

Subject 583

## **SUMMARY OF TOPICS**

*The following changes in requirements are being proposed:*

- 42. Additional definitions for UL 583*
- 43. Deletion of 7.2 in UL 583*
- 44. Revision to the wiring requirements in UL 583*
- 45. Clarification of 9.1 and 9.4 of UL 583*
- 46. Revisions to the requirements for battery compartment enclosures in UL 583*
- 47. Revisions to the requirements for batteries in UL 583*
- 48. Revisions to requirements for battery leads in UL 583*
- 49. Revisions to the requirements for battery connectors in UL 583*
- 50. Addition of requirements for external charging cables in UL 583*
- 51. Deletion of the requirements for horns in UL 583*
- 52. Revision of limited power circuits in UL 583*
- 53. Revision to 19.2 of UL 583*
- 54. Revision to 19.3 of UL 583*
- 55. Revisions to update the dielectric voltage withstand test requirements to reflect current practices in UL 583*
- 56. Revision to allow low voltage circuitry to be disconnected in the dielectric voltage withstand test requirements in UL 583*
- 57. Revisions to the burnout test requirements in UL 583*
- 58. Revisions to the requirements for electric controls in UL 583*

## **ADDITIONAL PROPOSALS FOR UL 583**

For your convenience in review, proposed additions to existing requirements are shown underlined and proposed deletions are shown ~~lined-out~~.

## 42. Additional definitions for UL 583

### RATIONALE

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

The following definitions were proposed because the words are used within the standard, yet there are no definitions.

### PROPOSAL

2.4.2 BATTERY COMPARTMENT – The aperture on the truck that houses the battery.

2.4.3 BATTERY ENCLOSURE – A container or tray that houses the individual cells.

2.4.4 CONTROL CIRCUIT – Electrical circuitry that controls truck movement.

2.4.5 ELECTRICAL ENCLOSURE – An aperture on a truck that houses uninsulated live electrical connections.

2.4.6 LIVE PART – An uninsulated conductor or uninsulated conductive part intended to be energized in normal use.

2.4.7 POWER CIRCUIT – A circuit that supplies a motor control circuit that is not provided with overcurrent protection. A circuit is not considered a power circuit if it supplies a circuit with overcurrent protection.

2.4.8 RISK OF FIRE – Any device that has a surface temperature greater than 175°C (347°C) or emits sparks outside of its enclosure.

2.4.9 RISK OF SHOCK – A circuit involving a potential greater than 42.4 V peak (30 Vrms) or 60 Vdc.

## 43. Deletion of 7.2 in UL 583

### RATIONALE

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

The current 7.2 reflects old technology and does not apply to current state of the art trucks. It is proposed to be deleted.

### PROPOSAL

~~7.2 A reversing controller shall be interlocked, either mechanically, electrically, or both, to prevent reversal of the motor when power is applied to the motor being reversed.~~

~~Exception: A controller tested for the reversing arrangement provided is considered to meet the intent of the requirement.~~

#### 44. Revision to the wiring requirements in UL 583

##### RATIONALE

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

The current text contained in paragraphs 8.5 – 8.8, 8.10 and 8.11 is design restrictive.

##### PROPOSAL

~~8.5 Wiring shall be protected against mechanical damage by: All conductors shall be either effectively insulated and where necessary protected against mechanical damage or shall be so placed and safeguarded as to avoid damage when the truck is in its normal operating condition. Wiring that flexes during normal operation of the truck functions shall be relieved of mechanical strain at their electrical termination. Protection for insulated leads inside the operator's compartment is not required if leads are not subject to damage by the operator.~~

- ~~a) Enclosing it in the body of the truck;~~
- ~~b) Enclosing it in metal raceway, such as armored cable, rigid metal conduit, or electrical metallic tubing; or~~
- ~~c) Protecting it with metal, phenolic composition, or other thermosetting material having equivalent mechanical strength and resistance to impact. Electrical wiring mounted on booms, lifts, and similar parts shall be installed so as to reduce the likelihood of mechanical damage and kinking.~~

