Japan Comments for Battery Durability GTR EVE40

24.November.2020

EVE 39 – November 4, 2020
Primary Decision Points for next meeting: November 24th and 25th

1. Confirmed – Adopt (2) SOH monitors
    a. SOCC – State of Certified Capacity
        i. Available to the customer and regulatory authorities
    b. SOCR – State of Certified Range
        i. Available to regulatory authorities
2. Confirmed – Adopt a Minimum Performance Requirement (MPR) (or DPR) in Phase 1
    a. Decision: MPR based on SOCC or SOCR or both?
    b. Decision: Value of the MPR
        i. Decision: Japanese MPR Matrix Proposal (EVE-38-03e)
        ii. Decision: Base MPR on TEMA model results
        iii. Is there other data on which to base the MPR?
    c. Confirmed: DPR may be established in Phase 1
    d. Decision: If the MPR is based on SOCC, how to monitor SOCR
3. Confirmed a Part A and Part B of the GTR
    a. Confirmed: Part A will validate the SOH
        i. Decision: Validate both SOCC and SOCR?
    b. Confirmed: Part B will validate the MPR
        i. Decision: Statistical analysis of pass/fail and consideration of tolerances
        ii. Decision: Family Definitions
            1. Decision: Japanese IP and SOH family proposal
            2. Decision: Or Proposal currently in the draft GTR text

Note: Please forward any new proposals 1 week in advance of the next meeting (17.11.2020)

Decision: To be made

Japan Comment

2. Confirmed – Adopt a Minimum Performance Requirement (MPR) (or DPR) in Phase 1
   a. Decision: MPR based on SOCC or SOCR or both?

<Japan stance>

There is no change from the stance presented at EVE 39.

1) In Phase 1, SOCC will be implemented at Part A/B,
SOCR will be implemented at Part A without criteria, and it will be monitored at Part B .
SOCC: Available to the customer and regulatory authorities
SOCR: Available to regulatory authorities

2) Based on the monitoring results in Phase 1, Part A SOCR criteria and Part B SOCR MPR will be determined in phase 2 .

   b. Decision: Value of the MPR
      i. Decision: Japanese MPR Matrix Proposal (EVE-38-03e)

<Japan stance>

1.Single number in Phase 1.
Regarding MPR matrix, the title, concept and sample matrix is described only in Annex. (See p.4)
[add a "placeholder" Annex X, titled "RESERVED: Annex X/MPR matrix", containing text.] such as
[In Phase 2, the substandard areas will be defined and each CP can decide MPR]
2.In Phase 2, Specific numbers of MPR , including whether to use or not a MPR matrix,
will be discussed based on the results of Phase 1.

