

Comment				Comment summary	Suggested resolution	From the commenter point of view a modification of the published text is*: -Not requested; -Recommended; -Requested	EASA comment disposition	EASA response [follow the instructions below when the reponses as prepared: remove the text in [], add text in the field <>. The prompt text should be deleted when the CRD is sent for consultation]
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1	Transport Canada	2.5 1st §	5	We support the rejection of the deviation.	N/A	Not requested	Noted	Thank you for your comment. EASA acknowledges the comment.
2	Transport Canada	2.5 2nd §	5	The proposed elimination of the cell level reverse polarity requirement (2.2.1.2.2) and test (2.4.1.2.2) is based on the fact that for reverse polarity to occur it is necessary to have several cells connected in series, what is not possible with a single cell. Therefore, in this specific case the three successive barriers approach is not feasible.	Amend 2nd paragraph of EASA position to acknowledge that in this specific case the three successive barriers approach is not feasible.	Requested	Accepted	Thank you for your comment. EASA agrees and has revised the text as proposed.
3	Transport Canada	2.5 3rd §	5	The EASA statements in this paragraph are true. However, given the proposal to remove the cell level reverse polarity requirement and test, we suggest the change on the next right column.	Suggest to change to: <i>Until DO-227b is published including the removal of the cell level reverse polarity test and requirement, the deliberations of the committee SC-235 are not final and therefore cannot (should not) be used as justification to grant a deviation from DO-227a.</i>	Recommended	Accepted	Thank you for your comment. EASA agrees and has revised the text as proposed.

4	The Boeing Company	2.5 EASA Position	5	<p>EASA Position:</p> <p>We reject the deviation.</p> <p>The Boeing Company Comments:</p> <p>The Boeing Company supports the applicant’s request for deviation.</p> <p>EASA Position:</p> <p>The current DO-227A provides three successive barriers to reduce the effect of cell failures: tests at cell level, at battery level and end-item level. DO-227A also foresees that some cell failures can be mitigated at upper (battery or end-item) level. However, the standard only granted this alleviation to the leak and vent, but not to the fire or rupture (see note 2 to DO-227A table 2-3 for cell polarity reversal test).</p> <p>The position proposed by the industry removes one of these three barriers with the argument that two barriers are safe enough. Reports of accident and incident involving lithium batteries show that safety events have occurred when at least one of these safety barriers was faulty, e.g. as a result of production issues. This consideration resulted in DO-227A introducing a third barrier (the end-item tests) in comparison to the initial release of DO-227 that contained only two (cell and battery).</p> <p>The Boeing Company Comments:</p> <p>The RTCA DO-227A Cell Polarity Reversal Test 2.4.1.2.2 is not representative of any possible in-service condition for a single cell and it is not a foreseeable condition. This is due to the fact that a single cell cannot drive itself into reversal. Therefore, since Special Condition 1 for Non-Rechargeable Lithium Battery Installations states: “Be designed to maintain safe cell temperatures and pressures under all foreseeable operating conditions to prevent fire and explosion.”, it should be acceptable to remove this unforeseeable test from the DO-227A test sequence.</p> <p>With regard to the potential loss of a layer of protection, the RTCA DO-227A Battery Polarity Reversal Test 2.4.2.2.1 places a single cell in the battery into polarity reversal in a realistic and representative condition. Since the target cell in the battery test is being put into polarity reversal, the data about level of protection, or the ability of a cell to tolerate polarity reversal, is measured. In this sense the single cell polarity reversal test is redundant and does not offer unique information that is relevant to the question of safety. Because the battery reversal test requires the reversal of a single cell, the discrete single cell test is not providing an additional level of protection. Therefore there is</p>	<p>EASA to reconsider their position.</p> <p>If EASA still thinks that the deviation needs to be rejected until RTCA DO-227B is released, we suggest the following potential solutions:</p> <ul style="list-style-type: none"> • Work with the applicant / industry and other regulators to define an acceptable alternative test method to the RTCA DO-227A Cell Polarity Reversal Test that would be a more representative test at the cell level such as the suggested approach in the Comment Summary: <i>“This is best established by testing with a second cell which will naturally discharge into the test cell instead of using a power supply fixed at constant current and constant voltage.”</i> • When utilizing RTCA DO-227A, allow for Note 2 in Table 2-3 “This is a failure at the cell level. If used at the battery level, this failure may be mitigated at the battery or end item level. The condition is reportable so that design requirements of higher-level products or assemblies can incorporate the mitigation.” to be utilized for Test 2.4.1.2.2 Cell Polarity Reversal for Fire and Rupture as long as the applicant meets the requirements in RTCA DO-227A Table 2-4 and Table 2-5. 	Recommended	Partially Accepted	<p>Thank you for your comment. EASA will take in duly consideration the suggested potential solution for future evaluations of deviation requests on this subject. In addition EASA is willing to discuss and support future requests for deviation on this topic based on equivalent safety level means. Text remains unchanged.</p>
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				<p>no loss of a layer of protection with the removal of the non-representative single cell reversal test.</p> <p>Nevertheless if testing of a single cell is still desired to assure safety of the product, then the selected test method should mirror the actual conditions that are encountered by a cell in a battery. This is best established by testing with a second cell which will naturally discharge into the test cell instead of using a power supply fixed at constant current and constant voltage.</p> <p>EASA Position: EASA noted that the RTCA Special Committee SC-235 agreed to remove the cell-level polarity reversal test. This position is however not consulted with the public and might not be maintained in the future release of DO-227. Conversely, the standard may incorporate other requirements or tests that might provide further mitigations to the removal of the cell-level polarity reversal test. Furthermore, there is no assurance that the different authorities implementing this standard through an ETSO, TSO or equivalent will not amend the RTCA standard. Consequently, EASA does not consider that the RTCA statement provides an acceptable equivalent level of safety before the future standard is adopted in an ETSO.</p> <p>The Boeing Company Comments: RTCA SC 235 is unlikely to complete DO-227B before 2Q 2022 and all the associated TSO/ETSOs and Advisory Circulars will likely follow several months later. In the meantime, it would be beneficial to industry to define an interim approach which allows certification of safe products such as outlined in our suggested resolution.</p>				
5	ECA Aerospace	2.5	5	EASA's position does not mention anywhere the involvement of EASA as an active member of the RTCA SC-235 working group.	It is important to mention what is the involvement of EASA in the RTCA SC-235 working group.	Requested	Accepted	Thank you for your comment. EASA has revised the text as proposed.