~~8.6 Protection for insulated leads located within the operator's compartment is not required if: All of the splices and connections shall be mechanically secure and shall provide electrical contact without stress on connections and terminals. A splice shall be provided with insulation equivalent to that on the wires involved.~~

- ~~a) The walls and floor of this compartment are of metal, phenolic composition, or other thermosetting material having equivalent mechanical strength and resistance to impact; and~~
- ~~b) The leads are not likely to be subjected to mechanical damage by the operator.~~

~~8.7 A conductor connected to a moving or movable part that cannot be protected as indicated in 8.6 shall be designed for the intended use and shall comply with the test requirements in this standard. Consideration shall be given to the resistance of the conductor to damage resulting from flexing, abrasion, or impact. Flexible metallic conduit is to be used only for flexible connections subject to small and infrequent movements. Copper conductors external to enclosures (excluding short connections between electric or electronic components and wires that are an integral part of proprietary components) shall be flexible and be of suitable mechanical strength for the application.~~

~~8.8 Wiring connections to a continuously moving part, or a part for which the degree of movement is appreciable shall be Type S, SJ, SJO, SJT, SJTO, SO, ST, or STO flexible cord.~~

~~*Exception: Individual conductors having flexible stranding, such as Type FFH-2, TFF, or SFF-2, enclosed in flexible tubing are permitted to be used in place of flexible cord. The tubing is permitted to be omitted from exposed moving conductors that are readily visible to the operator and are therefore subject to replacement when damaged.*~~

~~8.9 All of the splices and connections shall be mechanically secure and shall provide electrical contact without stress on connections and terminals. A splice shall be provided with insulation equivalent to that on the wires involved.~~

~~8.10 A hole by means of which insulated conductors pass through a sheet-metal wall shall be provided with a smooth, rounded bushing, or shall have smooth, rounded surfaces upon which the insulated conductors may bear.~~

~~8.11 Wireways shall be smooth and free from sharp edges, burrs, fins, or moving parts that may damage wiring.~~

#### **45. Clarification of 9.1 and 9.4 of UL 583**

##### **RATIONALE**

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

The current text is not clear.

##### **PROPOSAL**

##### **9 Overcurrent Protection**

~~9.1 Overcurrent protection of the size necessary to reduce the likelihood of overheating of the smallest conductor in the circuit shall be provided in a light, warning signal, or other auxiliary circuit. Power, control and auxiliary circuits shall have overcurrent protection that is sized to prevent overheating of the smallest size conductor.~~

~~9.4 An overcurrent device provided in a control circuit in accordance with 9.1 or an overcurrent device in a power circuit provided in accordance with 9.2 shall be located as close as practicable to the battery terminals. Such a device shall be identified as to the maximum rating of the overcurrent protection to be employed, and it is recommended that it also be identified to indicate the circuit in which it is employed. Overcurrent devices in the control and power circuit shall be as close as practicable to the power supply or battery. Non-resettable overcurrent devices shall be identified as to the replacement rating of the device. Required marking shall be provided with the truck separate from the overcurrent device.~~

#### **46. Revisions to the requirements for battery compartment enclosures in UL 583**

##### **RATIONALE**

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

The clearance above the battery needs to be specified.

##### **PROPOSAL**

10.4 A metal cover for a compartment or separate enclosure that houses a battery shall have:

- a) Such strength and rigidity that, in conjunction with an air spacing of at least 1.2 in (30 mm) provided between it and the battery terminals, the battery terminals are not short-circuited when a 250-pound (1110-N) force is applied to any 1-square-foot (930-cm<sup>2</sup>) area of the cover; or

b) Insulation secured to the inner surface to reduce the likelihood of short-circuiting of the battery terminals. The air space may be reduced to a minimum of 0.394 inches (10 mm) provided covers or live parts of the battery are insulated in such a manner that disintegration and/or displacement of the insulation is prevented.

#### 47. Revisions to the requirements for batteries in UL 583

##### RATIONALE

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

For 11.1, the current text is design restrictive. Battery construction should be defined by another standard. For 11.3, the current text is design restrictive and limited in scope.

