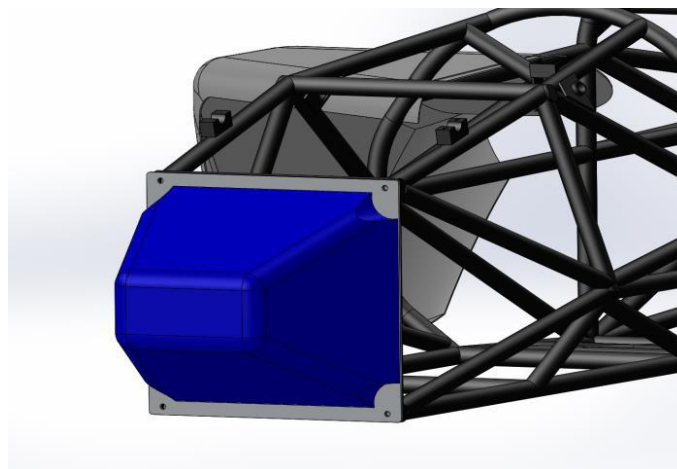


SES Guidance (Structural Equivalency Spreadsheet) (等価構造計算書)

F.8 Front Protection



Attenuator and Diagonal

Anti-Intrusion Plate

IA Attachment, Wing Detachment

Front Bulkhead, Composite Diagonal

AIP and Diagonal Attachment

Physical Test Fixture Guidance

Physical Tests

Composite AIP 100N Physical Test

Via's

In tech inspection with the tires on the ground, your team needs to be able to clearly, visibly measure ride height to the designated point on the chassis in about 30 seconds and +/-3mm ish. That is what we ultimately care about. Tape measure and/or calipers will be used. The minimum diameter for a top view opening is 5mm, no more than 20mm from the designated point on a non-level surface. If we can simply reach and see the measurement easily from the side or back, great. Access panels, permanent holes, plugs, etc are acceptable, maybe even a quick sideload off, maybe another creative idea. But not sitting there for minutes while the floor comes off. We do not want to have to zoom in with a phone camera, might not be able to serve a dual purpose here.

Front view, show the front w/iz and mounts are entirely outside / below the front bulkhead.

Show total number of fasteners for Fastener Shear Evaluation.

Show fastener UTS source / conversion.

- Attenuator and Diagonal
- Anti-Intrusion Plate
- IA Attachment
- Wing Detachment
- Front Bulkhead
- AIP Attachment
- Physical Tests
- Appendix1
- Appendix2

- Attenuator and Diagonal
- Anti-Intrusion Plate
- IA Attachment
- Wing Detachment
- Front Bulkhead
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- Appendix1
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IAは4択 テスト方法はそれぞれのタイプに従うこと
 There are 4 choices for IA, and the test method should follow each type.

BLANK Attenuator and Diagonal

No Test: +

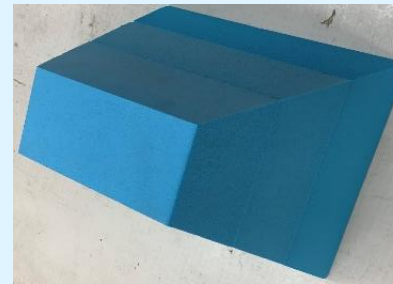
赤枠内の項目をそれぞれ選択すること
 Select the answer for all questions within the red frame.

BLANK			
F.8.4.1	Impact Attenuator Type:	<input type="text" value="BLANK"/>	BLANK
		<input type="text" value="355mm (14in)"/>	N/A
F.8.4.3	Front Bulkhead Outside to Outside Height:	<input type="text" value=""/>	mm
	Front Bulkhead Outside To Outside Width:	<input type="text" value=""/>	mm

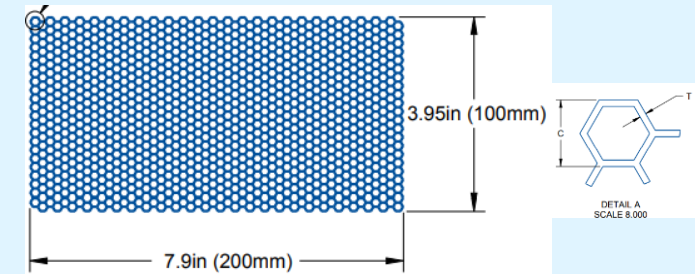
BLANK			
F.8.4.3	Diagonal Tube, Attenuator Test, or Composite	<input type="text" value=""/>	BLANK
	Minimum	Tube Used	N/A
F.3.2.1	Example: 25.4mm x 1.2mm round	Steel	<input type="text" value=""/>
F.3.4.1	Diagonal Minimum Tube:	Size C	<input type="text" value=""/>
	Wall thickness:	1.2	mm
F.3.4.1	Square side:	25	mm
	Wall thickness:	0.0012	m
	Square side:	0.025	m
	Tube cross sectional area (A):	9.10E-05	m ²
	Tube second moment of inertia (I):	6.70E-09	m ⁴
F.3.4.2	Young's Modulus (E):	2.00E+11	0.00E+00 Pa
F.3.5	Critical	S_Yield(S):	3.05E+08
Buckling Modulus	E_1*I_1 <= E_2*I_2:	1.34E+03	N/A
S_Yield(S):	S_1*A_1 <= S_2*A_2:	2.78E+04	N/A
Bending	4*S_1*I_1/r <= 4*S_2*I_2/r:	6.43E+02	N/A
Deflection	Bending_1/(48*EI):	1.00E-02	N/A
Energy	0.5*Bending^2/(48*EI):	3.22E+00	N/A