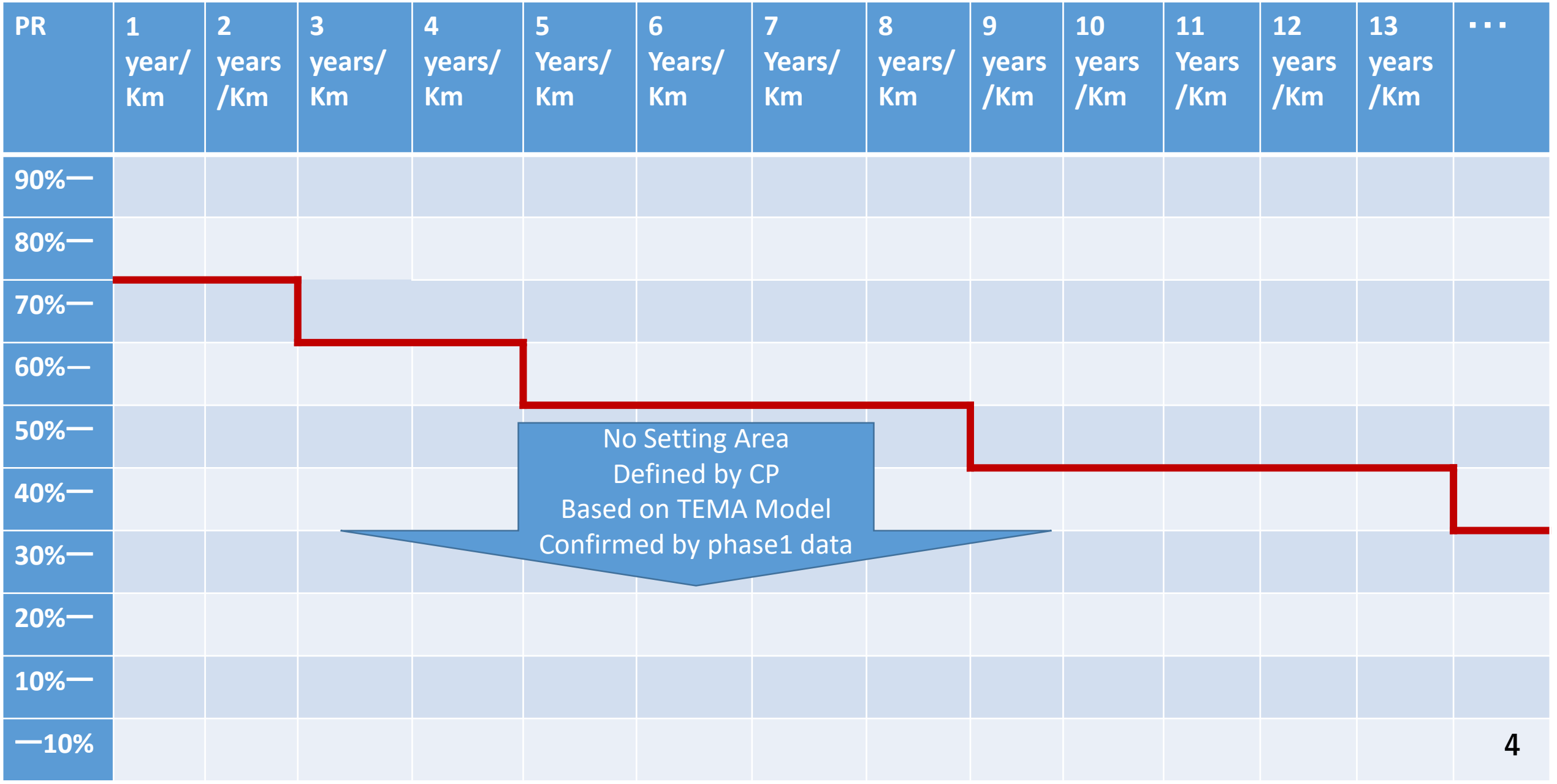
      ii. Decision: Base MPR on TEMA model results

<Japan stance>

1.Request to continue discussions, using as starting point with the results of the TEMA model.
2.Use Phase 1 data to improve the TEMA model, including better correlation with the market, and further utilize it in Phase 2

Sample MPR Matrix

In Phase 2, the substandard areas will be defined and each CP can decide MPR



i. Is there other data on which to base the MPR?

c. Confirmed: DPR may be established in Phase 1

d. Decision: If the MPR is based on SOCC, how to monitor SOCR

<Japan stance>

1. Already commented that SOCR is only monitored-, Japan thinks MPR is unnecessary for monitoring SOCR.
On the other hand, it is also acceptable for Japan to use MPR for monitoring SOCR through following procedure (See 2.).
Japan would like to confirm the necessity of MPR for monitoring SOCR in the case of SOCR is just monitored.

2. SOCR will be calculated by Electric Consumption at the certification and UBE obtained by ECU ,
the same MPR of SOCC can be used.
However, the tolerance Z in Part A needs to be considered the errors (*) at the range measurement in CDY ,
so it should be higher than the tolerance Z of SOCC. (* Estimates are around 3 ~ 5%)

3. Confirmed a Part A and Part B of the GTR
   a. Confirmed: Part A will validate the SOH
      i. Decision: Validate both SOCC and SOCR?

<Japan stance>

There is no change from the stance presented at EVE 39.

1) In Phase 1, SOCC will be implemented at Part A/B,
SOCR will be implemented at Part A without criteria, and it will be monitored at Part B

   b. Confirmed: Part B will validate the MPR
      i. Decision: Statistical analysis of pass/fail and consideration of tolerances

<Japan stance>(Japan Understood that there was no statistical or tolerance discussion in Part B @t EVE39 and comment for Part A)

- **There is no change from the stance presented at EVE 39.**
- **Part A validation will use the average analysis, and subsequent periodic checks will use the statistical analysis.**
- **Part A tolerance "z" is indicated as an example;**