##### PROPOSAL

#### 11 Battery

11.1 ~~Cells employing metal containers, such as alkaline batteries, shall be insulated from one another and from a metal tray or metal battery compartment. Insulation of wood or other material shall be: All trucks are to be provided with an insulated battery.~~

- a) ~~Treated or painted to reduce deterioration by the battery electrolyte, and~~
- b) ~~Constructed to reduce the risk of damage to the insulation in the normal operation and maintenance of the truck.~~

11.3 ~~Battery terminals that are threaded shall be provided with lock washers or equivalent means to reduce the risk of a loose wiring nut terminal connection causing an arc an ignition of gases from the battery that may be present. A flat washer shall be used between a lock washer and any surface that is made of lead. For battery terminals, measures shall be taken to reduce the risk of a connection coming loose causing arcing or overheating.~~

#### 48. Revisions to requirements for battery leads in UL 583

##### RATIONALE

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

The proposed revisions are intended to clarify the requirements and to include metric sized cables.

##### PROPOSAL

12.1 A battery lead shall be of a size and ampacity acceptable for the application. It shall be

- a) Neoprene-insulated or insulated with an equivalent material,
- b) Resistant to acids or alkalies, and
- c) Able to withstand flexing, handling, and impact at temperatures between 54°C (130°F) and minus 29°C (minus 20°F). ~~The average insulation thickness shall not be less than 0.060 inch (1.52 mm) for a No. 8 — 2 AWG (8.4 — 33.6 mm<sup>2</sup>) wire and shall not be less than 0.080 inch (2.03 mm) for a No. 1 — 4/0 AWG (42.4 — 107.2 mm<sup>2</sup>) wire.~~

d) The average insulation thickness shall not be less than 0.060 inch (1.52 mm) for a No. 8 – 2 AWG (8.4 – 33.6 mm<sup>2</sup>) wire and shall not be less than 0.080 inch (2.03 mm) for a No. 1 – 4/0 AWG (42.4 – 107.2 mm<sup>2</sup>) wire. The average insulation thickness for metric sized cables shall not be less than 1.5 mm for a wire less than or equal to 35 mm<sup>2</sup> and shall not be less than 2.0 mm for a wire greater than 35 mm<sup>2</sup>.

#### **49. Revisions to the requirements for battery connectors in UL 583**

##### **RATIONALE**

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

In the current standard, there is no mention of the charger connector or intermateability. The proposed paragraph 13.6 addresses this issue.

##### **PROPOSAL**

13.6 The connector shall be designed so that opposite polarities can not be coupled together. Different operating voltages shall be indicated either by color or by a coding device.

#### **50. Addition of requirements for external charging cables in UL 583**

##### **RATIONALE**

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

There is no mention of the situation when external charging cables are connected to a truck.

##### **PROPOSAL**

13.7 When external-charging supply cables are connected to the truck or to the truck battery, it shall not be possible to energize the truck movement circuits. This does not apply to trucks designed for permanent charging during operation.

#### **51. Deletion of the requirements for horns in UL 583**

##### **RATIONALE**

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

The requirement currently reflects old technology and can be removed.

##### **PROPOSAL**

##### **14.2 Horns**

~~14.2.1 The coil and other electrical parts of an electrical horn or warning device shall be enclosed. See 32.3.~~

## 52. Revision of limited power circuits in UL 583

### RATIONALE

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

The UL 2267 text is clearer and more defined. It is proposed to remove all paragraphs in 16.1 and 16.2 and replace them with text from Section 32 of UL 2267.

