASSEMBLY. A PINCHED WIRE COULD CAUSE A SHORT CIRCUIT THAT WOULD DAMAGE THE BATTERY.

- (1) Start the cell (60) installation with cell number four. Install the plate of temperature sensor assembly (190) between cell (60) number two and number three. Position the wires from the temperature sensor assembly (190) as shown in Figure 2.

For easiest insertion, insert cell number one and number six last. If necessary, use a light mineral oil on a clean cloth and wipe each cell body to lubricate prior to insertion.

NOTE: The cell (60) number sequence starts with the cell that is connected to the positive terminal of the receptacle assembly (170). This cell is called number one. From cell number one, in a counter-clockwise sequence, the cell that is connected to it is number two. The cell that is connected to the negative terminal of the receptacle assembly (170) is number seven.


- (2) Install the shims (30) as you insert each cell (60) into the marked can assembly (10). Position the shims (30) for each cell (60) as shown in Figure 2.
 - (3) Insert the shims (30) and the cells (60) in a counter-clockwise sequence, except for the number two and number six cells.
 - (4) Install the shims (30) as you insert the number two and number six cell (60) into the marked can assembly (10).
- (c) Install the inter-cell connectors (40 and 50) and the end-cell connectors (120 and 130) with washers (110), washers (100), and screws (90). The screws (90) must only be finger-tight at this step in the procedure.
 - (d) Tighten the screws (90) in the sequence that follows:
 - (1) Always tighten the screws (90) that fasten the inter-cell connectors (40 and 50) to the cell (60) terminals in a sequence that starts with cell number one and ends with cell number seven. Tighten every screw (90) on every inter-cell connector (40 and 50) to a torque value of 100 – 125 lb-in.
 - (2) Tighten the screws (90) that fasten the end-cell connectors (120 and 130) to the negative and positive terminals of the receptacle assembly (170) to a torque value of 100 – 125 lb-in.
 - (e) Test and charge the assembled battery (ref. TESTING AND FAULT ISOLATION, CMM 24-34-05, Marathon Document Number CMM32364).
 - (f) Install the marked cover assembly (70) when the battery is charged and ready to be put into service on the aircraft or into storage.

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(g) Use black ink to put an "A" in the MOD STATUS block on the Battery nameplate.

5. Further Information

A. Warranty

 The returned batteries will be evaluated and handled in accordance with the Warranty provisions given in the Product Support Agreement. If the battery is under warranty and the cells need to be replaced, Marathon will replace the cells with the Marathon 75M³ 120 MOD A cells at no cost. Upgrades of the cells at customer request will be at the Unit List Price given in paragraph 3.C./D.(1).

Warranty of the Battery is not affected by incorporation of this modification by Marathon. Once modifications have been completed and the battery is returned, the unexpired portion of the warranty period will remain valid.

If the operator chooses to do the modification procedures in the field to the Battery that are given in this Service Bulletin, any remaining warranty on the Battery is no longer applicable.

B. Repair Status Information

For repair status information please contact:

Primary Contact:

CUSTOMER

Boeing and Airlines/Operators

<u>Marathon Contact</u>	<u>Telephone</u>	<u>Facsimile</u>
Tim Asyn	1-254-741-5476	1-254-776-1309
Lisa McKethan	1-254-741-5429	1-254-776-6558

Alternate Contact:

CUSTOMER

Boeing and Airlines/Operators

<u>ELDEC Contact</u>	<u>Telephone</u>	<u>Facsimile</u>
Bruce Thompson	1-425-743-8535	1-425-743-8562
John Hendrickson	1-425-743-8455	1-425-743-8562

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C. Shipping Address

Customers shall return the BA36-01 Battery or individual cells for recycling to the address below, with a shipper of their choice:

Marathon Power Technologies Company
8301 Imperial drive
Waco, TX. 76712

D. Technical Information

For technical questions please contact the Product Support Representative at:

ELDEC Corporation
PO BOX 97027
LYNNWOOD, WA 98046-9727
U.S.A.
Telephone: 1-425-743-8168
Facsimile: 1-425-743-8234
Internet: <http://www.eldec.com>
Email: pubs@eldec.com