SOCC _ measured + 7% ≥ SOCC _ ecu

However, 7% is calculated from the data of 1 OEM （fig. shows）

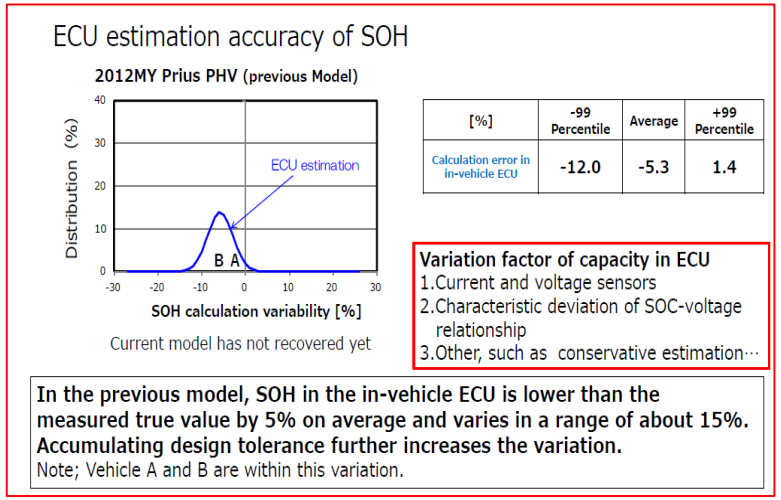


Fig. calculated data of 1 OEM (presented in EVE IWG#39)

      ii. Decision: Family Definitions
         1. Decision: Japanese IP and SOH family proposal
         2. Decision: Or Proposal currently in the draft GTR text.

<Japan stance>

Cannot support the current GTR draft because the resources necessary to implement Part A are expected to be tight for both the OEMs and the government. Japan continues to insist on our proposal.

The following pages provide a supplementary explanation of the SOH algorithm and a comparison of the estimated number of Part A

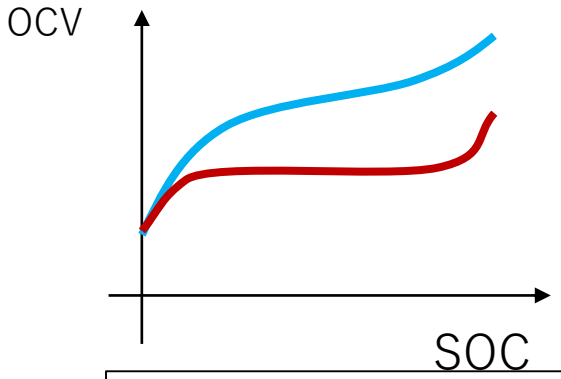
SOCC Calculation General Flow

Determine the Available SOC Width

Determined by durability evaluation.
SOC width depends on the **type of cell,** but is set for the same flow (calibration)

Calculate Current SOC

Depends on the **type of cell**, the calibration flow obtained from the relationship between OCV and SOC (see fig. right) is the same.



・SOC and OCV are correlated
・The correlation is specific to the cell type.

Estimate Capacity

Calculated according to basic formula; current integration value/ΔSOC

Calculation of UBEnow

SOC width and distribution are different between **EV and PHEV**.
Flow needs some know-how *

SOCC= UBEnow/ UBE@ta

The general flow is the same.

<* Example of know-how>
When the capacity is calculated if ΔSOC is small, there is a possibility of large errors due to the large extrapolation range.
Measures:Conditions to allow calculation of capacity IF ΔSOC ≥ threshold.
As an adverse effect, frequency of calculation is decreased
Measures:
1)At UBE calculations, the elapsed time since the last capacity calculation will be recorded.
2)Confirm with sufficient frequency against battery degradation speed.

SOH Family Proposal:
Add Type of Cell, EV/PHEV split in addition to algorithms and sensors

1-1. SOH family definition

(1) Same algorithm for SOH calculation. "Same algorithm" is the same controls architecture, and not identical calibration parameters.

(2) Same sensor configuration (only sensors providing Input to the ECU for SOH calculation)

Part numbers, suppliers, or physical location on the vehicle and so on shall not be the factor for family deviation.

Voltage sensor: specs example., measured range (0 - 300 V**), Current sensor;** specs example**.,** measured range(0 - 200 A),

Accuracy ( ), guaranteed temperature range ( ),…..

(3) Same type of Cell

(4) PEVs and OVC-HEVs shall be separate SOH families.