### PROPOSAL

#### ~~16 Power Circuits~~

##### ~~16.1 Limited-power circuits~~

~~16.1.1 A limited-power circuit is considered to originate at any two points where the power that can be delivered continuously to an adjustable external resistance load connected between the points, with all other loads removed, does not exceed 15 watts.~~

~~16.1.2 If a resistor is employed in circuitry on the supply side of a limited-power circuit as mentioned in 16.1.1 to limit the power to 15 watts or less, no condition of loading to the maximum power or less, or short-circuiting the points of origin of the limited-power circuit shall cause the resistor to change value to the extent that the 15-watt limit will be exceeded. The short-circuiting or open-circuiting, singly, of any rectifier, transistor, or electrolytic capacitor in the circuitry on the supply side of the limited-power circuit shall not cause the 15-watt limit to be exceeded.~~

~~16.1.3 Short-circuiting of the points of origin of a limited-power circuit as mentioned in 16.1.2, or overloading a circuit to maximum power is to be continued until no further change is likely to take place, but not for longer than 7 hours. Cotton packed loosely around the circuit elements on the supply side and on the limited-energy circuit side shall not ignite. If the circuit elements are in an assembly that is provided with an enclosure, the cotton is to be placed around the outside of the enclosure on the supply side and on the limited-energy circuit side. Normally the test is to be conducted on a test bench but may be conducted in the truck.~~

~~16.1.4 If overloading a circuit as mentioned in 16.1.3 causes a circuit element to open, one additional overload test is to be conducted such that the overload will cause a circuit element — not necessarily the same circuit element as opened in the test of 16.1.3 — to open in not more than 8 hours and not less than 6 hours. The overload is to be created by introducing impedance into the circuit. After 6 hours of operation with the overload, the impedance is to be reduced to zero to cause the circuit element to open. Cotton placed as noted in 16.1.3 shall not ignite.~~

~~16.1.5 The term maximum power in 16.1.2 and 16.1.3 is the maximum power that can be delivered into an external variable resistor by the circuit on the supply side of the two points being investigated.~~

## 16.2 Limited-energy circuits

16.2.1 A limited-energy circuit is considered to originate on the load side of an overcurrent-protective device that limits the energy to a nonhazardous level as determined by the following tests:

- a) Loosely packed cotton is to be placed over the circuit elements during the tests described in (c) and (d). When the circuit elements are in an assembly that is provided with an individual enclosure, the cotton is to be placed around the outside of the enclosure.
- b) An external variable resistor connected between the points of origin of the limited-energy circuit is to be adjusted so that 15 watts is delivered to the resistor. The overcurrent-protective device shall open within 7 hours under these conditions.
- c) An external variable resistor is to be used to create an overload or short circuit between any two points of the circuitry of the limited-energy circuit causing an overload of 135 percent, 200 percent, and 600 percent of the rating of the overcurrent-protective device to flow through points that represent the smallest electrical spacings or possible source of malfunction. The test is to be conducted three times at each value of load until the overcurrent device opens, until stable conditions result, or not longer than 2 hours.
- d) The circuit is to be short-circuited between the same sets of two points chosen as described in (c).

16.2.2 With reference to 16.2.1, the energy is not considered to be limited to a nonhazardous level if cotton ignites or if the assembly does not withstand for 1 minute without breakdown the application of a 60-hertz essentially sinusoidal potential of:

- a) 1,000 volts plus twice the rated voltage if the truck is rated 60 volts or more, or
- b) If the truck is rated less than 60 volts, 500 volts applied between the current-carrying parts and parts normally connected to the frame of the truck with all current-carrying parts normally connected to the frame disconnected.

16.2.3 If a fuse of a type intended to be replaced in the field is used as an overcurrent-protective device, the ampere rating of the fuse shall be marked adjacent to the fuseholder and the test is to be conducted with a fuse rated as specified in the marking.

## 16A Limited Power Circuits

16A.1 A limited power source shall comply with one of the following:

- a) The output is inherently limited in compliance with Table 16A.1;
- b) An impedance limited output in compliance with Table 16A.1. If a positive temperature coefficient device is used, it shall comply with Manufacturing Deviation and Drift, Clause 15, Endurance, Clause 17, and Requirements for Controls Using Thermistors, Annex J, in the Standard for Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements, UL 60730-1A;
- c) A non-arcing over-current protective device is used and the output is limited in compliance with Table 16A.2;

d) A regulating network limits the output in compliance with Table 16A.1 both under normal operating conditions and after any single fault conditions in the regulating network (open circuit or short circuit); or

e) A regulating network limits the output in compliance with Table 16A.1 under normal operating conditions and a non-arcing over-current protective device limits the output in compliance with Table 16A.2 after any single fault condition in the regulating network (open and circuit or short circuit).