No Test

Standard Foam



Standard Honeycomb

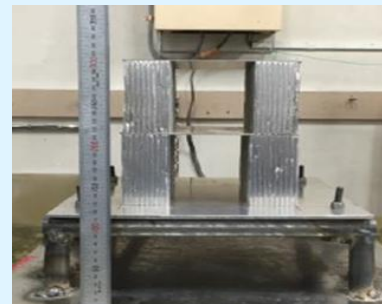


Need Test

Custom-Non-Composite

Custom-Composite : モノコック構造の意味

Physical Test Custom IA + AIP + FB Replica



Dynamic Test Composite IA + AIP + FB Replica



要求されたエビデンスを添付すること Attach the requested evidence

Insert Pictures - may be added left or below:

(a.) Standard Impact Attenuator Receipt

(b.) Adhesive Material Properties -

Indicate selected value, include units conversion

(c.) Composite Material Receipts

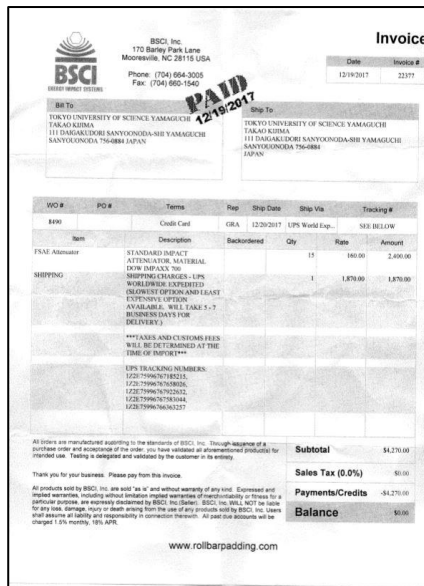
(if not already on 3-Point test tab)

- 他チームと共同購入でも、販売元の領収書を添付すること。
Even when purchasing jointly with other teams, attach the vendor's receipt.

- IAは写真を添付。寸法もわかるようにすること。
IA should attach photos. Ensure dimensions are clearly visible.

- 接着剤は、どの接着強度で計算したかわかるように図示すること。
The adhesive strength used in calculations must be clearly indicated in the diagram.

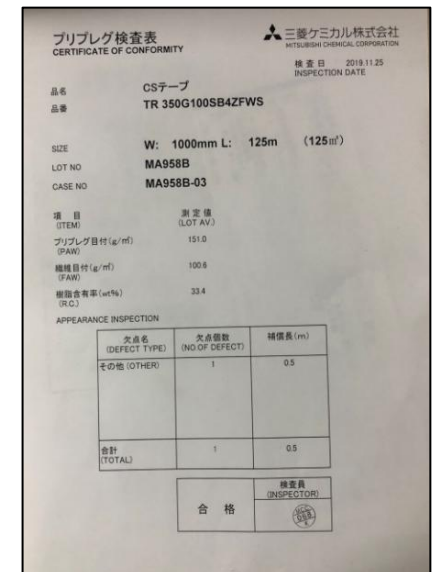
(a.)



(b.)



(c.)



要求されたエビデンスを添付すること Attach the requested evidence

BLANK			
F.8.4.1	Impact Attenuator Type:	<input type="text"/>	BLANK
		<input type="text"/>	N/A
		<input type="text"/> 355mm (14in)	N/A
F.8.4.3	Front Bulkhead Outside to Outside Height:	<input type="text"/> mm	BLANK
	Front Bulkhead Outside To Outside Width:	<input type="text"/> mm	BLANK

Diagonal, AIP, and FB material must be entered in cells J57, J59, T37, AN35, and AN37.