(5) Definition of SOH family equivalence;

SOH_capacity_ecu = UBE_now / UBE_certification

UBE_now = F (Voltage, Current,,,,,)

If these two concepts remain the same in SOH calculations, the SOH family can be considered to be equivalent even if the algorithm (OEM Responsibility) is improved to the extent of the same algorithm.

The definition of "same algorithm" needs to be considered.

1-2. IP family definition （Interpolation family） （quoted from GTR15）

5.6.3. Interpolation family for PEVs

Only PEVs that are identical with respect to the following electric powertrain/transmission characteristics may be part of the same interpolation family:

(a) Type and number of electric machines: construction type (asynchronous/ synchronous, etc.), type of coolant (air, liquid) and any other characteristics having a non-negligible influence on electric energy consumption and range under WLTP conditions;

(b) Type of traction REESS (type of cell , capacity, nominal voltage, nominal power, type of coolant (air, liquid));

(c) Transmission type (e.g. manual, automatic, CVT) and transmission model (e.g. torque rating, number of gears, numbers of clutches, etc.);

(d) Number of powered axles;

(e) Type of electric energy converter between the electric machine and traction REESS, between the traction REESS and low voltage power supply and between the recharge-plug-in and traction REESS, and any other characteristics having a non-negligible influence on electric energy consumption and range under WLTP conditions;

(f) Operation strategy of all components influencing the electric energy consumption within the powertrain;

(g) n/v ratios (engine rotational speed divided by vehicle speed). This requirement shall be considered fulfilled if, for all transmission ratios concerned, the difference with respect to the n/v ratios of the most commonly installed transmission type and model is within 8 per cent.

1-4. ISC Part A Frequency of verifications

【GTR draft】

The manufacturer shall complete the procedure for in-use verification **at least every two years for the lifetime of each vehicle type** and report all values to the authorities. The authorities may decide to proceed with their own verification of either Part A, Part B or both at a frequency and magnitude based on risk assessment.

【Proposal】

		PEV/OVC-HEV **IP family**														**minimum # of tests**	remarks
		A		B		C		D		E		F		…			
age		~3 years	3 ~ 5 years	~3 years	3 ~ 5 years	~3 years	3 ~ 5 years	~3 years	3 ~ 5 years	~3 years	3 ~ 5 years	~3 years	3 ~ 5 years	~3 years	3 ~ 5 years		
mileage (preferably)		10K ~ 50K	30K ~ 80K	10K ~ 50K	30K ~ 80K	10K ~ 50K	30K ~ 80K	10K ~ 50K	30K ~ 80K	10K ~ 50K	30K ~ 80K	10K ~ 50K	30K ~ 80K	10K ~ 50K	30K ~ 80K		
for each **SOH family**	case_1	4	4													**8**	
	case_2	3	3	3	3											**12**	
	case_3	2	2	2	2	2	2									**12**	
	case_4	2*	2*	2*	2*	1	1	1	1							**12**	* : preferably higher sales volume
	case_5	2*	2*	1	1	1	1	1	1	1	1					**12**	
	case_6	1	1	1	1	1	1	1	1	1	1	1	1			**12**	
	case_7	1	1	1	1	1	1	1	1	0**	0**	1	1	1	1	**12**	** : preferably smaller sales volume

Purpose: Verify a wider range of mileage (not mentioned in current draft).
With good balance between robust evaluation and test burden.