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6	ECA Aerospace	2.5	5	EASA's position does not mention that EASA participated in the discussions about removing the cell polarity reversal test in the future DO-227B. Such discussions took place during SC-235 working sessions. It does not mention neither EASA's position at the moment when the decision was submitted and accepted (consensus) in the 16 th plenary session as indicated in the <i>Plenary #16 Active Status Meeting</i> document.	It is important to mention what was the EASA's position on the decision taken by the RTCA SC-235 (i.e. removing the cell polarity reversal test in the DO-227B), first discussed during the working group sessions and later agreed in the 16 th plenary.	Requested	Accepted	Thank you for your comment. See comment #3. EASA has revised the text as proposed.
7	ECA Aerospace	2.5	5	Removing the cell polarity reversal is not a position from the Industry, but a position from the SC-235 which EASA is part of.	It should be clearly said that the industry position is based on the SC-235 decision agreed during the 16 th plenary, which was finally confirmed with cell manufacturers who stated that it is technically and physically impossible for a single cell to enter in a reversed polarity condition on its own.	Requested	Accepted	Thank you for your comment. EASA has revised the text as proposed.
8	ECA Aerospace	2.5	5	<p>True, the DO-227A introduced a 3rd barrier (end item tests) compared to the initial DO-227, and that, following the report of accident and incident involving lithium batteries.</p> <p>However, the SC-235 has considered now that the two upper barriers (i.e. battery and end-item) are enough to address the reverse polarity hazard, and better compared to the old DO-227 (cell and battery only), mainly due to the introduction of the end item tests, like the thermal runaway containment test (DO-227A sections 2.2.3.2.2, 2.4.3.2.2, figure 2-27 and table 2-5).</p> <p>The idea is to have the right assessment at the right level, this is actually supported by the fact that a reverse polarity condition cannot happen in a single cell on its own, as it has to be in a serial configuration with at least one other cell, that's the reason why the best place to assess such risk is at the battery level through the Battery Series Cell Polarity Reversal test (DO-227A sections 2.2.2.2.1, 2.4.2.2.1, figure 2-26 and table 2-4).</p> <p>Thus, EASA's position may be understood like if SC-235 proposed barriers (battery and end-item) would not be enough compared to initials barriers defined in the old DO-227, which it is not the case.</p>	Can EASA's position be re-assessed again by comparing the proposal from SC-235 (i.e. battery and end-item level) against the old DO-227 (i.e. cell and battery)?	Recommended	Not Accepted	Thank you for your comment. See comment #3. EASA highly appreciates the input provided anyhow would not consider this in the context of this deviation request rather would be considering the input for future deviation requests on the same subject. EASA will not change the text.