BLANK							
	Diagonal	Composite	<input type="text"/>	to	<input type="text"/>	Composite	BLANK
N/A	<input type="text"/>	mm			<input type="text"/>	mm	N/A
N/A	<input type="text"/>	mm			<input type="text"/>	mm	N/A
N/A	<input type="text"/>	0.00E+00 Pa			<input type="text"/>	Typo Pa	EQ
N/A	<input type="text"/>	Typo mm			<input type="text"/>	Typo mm	EQ
N/A	<input type="text"/>	Typo mm			<input type="text"/>	Typo mm	EQ
N/A	<input type="text"/>	mm			<input type="text"/>	mm	N/A
N/A	<input type="text"/>	mm			<input type="text"/>	mm	N/A
					<input type="text"/>	mm	N/A
					<input type="text"/>	mm	N/A
					<input type="text"/>	mm	N/A
					<input type="text"/>	mm	N/A
					<input type="text"/>	N	N/A
					<input type="text"/>		N/A
					<input type="text"/>	0.00E+00	N/A
N/A	0.00E+00				<input type="text"/>	#VALUE! #VALUE!	N/A
N/A	0.00E+00				<input type="text"/>	#VALUE! #VALUE!	N/A
					<input type="text"/>	0.00E+00 Pa	N/A
					<input type="text"/>	mm	N/A
					<input type="text"/>	0 mm	N/A
					<input type="text"/>		N/A
					<input type="text"/>		N/A
					<input type="text"/>	N/mm^2	N/A
					<input type="text"/>	mm^2	N/A
					<input type="text"/>		N/A
					<input type="text"/>	mm	N/A
					<input type="text"/>	#VALUE! m^2	N/A
					<input type="text"/>	Pa	N/A
					<input type="text"/>	0.00%	N/A

BLANK			
F.8.4.3	Diagonal Tube, Attenuator Test, or Composite	<input type="text"/>	BLANK
	Minimum Tube Used		N/A
F.3.2.1	Example: 25.4mm x 1.2mm round	Steel	N/A
F.3.4.1	Diagonal Minimum Tube: Size C	<input type="text"/>	N/A
	Wall thickness: 1.2	<input type="text"/> mm	N/A
F.3.4.1	Square side: 25	<input type="text"/> mm	N/A
	Wall thickness: 0.0012	<input type="text"/> m	N/A
	Square side: 0.025	<input type="text"/> m	N/A
	Tube cross sectional area (A): 9.10E-05	<input type="text"/> m^2	N/A
	Tube second moment of inertia (I): 6.70E-09	<input type="text"/> m^4	N/A
F.3.4.2	Young's Modulus (E): 2.00E+11	0.00E+00 Pa	N/A
F.3.5	Critical S_Yield(S): 3.05E+08	0.00E+00 Pa	N/A
Buckling Modulus	$E_1 \cdot I_1 \leq E_2 \cdot I_2$: 1.34E+03		N/A
S_Yield(S):	$S_1 \cdot A_1 \leq S_2 \cdot A_2$: 2.78E+04		N/A
Bending	$4 \cdot S_1 \cdot I_1 / r \leq 4 \cdot S_2 \cdot I_2 / r$: 6.43E+02		N/A
Deflection	Bending_1/(48*EI): 1.00E-02		N/A
Energy	0.5*Bending^2/(48*EI): 3.22E+00		N/A

Standard IAで、FBHにDiagonalが必要になる場合は、これらの入力も忘れないこと。

When using Standard IA and Diagonal is required for FBH, do not forget these inputs.

※Standard honeycombの接着面積についてはAppendix1を参照のこと

For the bonding area of standard honeycomb, refer to Appendix.

- Attenuator and Diagonal
- **Anti-Intrusion Plate**
- IA Attachment
- Wing Detachment
- Front Bulkhead
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- Appendix1
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Composite AIP の場合はPhysicalテストが必須
Physical test is required for Composite AIP

No additional test for Steel or Aluminum AIP.

BLANK			
F.8.2.1	Anti-Intrusion Plate (AI) material:	Steel	EQ
	Steel: 1.5mm (0.060in), Aluminum: 4.0mm (0.157in):	mm	BLANK

F.8.3.2 AI plates made of any material besides steel or aluminum must either:

F.8.3.2.a Be physically tested on a replica bulkhead up to 120kN, with the load distributed over the 200 mm x 100mm minimum IA area.

F.8.3.2.b Show F.8.3.4 120kN equivalence from F.4.3.1 laminate testing.

EQ			
F.8.3.2	Composite Anti Intrusion:	Steel	N/A
F.8.3.2	Composite AI Equivalence:		N/A
	Type SES Tab Name Of Layup Used:		N/A
F.4.3.2.d	50% < Core < 100%:	Typo Core thickness:	mm N/A
Scaling option, layup repeats:	Outer skin thickness:	Layup mm	N/A
Scaling option, layup repeats:	Inner skin thickness:	Typo mm	N/A
	Thickness of panel:	#VALUE! mm	N/A
	Composite Panel Height:	mm	N/A
	Composite Panel Width:	mm	N/A
	Top Edge of FB to Top Edge of IA:	mm	N/A
F.8.3.1	Minimum Required Impact Attenuator Height:	100 mm	N/A
	Minimum Required Impact Attenuator Width:	200 mm	N/A
	Second moment of inertia I, Vertical:	m^4	N/A
	Second moment of inertia I, Horizontal:	m^4	N/A
	Young's Modulus (E):	Layup Pa	N/A
	Ultimate Tensile Strength (S):	Name Pa	N/A
	Shear:	Typo Pa	N/A

Composite AIP -

Physicalテスト必須
Physical test required

EQ			
F.8.2.1	Anti-Intrusion Plate (AI) material:	Composite	EQ
	Steel: 1.5mm (0.060in), Aluminum: 4.0mm (0.157in):	mm	N/A

F.8.3.2 - AIP 3-Point & Shear or 120kN Physical Test required.

