



Summary of the 26th Plenary Special Committee 235 - Non-Rechargeable Lithium Batteries

Meeting Summary:

The 26th Plenary Meeting of Special Committee 235 (SC-235) was held on January 18-20, 2023. This was the first "in-person" Plenary held since the COVID Pandemic and was held at RTCA's facilities in Washington DC. The meeting was also conducted as a Virtual Meeting with many attendees participating via WebEx.

John Trela (Chairman)

Norman Pereira (Government Authorized Representative)

Jeff Densmore (Secretary)

Karan Hofmann (Program Director)

Camilo Camargo (*) Antonio Chiesa (*) Jim Christo (*)

Carlos Javier Munoz Garcia (*) Maria Teresa Inigulez-Yarza (*)

Nazih Khaouly (*) Christopher Kusak (*) Thomas Maloney

Maria Jose Blanco Martin (*)

Frederic Menard Kathryn Mulhollen John Nielsen Tom Pack (*) Paul Pfeifer Ray Rodriguez Cory Rule (*)

Jim Russell (*)
Leire Segura (*)
Adrian Sfetcu (*)
Greg Smith
Mel St.John (*)

Clayton Vondrasek (*)

The Boeing Company

Federal Aviation Administration Radiant Power Corporation

RTCA, Inc. ECA

Transport Canada

NOAA EASA EASA

Federal Aviation Administration

U.S. Air Force

Federal Aviation Administration

Airbus Orolia U.S. Air Force Ultralife

ACR Electronics

Textron U.S. Air Force

NIAR

The Boeing Company (retired)

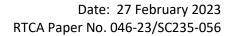
Δirhus

Bell Helicopter Textron, Inc

U.S. Air Force

NIAR Garmin Ltd

(*) Attended Virtually





Opening Plenary

- The 26th Plenary meeting of SC-235 was convened on January 18, 2023 at 9:00am EDT by Chair John Trela (Boeing). Jeff Densmore (Radiant Power) was the SC-235 Recording Secretary.
- Norman Pereira was introduced as the Government Authorized Representative.
- An RTCA overview, including RTCA's Proprietary References Policy was read by Karan Hofmann, the Program Director.
- Welcoming remarks were made by John Trela. Each person in attendance was invited to introduce themselves.
- The meeting agenda was reviewed.
- The Meeting Summary for SC-235 Plenary #25 was reviewed and approved as written.
- All documents and presentation material reviewed during Plenary #25 have been uploaded and are available on in the RTCA AerOpus documents folder.

Plenary #25 Action Item Review

There was one Action Item assigned during Plenary #25, with status as follows:

Contact cell manufacturers and request their review and comment on these OCV monitoring requirements during the FRAC process.

Assigned to: John Trela

Status: CLOSED. Emails were sent to several cell manufacturers notifying them of the upcoming FRAC Process and encouraging them to participate with comments.

DO-227B Schedule Review

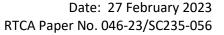
John Trela presented an overview of the current status of the Final Review and Comment (FRAC) process of DO-227B. In summary:

FRAC Began: 12 September 2022 FRAC Completed: 12 October 2022

Comment Resolution Via Working Group Meetings: Oct 2022 thru Jan 2023 FRAC Comment Resolution Plenary 26: 18-20 January 2023 Comment Resolution Via Working Group Meetings: Jan 2023 thru Mar 2023

FRAC Comment Resolution Plenary 27: 7-9 March 2023 (earliest completion)

Based on above, the earliest possible completion date would be March 2023. It was agreed, however, that this is not likely. It was also suggested that there may also be a need to repeat the FRAC process for a second time due to the large volume of changes to the document resulting from the comment resolution activities.





DO-227B Comment Resolution

There were 561 total comments received during FRAC against DO-227B. Beginning in October 2022, the SC-235 Working Group began the comment resolution process focusing on Editorial Comments and other items that could be addressed based on those in attendance. The comments are categorized as shown below, with a summary of those remaining unresolved.

Type	Total	Unresolved	% Unresolved
Non-Concur	2	2	100%
High	59	48	81%
Medium	223	180	81%
Low	125	99	79%
Editorial	152	3	2%
Total	561	332	59%

The objectives of Plenary #26 were to resolve comments with the following priorities:

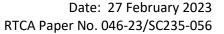
- Comments Generated by EASA during the morning sessions.
- Non-Concur and High comments during the afternoon sessions.
- All other comments, time permitting.

Note that the "DO-227B FRAC Comment List 2022-12-14.xlsx" spreadsheet was used for tracking comments for this Plenary Meeting. A copy of this file has been uploaded in AerOpus for reference. All comments referenced herein are identified by the comment "Line Number" in this spreadsheet.

Also note that comment resolution occurring during this Plenary Meeting have been tracked in the "DO-227B FRAC Comment List Plenary 26.xlsx". As an aide, the "Line Number" column was color coded to indicate which day each comment was discussed: (1) Orange on 18Jan, (2) Blue on 19Jan, and (3) Purple on 20Jan.