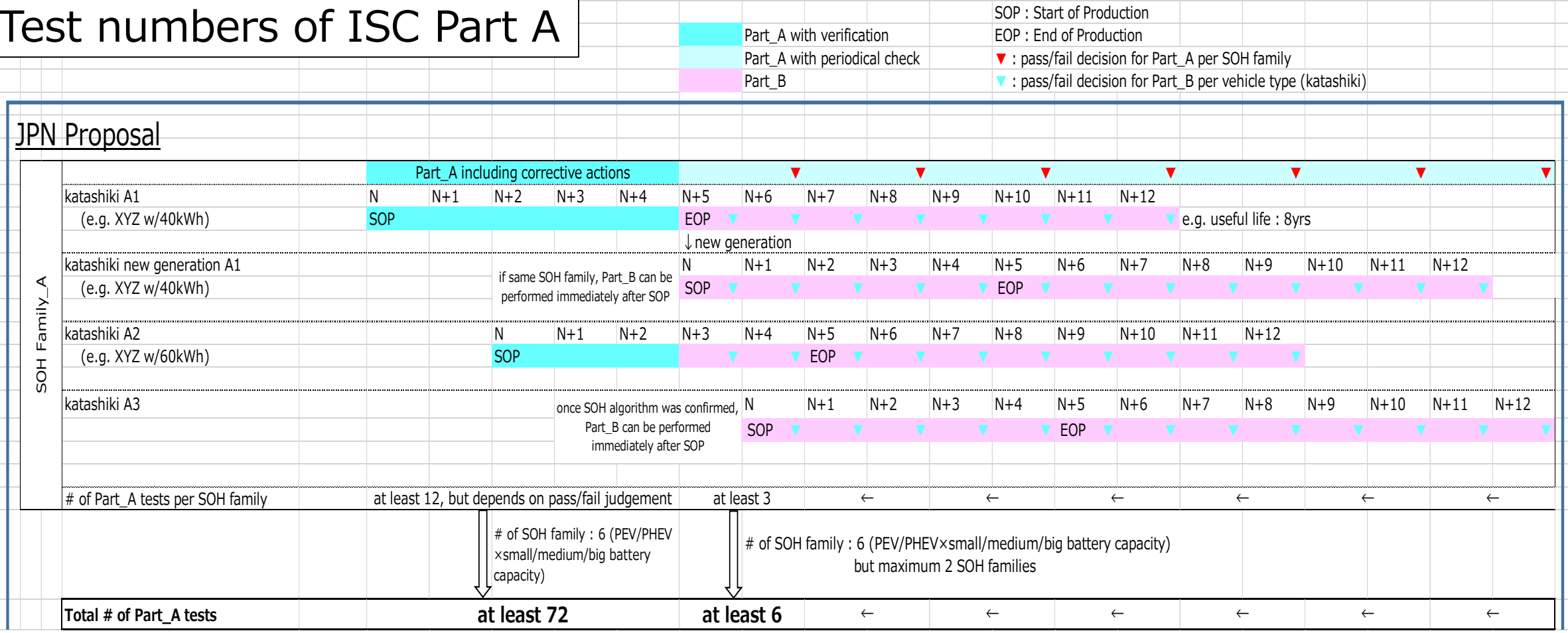
Judgement;

1. Compare the mean of all test results with tolerance Z.
2. When passing, it shifts to Part B. In case of failure,
   take measures as described in the draft GTR, and perform Part A again.

Case 1: GTR draft: at least 3 units every 2 years,
For 5 years, 7.5 units = > **8 units proposed**

Case 2 onward, for algorithm verification.
the ISC burden is reduced to select 1.5 times
= > **12 units proposed**