F.8.3.2 AI plates made of any material besides steel or aluminum must either:

F.8.3.2.a Be physically tested on a replica bulkhead up to 120kN, with the load distributed over the 200 mm x 100mm minimum IA area.

F.8.3.2.b Show F.8.3.4 120kN equivalence from F.4.3.1 laminate testing.

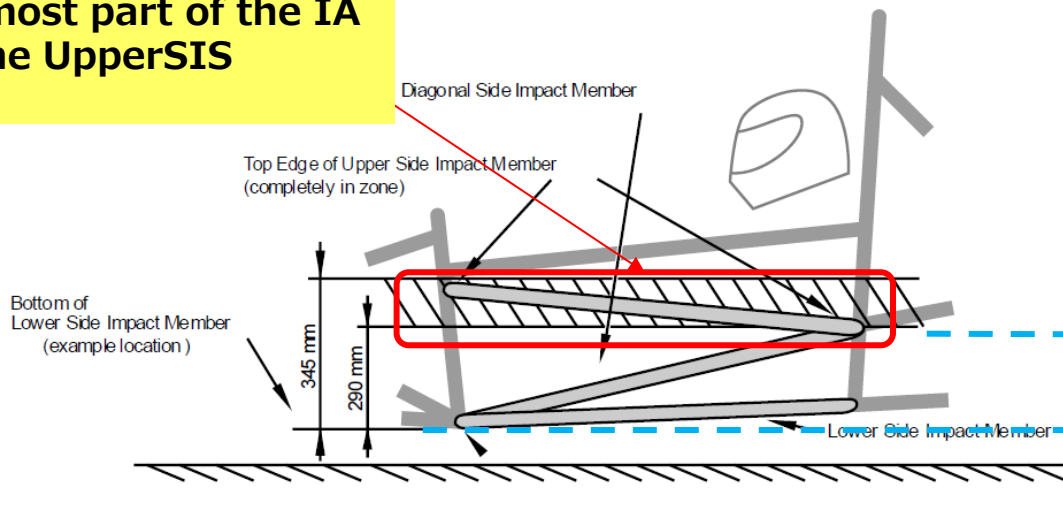
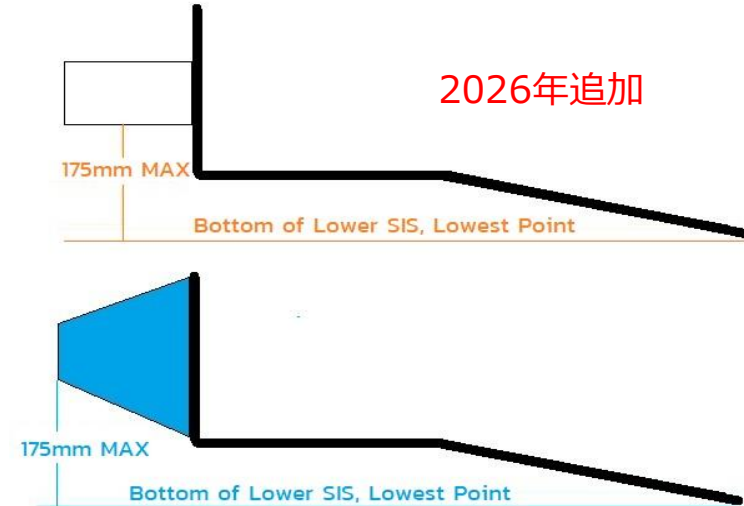
BLANK			
F.8.3.2	Composite Anti Intrusion:	Composite	EQ
F.8.3.2	Composite AI Equivalence:		BLANK
	Type SES Tab Name Of Layup Used:		BLANK
F.4.3.2.d	50% < Core < 100%:	Typo Core thickness:	mm BLANK
Scaling option, layup repeats:	Outer skin thickness:	Layup mm	EQ
Scaling option, layup repeats:	Inner skin thickness:	Typo mm	EQ
	Thickness of panel:	#VALUE! mm	EQ
	Composite Panel Height:	mm	BLANK
	Composite Panel Width:	mm	BLANK
	Top Edge of FB to Top Edge of IA:	mm	BLANK
F.8.3.1	Minimum Required Impact Attenuator Height:	100 mm	EQ
	Minimum Required Impact Attenuator Width:	200 mm	EQ
	Second moment of inertia I, Vertical:	m^4	EQ
	Second moment of inertia I, Horizontal:	m^4	EQ
	Young's Modulus (E):	Layup Pa	BLANK
	Ultimate Tensile Strength (S):	Name Pa	BLANK
	Shear:	Typo Pa	BLANK

- Attenuator and Diagonal
- Anti-Intrusion Plate
- **IA Attachment**
- Wing Detachment
- Front Bulkhead
- AIP Attachment
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- Appendix2

REPLACE THIS EXAMPLE WITH YOUR OWN CAD.