16A.2 The load referenced in footnotes 2 and 3 of Tables 16A.1 and 16A.2 is to be adjusted to develop maximum current and power transfer respectively. Single faults in a regulating network are applied under these maximum current and power conditions.

**Table 16A.1**  
**Limits for inherently limited power sources**

<b>Output voltage dc<sup>a</sup></b> <b>(Voc)</b> <b>Vdc</b>	<b>Output current<sup>b</sup></b> <b>(Isc)</b> <b>A</b>	<b>Apparent power<sup>c</sup></b> <b>(S)</b> <b>VA</b>
$\leq 20$	$\leq 8.0$	$\leq 5 \times V_{oc}$
$20 < V_{oc} \leq 30$	$\leq 8.0$	$\leq 100$
$30 < V_{oc} \leq 60$	$\leq 150 / V_{oc}$	$\leq 100$

<sup>a</sup> Voc: Output voltage measured with all load circuits disconnected. Voltages are for ripple free dc.  
<sup>b</sup> Isc: Maximum output current with any non-capacitive load, including short circuit, measured 60 s after application of load.  
<sup>c</sup> S (VA): Maximum output VA with any non-capacitive load measured 60 s after application of load.

**Table 16A.2**  
**Limits for power sources not inherently limited (overcurrent protection required)**

<b>Output voltage<sup>a</sup></b> <b>(Voc)</b> <b>Vdc</b>	<b>Output current<sup>b</sup></b> <b>(Isc)</b> <b>A</b>	<b>Apparent power<sup>c</sup></b> <b>(S)</b> <b>VA</b>	<b>Current rating of overcurrent protection<sup>d</sup></b> <b>A</b>
$\leq 20$			$\leq 5.0$
$20 < V_{oc} \leq 30$	$\leq 1000 / V_{oc}$	$\leq 250$	$\leq 100 / V_{oc}$
$30 < V_{oc} \leq 60$			$\leq 100 / V_{oc}$

<sup>a</sup> Voc: Output voltage measured with all load circuits disconnected. Voltages are for ripple free dc.  
<sup>b</sup> Isc: Maximum output current with any non-capacitive load, including short circuit, measured 60 s after application of load. Current limiting impedances in the equipment remain in the circuit during measurement, but overcurrent protection means are bypassed.  
<sup>c</sup> S (VA): Maximum output VA with any non-capacitive load measured 60 s after application of load. Current limiting impedances in the equipment remain in the circuit during measurement, but overcurrent protection means are bypassed.  
**NOTE – The reason for making measurements with overcurrent protection means bypassed is to determine the amount of energy that is available to cause possible overheating during the operating time of the overcurrent protection means. If the overcurrent protection means is a discreet arcing device, further evaluation with respect to its isolation from potentially flammable gas vapors is to be made.**  
<sup>d</sup> The current ratings of the overcurrent protection means are based on fuses and circuit breakers that break the circuit within 120 s with a current equal to 210% of the current rating specified in the table.

**53. Revision to 19.2 of UL 583****RATIONALE**

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

The words “reversals full height lifting” are not clear. Past testing practice of UL was that the lift height was not to exceed the rated lift height for the load condition.

**PROPOSAL**

19.2 The truck is to be loaded to 110 percent of its maximum rated load capacity. The center of the load for a lift truck is to be located so as to yield rated load movement about the load axle. The truck is to be quickly and rapidly operated through 25 reversals of direction of travel, reversals of ~~full height lifting~~ lift height (not to exceed the rated lift height for the load conditions), and other operations that are performed by the truck such as flashing of lamps, blowing of horn, and other normal operating sequences.

**54. Revision to 19.3 of UL 583****RATIONALE**

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

This paragraph is being proposed to clarify the requirement.