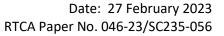
EASA Comments Resolution Summary

Line	Category	Resolution	Disposition
285	Medium	Add a corresponding requirement.	Rejected
293	Medium	proposed requirement e): As protective devices (e.g. PTCs and diodes) have limitations, tests and analyses at the appropriate level shall confirm that the protective devices function as intended and do not impose additional risks on cell or battery operation.	Rejected
359	Medium	Identify clearly whether it is the manufacturer (POH) or the supplier (organization that process the cell).	Rejected
364	Low	Remove cage code from the list as an only means.	Rejected
394	Medium	Provide an objective criterion.	Accepted





Resolution **Disposition** Line Category Accepted 413 Medium Include a requirement to cope with threats indicated. Reformulate the requirement, so that it is verifiable at article 438 Medium Accepted level. Add a requirement that any of these occurrences have to be Accepted 448 Medium reported to the certifying authority. replace "are required to" by "shall" 460 Medium Accepted 495 Medium Include the necessary requirement(s). Superseded 506 Medium Include the necessary requirement(s). Superseded Include the necessary requirement(s). 517 Medium Superseded Medium Superseded 531 Include the necessary requirement(s). 542 Medium Include the necessary requirement(s). Superseded Define term. Most likely it is meant to be the capacity 544 Medium determined in 2.2.1.1.1. If it is so, then use the term used in Accepted Formulate and add requirement. Could be solved when 2.4.4 Medium Superseded 547 would be moved to requirement section. Formulate and add requirement(s). Superseded 596 Medium the removal of requirement for single cell batteries used as end item has to be explicit, and not just with the words "some and Medium 625 Accepted may". Cases are well known. Recommended to include all cases in 2.2.2 to provide better visibility. formulate the requirement with a shall 631 Medium Accepted Standard test conditions shall be included in the requirement. 642 Medium Superseded Proposal: "at standard test conditions it shall be determine...." include a requirement that the vibration test has to be conducted before compliance with table 2-4 is determined. And Validation 654 Medium Accepted expected to be in requirement section with a shall. include a requirement that the shock test has to be conducted before compliance with table 2-4 is determined. And Validation Medium Accepted 665 expected to be in requirement section with a shall. include a requirement that the temperature cycling test has to be Medium conducted before compliance with table 2-4 is determined. And 674 Accepted Validation expected to be in requirement section with a shall. include a requirement that the altitude test has to be performed before compliance with table 2-4 is determined. And Validation 683 Medium Accepted expected to be in requirement section with a shall. include a requirement that the decompression test has to be performed before compliance with table 2-4 is determined. And Medium Accepted 696 Validation expected to be in requirement section with a shall. include a requirement that the humidity test before compliance with table 2-4 is determined. And Validation expected to be in 707 Medium Accepted requirement section with a shall. include a requirement that the discharge has to be performed 717 Medium Superseded before compliance with table 2-4 is determined.





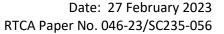
Line	Category	Resolution	Disposition
731	Medium	include a requirement that the discharge has to be performed before compliance with table 2-4 is determined.	
750	High	make the test also applicable to the parallel case. reject	
771	Medium	edium include a requirement that the polarity reversal test has to be performed before compliance with table 2-4 is determined.	
1381	High	To be re-discuss in the group.	Rejected
2356	High High It is advised to specify a threshold for the released heat value. If the threshold is exceeded, an additional test should be performed to measure the temperature of the released gases and installation limitations should be established accordingly.		Partially Accepted
2531	2531 High move the content of the entire section 2.4.4 to the appropriate sections of 2.2.		Partially Accepted

Non-Concur Comments Resolution Summary

Line	Category	Resolution	Disposition
2573	Non- Concur	This is containment test. All TR resultants need to be contained- we may need to discuss venting category to see if we can address any of these concerns using venting categories.	Accepted
3028 Non- Concur		Fragments outside of End Item would be a failure.	Accepted

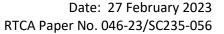
All Other Comments Resolution Summary in a "High" to "Low" Priority

Line	Category	Resolution	Disposition
151	High	Add reference to ADR/RID for "Transportation over land".	Accepted
230	High	Need to add "cells need to meet UL1642 as well as UN38.3 as	Rejected
		pre-requisite".	
432	High	Remove section 2.1.15.	Rejected
528	High	Change word from examine to shall meet	Accepted
735	High	Change to "c. No single battery measured in the post-test	Accepted
		battery capacity test shall differ by more than 5% from the	
		post-test average".	
772	High	Determine if requirement "b." is really needed. If it is, reword	Accepted
		to be clearer.	
965	High	Move lines 965 and 974 to Requirements starting in line 976.	Accepted
973	High	Delete "Released gas volume, release rate, and chemical Rejected	
		composition shall be measured and reported."	
977	High	Need to add to address anything coming out of End Item.	Accepted
977	High	Need discussion on venting categories.	Partial
			Accepted
1120	High	Need further discussion since this is not true unless tested and	Accepted
		verified.	
1127	High	Need an engineering documentation that possible all cell TR is Accepted	
		evaluated and documented- single cell will suffice.	