Test numbers of ISC Part A



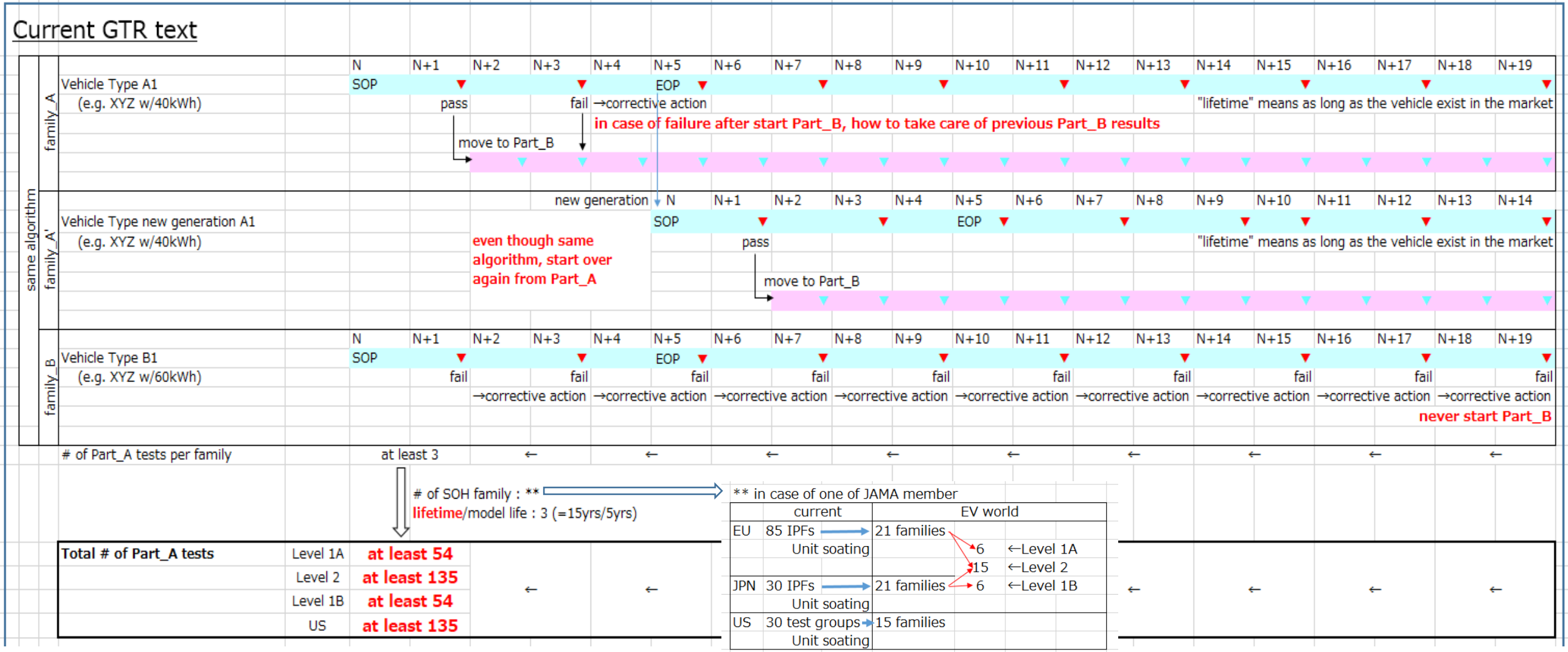
<Japan proposal>

1.Assuming 6 of SOH families, the minimum number of Part A in 5 years for Japan and Europe is **72 units.**

Assumption: Based on WLTP, six SOH families have been introduced both in Japan and Europe, Part A data from Europe and Japan to be shared.

2.After shifting to Part B, 2 out of 6 families will be selectively implemented to reduce the burden.(New proposal)

Objective: monitoring for unauthorized changes to software by OEM



<Case study when GTR draft proposal is adopted>

Assumption ; the current product lineup will shift to EV /PHEV, and the electric power train will be integrated.

1.Assuming 21 cases of the SOH family in Europe and Japan, every 2 years, minimum 63 units in Europe and 18 units in Japan.
When it is implemented 3 times during the regulated period, it is necessary to implement a minimum of **243 units**.

<Concerns>

2.Part A is described as "at least every two years for the **lifetime** of each vehicle type," and the time of termination should be clarified.

3.As long as Part A does not pass, it cannot move to Part B, GTR Draft must be modified (see P12)

- Methodology for In-Use Verification
- **Information gathering**

The following information shall be made available to the authorities by the manufacturer: Annual report on relevant warranty claims, annual statistics on repairs for batteries and other systems that might influence the electric energy consumption of the vehicle.

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- **Frequency of verifications**

The manufacturer shall complete the procedure for in-use verification for Part A at least every two years for the lifetime of each vehicle type and report the results of the verification to the authorities. The authorities may decide to proceed with their own verification of Part A, at a frequency and magnitude based on risk assessment, or ask more information from the manufacturers.

The authorities shall complete the verification of Part B on a frequency based on risk assessment.

OICA TF EVE (ACEA)
This could be a regional option if local legislation is requiring it

Aasebø Sigve Jarl
Untill 8 years after the lifetime of each type would match the MPR, or ?

DILARA Panagiota (GROW)
削除: all values

DILARA Panagiota (GROW)
削除: either

DILARA Panagiota (GROW)
削除: Part B or both

Current draft

- *Corrective measures for the SOH monitor:*

A fail decision for the sample means that the SOCR/SOCC monitors fails to report accurately the durability of the system and appropriate action shall be taken by the OEM with the agreement of the authority. This may lead to the requirement that the OEM repairs or replaces the faulty SOCR/SOCC monitor.

A pass decision allows for passing to Part B with the verification of the Fleet SOCR/SOCC.

Draft idea

- *Corrective measures for the SOH monitor:*

A fail decision for the sample means that the SOCR/SOCC monitors fails to report accurately the durability of the system and appropriate action shall be taken by the OEM with the agreement of the authority. This may lead to the requirement that the OEM repairs or replaces the faulty SOCR/SOCC monitor . Part B shall be started within X years from the date of fail decision.

A pass decision allows for passing to Part B with the verification of the Fleet SOCR/SOCC.