**PROPOSAL**

19.3 The test course for a fork-lift and a platform-lift truck is to be 40 feet (12.2 m) long. At the end of this course, the load is to be raised to ~~full height~~ the height designated by 19.2 and lowered to the hauling position. The truck with the load is then to be returned to the starting point by reversing the direction of travel.

**55. Revisions to update the dielectric voltage withstand test requirements to reflect current practices in UL 583****RATIONALE**

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

Current practice of UL testing allows the capacitance path for EMI/RMI signals to be defeated.

**PROPOSAL**

22.4 Componentry affixed to truck frame for EMI/RMI signals may be disconnected prior to test.

**56. Revision to allow low voltage circuitry to be disconnected in the dielectric voltage withstand test requirements in UL 583****RATIONALE**

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

The disconnection of low voltage circuitry prior to dielectric testing to prevent damage to components should be allowed.

## PROPOSAL

22.5 Semiconductors or similar electronic components liable to be damaged by application of the test voltage may be bypassed or disconnected.

### 57. Revisions to the burnout test requirements in UL 583

## RATIONALE

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

The proposal documents current practices by UL.

## PROPOSAL

24.7 For a Type E truck only, the burnout test described in 24.1 – 24.6 need not be conducted if a disconnect switch or battery connector is provided that is mechanical and positive in action and operable by the driver from the normal driving position.

### 58. Revisions to the requirements for electric controls in UL 583

## RATIONALE

Proposal submitted by: Steve McDermitt, Crown Equipment Corp.

The current requirement is design restrictive.

## PROPOSAL

32.3 A nonmetallic material used to provide an enclosure in accordance with ~~14.4 or~~ 32.1 and 32.2 shall be phenolic, an equivalent thermosetting material, or an equivalent thermoplastic material. Such a material shall be considered with respect to the following properties:

- a) Mechanical strength,
- b) Resistance to impact,
- c) Moisture-absorptive properties,
- d) Combustibility, and
- e) Resistance to distortion at temperatures to which the material is subjected as determined during the tests described in Temperature, Section 20.

## DISCUSSION ITEMS FOR UL 583

### **7. Revision to Section 21, Brakes – Submitted by: Steve McDermitt, Crown Equipment Corp.**

This entire Section needs to be completely rethought. We need to start by stating more clear objectives for the test.

In a true sense this is an abnormal type of test. The current truck test conditions do not reflect a typical application of a fork truck – loaded with maximum rated load, no forks empty condition – brought to a stop every 50 feet – no lifting or lowering involved.

There continues to be many problems with the interpretation of this section. It has not been revised since the use of plugging/regenerative braking and there are various interpretations for how the tests should be conducted. Many of these interpretations do not reflect the true operation and therefore should be reviewed and updated.

In previous tests, 1000+ cycles were run for more than 6 hours, discharging several batteries until the temperatures were stabilized.

Two proposals

1. Eliminate the test and measure the brake temperature during the temperature test phase of the testing. This represents an actual duty cycle and would reflect a true way as to how trucks are used. Or
2. Run the test for a fixed number of cycles (e.g. 50 stops) using a combination of plugging, regenerative and mechanical brakes to stop the truck.

Editorial correction for 21.1 – “175°F” should be “175°C.”

### **8. Revision to the dielectric voltage withstand test – Submitted by: Steve McDermitt, Crown Equipment Corp.**

For 22.1, no allowable leakage specification is stated in the requirements. The current understanding is that a maximum leakage current is also specified. This should be included with the breakdown voltage specification.

It is proposed that the maximum allowable leakage current be defined for a single component and the entire truck.

For 22.3, a definition is required for “energy-converting components.”

### **9. Additional testing requirements – Submitted by: Steve McDermitt, Crown Equipment Corp.**

UL testing data packet – Recent requests from UL inspections have included vehicle performance measurements (i.e. travel speed, lift speed, motor currents, etc.) This information is not requested in the UL 583 standard. There are many variables that could influence these measurements. If these performance measurements are to be included with the thermal data, then the UL 583 standard must describe the procedure. It would be better to document the vehicle setup parameters (i.e. controller settings) in lieu of measuring performance speeds.