BLANK			
Ground clearance under lowest part of Lower SIS, setup ride height:		mm	BLANK
F.6.4.4.b F.8.5.6.a IA lower leading edge < 175mm above reference:		mm	BLANK
F.8.5.2 IA to AI plate mounting method:	Bonded		EQ
			N/A
		mm	N/A
Adhesive brand and name?:			BLANK
F.8.5.3.b Minimum Bond Shear Requirement:	9.50E+04 N		EQ
Minimum shear / peel strength of adhesive:		N/mm ²	BLANK
F.5.5.3 50% adhesive reduction for safety factor:	0	N/mm ²	EQ
Area (show measurement or calc):		mm ²	BLANK
Calculated bond strength:			EQ

側面衝突してもIA最前面がUpperSISに当たるように
Assuming a collision with the side of the vehicle, request the positional relationship where the frontmost part of the IA hits the UpperSIS



Side Impact Structure 底部の最も低い箇所から 175mm

取付は、Lower Side Impact Structure 底面の最も低い箇所から175mm以下
ただし、V.1.4.2により最低地上高の上限があるため高すぎるとREJECTになります。

The mounting point shall be no more than 175 mm from the lowest point on the bottom surface of the Lower Side Impact Structure. However, since there is an upper limit of ground clearance in V. 1.4.2, if the ground clearance is too high, REJECT will occur.

要求されたエビデンスを添付すること
各チームの考え方や計算方法があるため、具体例は示さない。
Attach the requested evidence Since each team has a different way of thinking and calculation methods, we will not provide specific examples.

Insert Pictures - continued:

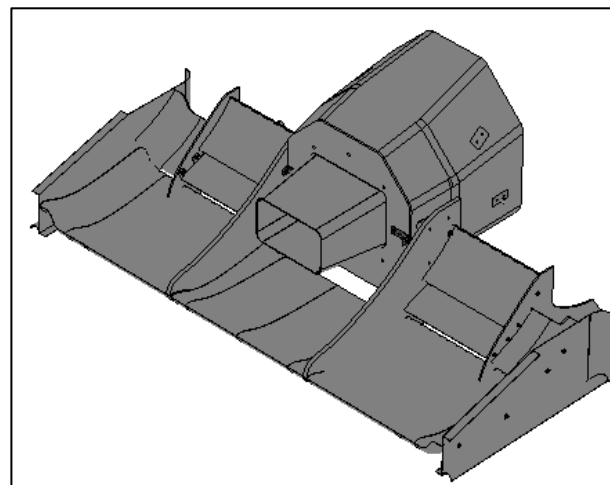
(d.) Wing Detachment Material Properties

(e.) Other Wing Detachment Calculations
(if not using standard fastener shear)

Insert measurement of IA front top edge height.

Shear Dimensions

Do not count holes as part of the area.
Even with precrush, honeycomb bond area is usually <math><50\%</math> of the face.
Include calculation of bond area.



AIP 及び IA固定方法については、下記アイソメ図に加え、三面図にブラケット・ステイ・ボルトなどの詳細情報を入力して添付すること。

また、どのような順番で破断していくか説明して計算すること。

例年、これらの不備が多く再審査の原因となっている。

For AIP and IA fixing methods, in addition to the isometric drawings below, attach detailed information such as brackets, stays, and bolts on the three-view drawings. Also, explain the sequence of failure and perform calculations accordingly. These deficiencies frequently cause re-examination each year.

引用したCAD図は東海大学のものである

大変分かりやすく、審査しやすい図面である

詳細は示さないが、敬意を持って紹介する

The diagram cited is from Tokai University.

It is an exemplary diagram, so I respectfully introduce it as a reference.

- Attenuator and Diagonal
- Anti-Intrusion Plate
- IA Attachment
- **Wing Detachment**
- Front Bulkhead
- AIP Attachment
- Physical Tests
- Appendix1
- Appendix2

Front Wing を含む場合の考え方は従来と同様
The concept when including the Front Wing is the same as before.

Front Wing Mount Limit は5種類あり入力項目が違うので要注意
Please note that there are 5 types of Front Wing Mount Limit and the input items are different.

次の場合は項目選択以外の入力不要
- Front Wingが無い
- IAと共に物理テストを行った

No input required except for item selection in the following cases:
- No front wing
- Physical testing conducted alongside IA

IA無しでテストした場合には、ファスナのせん断力で計算、また独自の計算をする場合は、計算結果とIAのピーク荷重を算出して記入してください。

When testing without IA, calculate using the fastener shear force. If performing your own calculations, calculate and record both the calculation result and the IA peak load.

BLANK
Physical Tests

Insert Test Pictures - may be added below:

(a) IA and EP test fixture before the test (F.8.7.4.d)

物理テストをした場合
テスト前後の写真・実験方法を示す写真を添付すること

(f) If you did a physical test, please attach photos before and after the test and photos showing the experimental method.