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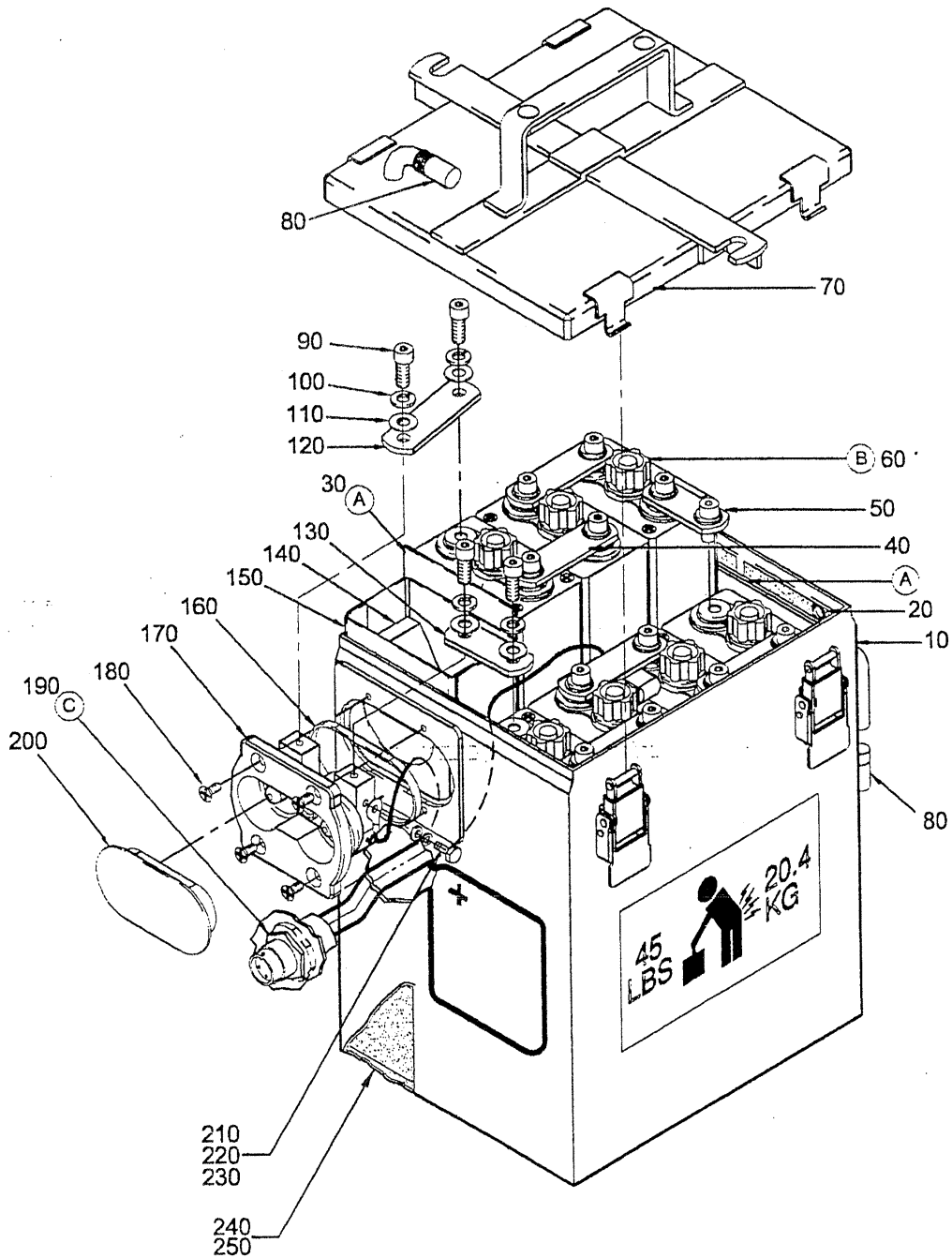


