

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)	The Boeing Company
Norman Pereira (Government Authorized Representative)	Federal Aviation Administration
Jeff Densmore (Secretary)	Radiant Power Corporation
Karan Hofmann (Program Director)	RTCA, Inc.
Camilo Camargo (*)	ECA
Antonio Chiesa (*)	Transport Canada
Jim Christo (*)	NOAA
Carlos Javier Munoz Garcia (*)	EASA
Maria Teresa Iniguez-Yarza (*)	EASA
Nazih Khaouly (*)	Federal Aviation Administration
Christopher Kusak (*)	U.S. Air Force
Thomas Maloney	Federal Aviation Administration
Maria Jose Blanco Martin (*)	Airbus
Frederic Menard	Orolia
Kathryn Mulhollen	U.S. Air Force
John Nielsen	Ultralife
Tom Pack (*)	ACR Electronics
Paul Pfeifer	Textron
Ray Rodriguez	U.S. Air Force
Cory Rule (*)	NIAR
Jim Russell (*)	The Boeing Company (retired)
Leire Segura (*)	Airbus
Adrian Sfetcu (*)	Bell Helicopter Textron, Inc
Greg Smith	U.S. Air Force
Mel St.John (*)	NIAR
Clayton Vondrasek (*)	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

Line	Category	Resolution	Disposition
413	Medium	Include a requirement to cope with threats indicated.	Accepted
438	Medium	Reformulate the requirement, so that it is verifiable at article level.	Accepted
448	Medium	Add a requirement that any of these occurrences have to be reported to the certifying authority.	Accepted
460	Medium	replace "are required to" by "shall"	Accepted
495	Medium	Include the necessary requirement(s).	Superseded
506	Medium	Include the necessary requirement(s).	Superseded
517	Medium	Include the necessary requirement(s).	Superseded
531	Medium	Include the necessary requirement(s).	Superseded
542	Medium	Include the necessary requirement(s).	Superseded
544	Medium	Define term. Most likely it is meant to be the capacity determined in 2.2.1.1.1. If it is so, then use the term used in 2.2.1.1.1.	Accepted
547	Medium	Formulate and add requirement. Could be solved when 2.4.4 would be moved to requirement section.	Superseded
596	Medium	Formulate and add requirement(s).	Superseded
625	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 may". Cases are well known. Recommended to include all cases in 2.2.2 to provide better visibility.	Accepted
631	Medium	formulate the requirement with a shall	Accepted
642	Medium	Standard test conditions shall be included in the requirement. Proposal: "at standard test conditions it shall be determine...."	Superseded
654	Medium	include a requirement that the vibration test has to be conducted before compliance with table 2-4 is determined. And Validation expected to be in requirement section with a shall.	Accepted
665	Medium	include a requirement that the shock test has to be conducted before compliance with table 2-4 is determined. And Validation expected to be in requirement section with a shall.	Accepted
674	Medium	include a requirement that the temperature cycling test has to be conducted before compliance with table 2-4 is determined. And Validation expected to be in requirement section with a shall.	Accepted
683	Medium	include a requirement that the altitude test has to be performed before compliance with table 2-4 is determined. And Validation expected to be in requirement section with a shall.	Accepted
696	Medium	include a requirement that the decompression test has to be performed before compliance with table 2-4 is determined. And Validation expected to be in requirement section with a shall.	Accepted
707	Medium	include a requirement that the humidity test before compliance with table 2-4 is determined. And Validation expected to be in requirement section with a shall.	Accepted
717	Medium	include a requirement that the discharge has to be performed before compliance with table 2-4 is determined.	Superseded

Line	Category	Resolution	Disposition
731	Medium	include a requirement that the discharge has to be performed before compliance with table 2-4 is determined.	Superseded
750	High	make the test also applicable to the parallel case.	rejected
771	Medium	include a requirement that the polarity reversal test has to be performed before compliance with table 2-4 is determined.	Superseded
1381	High	To be re-discuss in the group.	Rejected
2356	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	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 pre-requisite".	Rejected
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 battery capacity test shall differ by more than 5% from the post-test average".	Accepted
772	High	Determine if requirement "b." is really needed. If it is, reword to be clearer.	Accepted
965	High	Move lines 965 and 974 to Requirements starting in line 976.	Accepted
973	High	Delete "Released gas volume, release rate, and chemical composition shall be measured and reported."	Rejected
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 verified.	Accepted
1127	High	Need an engineering documentation that possible all cell TR is evaluated and documented- single cell will suffice.	Accepted

Line	Category	Resolution	Disposition
1132	High	Delete: Note: The vibration requirements stated here apply to End Items installed in the internal equipment bays of fixed-wing 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.	Accepted
1575	High	Delete: Note: The vibration requirements stated here apply to End Items installed in the internal equipment bays of fixed-wing 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.	Accepted
1767	High	2h slopes to be taken as per DO227A	Accepted
1827	High	Change to "c. No single battery measured in the post-test battery capacity test shall differ by more than 5% from the post-test average".	Accepted
1894	High	Confirm what the evaluation criteria is.	Accepted
2127	High	"A single End Item housing shall be used for the Shock and Vibration and then for the Thermal Runaway with the substitution of a new battery and potentially additional modifications"	Partially Accepted
2166	High	"Suggest deleting "" 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.""	Accepted
2167	High		Accepted
2172	High	Alternate suggestion would be to clarify that the end item 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."	Accepted
2181	High	Delete: Note: The vibration requirements stated here apply to End Items installed in the internal equipment bays of fixed-wing 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.	Accepted
2181	High	Suggest deleting "Any alteration requires approval from the responsible civil aviation authority. "	Accepted
2309	High	Correct requirement 2.1.6 title to match 2.1.6 section title. 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.	Rejected
2369	High	Remove requirement 2.1.8 from table C-1	Rejected
2406	High	Add to reportable external surface temperatures: The measured maximum surface temperature of the End Item as a function of time.	Accepted

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

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 were three new actions 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