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9	ECA Aerospace	2.5	5	<p>In addition and having a look to the current requirement of DO-227A §2.2.2.1. (Battery) Series Cell Polarity Reversal, it can be improved by asking in a more prescriptive way to have a designed battery system enabling the mitigation of a reverse polarity condition, which is not currently the case. The idea behind, is to have a requirement similar in principle with the DO-311A – MOPS for Rechargeable Lithium Batteries and Battery Systems, §2.1.7 (b) “The battery system shall be designed to mitigate the impact of thermal runaway as a result of foreseeable cell failure. Conditions that can cause cell failures include, but are not limited to: Cell Polarity Reversal ...”.</p> <p>In that sense, it is important to say that the DO-311A does not have an equivalent test or requirement, similar to cell polarity reversal test as required by the DO-227A.</p>	EASA may consider a more prescriptive requirement (in §2.2.2.1) asking for a battery system that shall be designed to mitigate the impact and/or appearance of a potential thermal runaway due to a cell and/or battery polarity reversal condition.	Recommended	Not Accepted	Thank you for your comment. EASA highly appreciates the input provided anyhow would not consider this in the context of this deviation request rather would be considering the input for future deviation requests on the same subject. EASA will not change the text.
10	Radiant Power Corp	2.5 EASA Position	5	<p>Within this paragraph, EASA rejects the requested deviation request because doing so would remove one of three barriers to reduce the effects of a cell failure.</p> <p>Radiant views this differently. There are two tests within DO-227A that evaluate the effects of reverse polarity of a cell: 2.4.1.2.2 Cell Polarity Reversal Test and 2.4.2.2.2 Battery Cell Series Polarity Test. Both of these tests evaluate the cell’s ability to withstand a reverse polarity condition.</p> <p>In 2.4.1.2.2, the reverse polarity condition is established with lab test equipment (a power supply) while in 2.4.2.2.2, the reverse polarity condition is established with other cells within battery. The former test condition is created by an artificial means, which never occurs in practice. The latter test condition is created by the actual battery.</p> <p>Therefore, the “barrier” that is being eliminated is based on an artificial condition and can be viewed as redundant to the same test being performed at the battery level.</p>	Radiant suggests that 2.4.2.2.2 be considered an equivalent level of safety to 2.4.1.2.2.	Recommended	Not Accepted	Thank you for your comment. EASA highly appreciates the input provided anyhow would not consider this in the context of this deviation request rather would be considering the input for future deviation requests on the same subject. EASA will not change the text.
11(*)	Saft America	2.4.1.2.1 & 2.4.1.2.2, Discharge Current & Cell Polarity Reversal Test	32 - 34	<i>Text omitted</i>	<i>Text omitted</i>	Recommended	Not Accepted	Thank you for your comment. EASA highly appreciates the input provided anyhow would not consider this in the context of this deviation request rather would be considering the input for future deviation requests on the same subject. EASA will not change the text.

* Please complete this column using the drop-down list

Note (*) Comment No.11 received by *Saft America* included proprietary data that EASA could not disclose in this public CRD. Anyhow, for consistency EASA’s comment response is in line with the other technical comments received herein.