Figure 1
BA36-01 Battery Disassembly/Assembly

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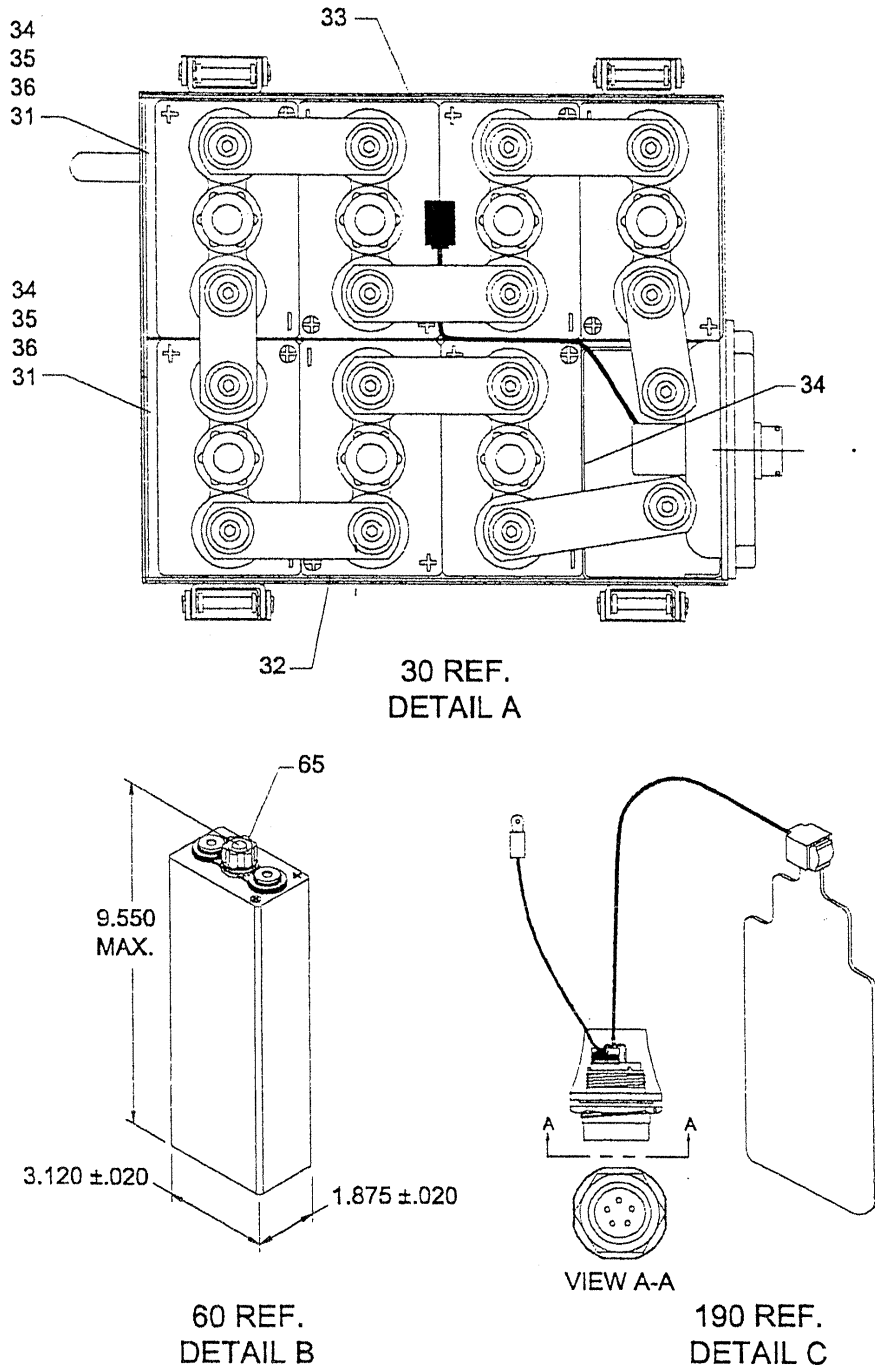


Figure 2
Detail View

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