(b) which shows the deflection was less than 25.4mm

(F.8.7.6.d)

(c.) IA / AIP Force Displacement Curve

Paste in IA data from test below:

It is acceptable to resample the data at a lower frequency to reduce the number of datapoints.

Paste in COMPOSITE AIP data from test below:

It is acceptable to resample the data at a lower frequency

Paste in FRONT WING ONLY data from test below:

It is acceptable to resample the data at a lower frequency.

物理テストをした場合、実験結果の生データを入力する事

*** 1mm毎の圧縮データを推奨**

If you did a physical test, you will need to input the data of the experimental results.

***Compressed data in 1mm increments is recommended.**

- Attenuator and Diagonal
- Anti-Intrusion Plate
- IA Attachment
- Wing Detachment
- **Front Bulkhead**
- AIP Attachment
- Physical Tests
- Appendix1
- Appendix2

F.8.4.3より次の条件ではDiagonalが必要となる

- 標準IA (Form) でフロントバルクヘッドの外側寸法が400×350mmより大きい
- 標準IA (Honeycomb) を使用している

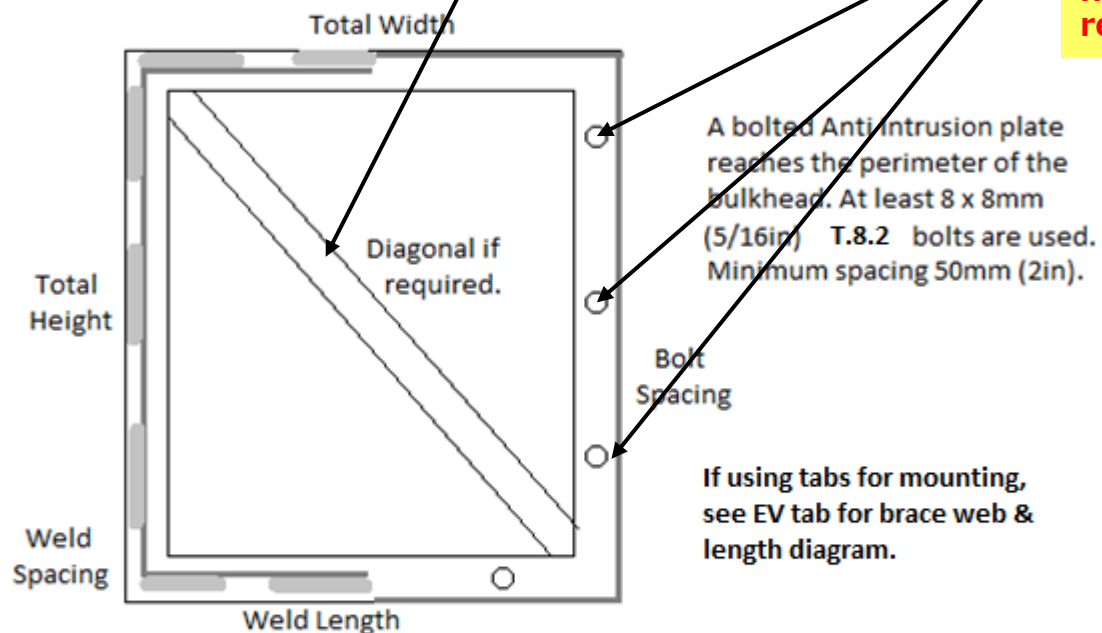
F.8.4.3 requires a diagonal under the following conditions:

- When the outer dimensions of the front bulkhead exceed 400×350mm in standard IA (Form)
- When standard IA (Honeycomb) is used

REPLACE THIS EXAMPLE WITH YOUR OWN CAD.

Include all required dimensions.

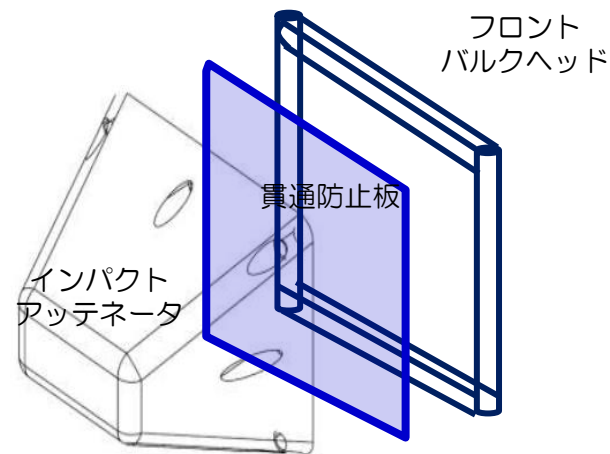
The Front Bulkhead shape may be more complex than this example