Line Resolution **Disposition** Category 1132 High Delete: Note: The vibration requirements stated here apply to Accepted End Items installed in the internal equipment bays of fixedwing turbo-jet powered airplanes. Applicants for other types of aircraft or other installation areas will need to coordinate with the certifying civil aviation authorities to determine the specific requirements that will apply. Delete: Note: The vibration requirements stated here apply to 1575 High Accepted End Items installed in the internal equipment bays of fixedwing turbo-jet powered airplanes. Applicants for other types of aircraft or other installation areas will need to coordinate with the certifying civil aviation authorities to determine the specific requirements that will apply. 2h slopes to be taken as per DO227A 1767 High Accepted Change to "c. No single battery measured in the post-test 1827 High Accepted battery capacity test shall differ by more than 5% from the post-test average". Confirm what the evaluation criteria is. 1894 High Accepted "A single End Item housing shall be used for the Shock and Partially 2127 High Vibration and then for the Thermal Runaway with the Accepted substitution of a new battery and potentially additional modifications" "Suggest deleting ""Applicants for other types of aircraft or 2166 High Accepted other installation areas will need to coordinate with the certifying civil aviation authorities to determine the specific requirements that will apply."" 2167 High Accepted Alternate suggestion would be to clarify that the end item 2172 High Accepted vibration test performed per this standard does not meet the aircraft level installation requirement for the End Item unless the required installation vibration profile is identical." Delete: Note: The vibration requirements stated here apply to 2181 High Accepted End Items installed in the internal equipment bays of fixedwing turbo-jet powered airplanes. Applicants for other types of aircraft or other installation areas will need to coordinate with the certifying civil aviation authorities to determine the specific requirements that will apply. Suggest deleting "Any alteration requires approval from the 2181 High Accepted responsible civil aviation authority. " Correct requirement 2.1.6 title to match 2.1.6 section title. 2309 High Rejected Review all titles and correct differences. Specify (possibly with a note?) that compliance with the Design Guidelines part of 2.1.6 is not required. Remove requirement 2.1.8 from table C-1 2369 High Rejected 2406 High Add to reportable external surface temperatures: The measured Accepted maximum surface temperature of the End Item as a function of time.



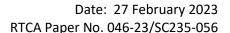


Line Resolution **Disposition** Category 2478 High Revert a. and b. Accepted "If air or other gases..." 2482 High Accepted Only video to be provided Partial 2498 High accept 2501 High provide the data for the worst case evaluation. Partial accept "Report the mass of the instrumented end item before and after 2541 High Accepted the test" Provide images of battery pack instead 2848 High Accepted 2994 High This need to be 'F' Accepted 3000 add CAA coordination. Rejected High Need 'F' in the row. 3051 High Accepted 3086 (1) Change Appendix D definition to: Non-Rechargeable High Accept Lithium Battery: A connected assembly of two or more nonrechargeable lithium cells connected together either in a series and/or parallel configuration which include [...] (2) Delete multiple references to single-cell battery. Change as follows: Equipment making use of the electrical 3557 High **Partial** energy provided by an installed or embedded non-rechargeable accept lithium cell or non-rechargeable lithium battery to fulfill an aircraft system function. 3575 Add coordination with authorities. High Accepted Merge both definitions within the definition of "Battery". 4 Accepted Medium "Modify the cell's definition in appendix D as follow: Accepted 415 Medium

At the conclusion of the Plenary, the committee was able to review and resolve 75 Comments. The status of all comments at the close of the meeting is summarized below:

Type	Total	Unresolved	% Unresolved
Non-Concur	2	0	0.0%
High	59	9	15.3%
Medium	223	151	67.7%
Low	125	98	78.4%
Editorial	152	3	2.0%
Total	561	261	46.5%

FRAC comment resolution will continue through the working group meetings, with a goal of completion by the next Plenary Meeting.





Action Item Summary

There was three new action generated during Plenary #26:

- (1) Draft the Executive Summary for the Release of DO-227B Assigned to: Nazih Khaouly
- (2) Create the Change Log from DO-227A to DO-227B Assigned to: Jeff Densmore and John Trela
- (3) Develop a Plan to Resolve FRAC Comments Regarding Orientation During Thermal Runaway and Disabling Cell and Battery Protective Devices

 Assigned to: Working Group

Working Group Meetings

It was agreed that Monday and Wednesday Working Group meetings will continue in an effort to continue resolution of FRAC comments. Karan will schedule these through the next Plenary Meeting.

Next Plenary

Plenary #27 has been scheduled as a Face-To-Face Meeting on 7-9 March 2023 at the Radiant Power facility in Sarasota, FL. Virtual attendance will also be accommodated.

-S-Jeff Densmore Secretary

CERTIFIED as a true and accurate summary of the meeting.

-S-John Trela Chairman