BH に直接穴を開けてボルト締結する場合

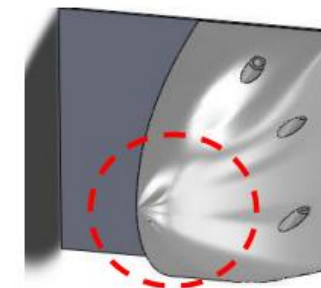
→ インサートを入れること。(レギュレーション要件)

When connecting bolts by directly drilling holes in BH → Put in the insert. (Regulation requirements)



標準IAはいかなる加工、形状変更禁止

Standard IA prohibits any processing or shape modification

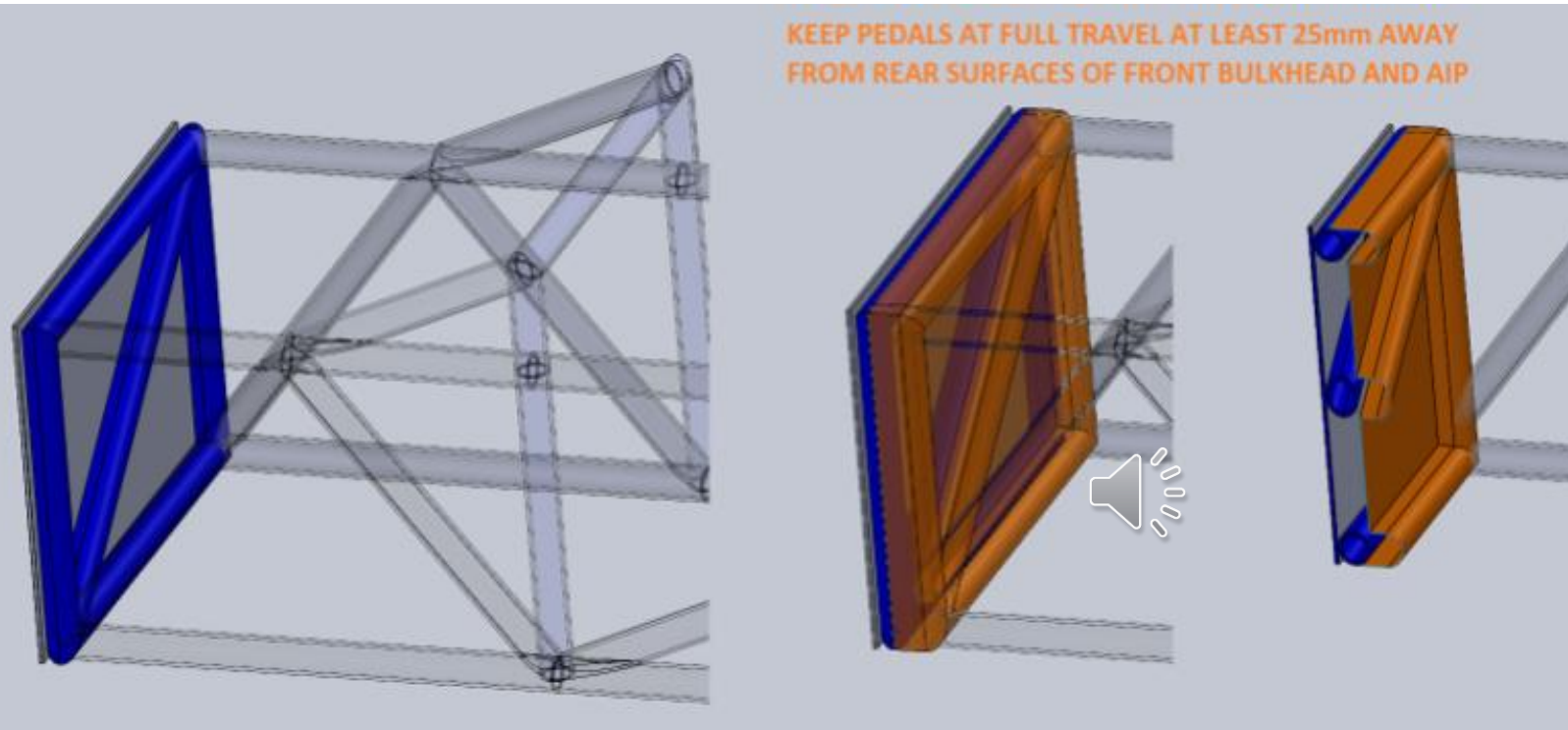


NOT PERMITTED: changed design or dimensions for Standard IA TYPE12

If not matched to the outside perimeter of the bulkhead, a welded Anti Intrusion plate reaches at least to the centerline of the bulkhead tubes. At least 50% of the plate perimeter is welded, with 25mm (1in) minimum welds.

AIPを間隔溶接する場合、比率が計算できること

When welding AIP, be able to calculate the ratio of welded and non-welded areas.



Front Bulkhead CAD with dimensions required.
Show 25mm gap to pedal assembly.
Pedal attachments preferably >25mm behind FB.

全ペダルにおいて、フルストローク時に（調整可能範囲の最大条件で）、
上の図のオレンジ色サーフェスの領域に抵触し入らないことを証明する3D図を添付すること。

※ペダルの状態（フルストロークなど）が不明なため、審査できないとの指摘が多いので注意

Attach a 3D CAD capture that proves that pedal assembly do not conflict with or enter the orange surface area shown above at full stroke (maximum adjustable range).

※Please note that submissions where the pedal condition (such as full stroke) is unclear cannot be reviewed, as this has been pointed out by many individuals.

※Q&Aで質問された以下の内容については、Appendix2を参照のこと

- Pedal Assemblyの範囲
- Pedal Full Travelの定義

Tube と Composite で入力項目が違う Tube and composite have different input items

F.8.6.3 A 25mm gap is required between the AIP + FB + Diagonal and the pedal assembly.

BLANK			
Air gap Front Bulkhead + Diag to pedals at full travel >= 25mm:		mm	BLANK
Air gap Front Bulkhead + Diag to pedal mounts should be >= 25mm:		mm	BLANK
BLANK			
F.6.1	Front Bulkhead	Tube	EQ
		Minimum	Tube Used
F.3.2.1	Example: 25.4mm x 1.6mm round	Steel	BLANK
F.3.4.1	Front Bulkhead Minimum Tube:	Size B	BLANK
	Wall thickness:	1.2 mm	BLANK
F.3.4.1	Square side:	25 mm	BLANK
	Wall thickness:	0.0012 m	EQ
	Square side:	0.025 m	EQ
	Tube cross sectional area (A):	1.14E-04 m ²	EQ
	Tube second moment of inertia (I):	8.51E-09 m ⁴	EQ
F.3.4.2	F.3.5	Young's Modulus (E): 2.00E+11	0.00E+00 Pa
F.3.5	Critical	S_Yield(S): 3.05E+08	0.00E+00 Pa
Buckling Modulus		E_1*I_1 <= E_2*I_2:	1.70E+03
S_Yield(S):		S_1*A_1 <= S_2*A_2:	3.48E+04
Bending		4*S_1*I_1/r <= 4*S_2*I_2/r:	8.17E+02
Deflection		Bending_1/(48*EI):	1.00E-02
Energy		0.5*Bending^2/(48*EI):	4.09E+00

Tube

EQ			
F.7.2	Front Bulkhead Construction:	Tube	0
Front Bulkhead Tubes Replaced Size B:		0	Diagonal Size C: 0
Type SES Tab Name Of Layout Used:			
Front Bulkhead			
F.4.3.2.d	50% < Core < 100%:	Typo	Core thickness: mm
Scaling option, layup repeats:		Outer skin thickness:	Layup mm
Scaling option, layup repeats:		Inner skin thickness:	Typo mm
		Thickness of panel:	#VALUE! mm
		Front Bulkhead Height:	mm
		Front Bulkhead Width:	mm
		Cutout Height:	mm
		Cutout Width:	mm
F.3.4.2.a	Composite Panel Height:	0	mm
		Young's Modulus (E):	2.00E+11 Layup Pa
		Ultimate Tensile Strength (S):	3.65E+08 Name Pa
		Shear:	2.11E+08 0.00E+00 Pa
F.7.2.2	25mm FBHS Section		
		Core thickness:	0 mm
		Outer skin thickness:	0 mm
		Inner skin thickness:	0 mm
		Thickness of panel:	0 mm
F.3.4.2.a	Young's Modulus (E):	2.00E+11	0.00E+00 Pa
		Ultimate Tensile Strength (S):	3.65E+08 0.00E+00 Pa
		Shear:	2.11E+08 0.00E+00 Pa
		0 x Steel Tube	Flat (h)

F.8.6.3 A 25mm gap is required between the AIP + FB + Diagonal and the pedal assembly.

BLANK			
Air gap Front Bulkhead + Diag to pedals at full travel >= 25mm:		mm	BLANK
Air gap Front Bulkhead + Diag to pedal mounts should be >= 25mm:		mm	BLANK
EQ			
F.6.1	Front Bulkhead	Composite	EQ
		Minimum	Tube Used
F.3.2.1	Example: 25.4mm x 1.6mm round	Steel	N/A
F.3.4.1	Front Bulkhead Minimum Tube:	Size B	N/A
	Wall thickness:	1.2 mm	N/A
F.3.4.1	Square side:	25 mm	N/A
	Wall thickness:	0.0012 m	N/A
	Square side:	0.025 m	N/A
	Tube cross sectional area (A):	1.14E-04 m ²	N/A
	Tube second moment of inertia (I):	8.51E-09 m ⁴	N/A
F.3.4.2	F.3.5	Young's Modulus (E): 2.00E+11	0.00E+00 Pa
F.3.5	Critical	S_Yield(S): 3.05E+08	0.00E+00 Pa
Buckling Modulus		E_1*I_1 <= E_2*I_2:	1.70E+03
S_Yield(S):		S_1*A_1 <= S_2*A_2:	3.48E+04
Bending		4*S_1*I_1/r <= 4*S_2*I_2/r:	8.17E+02
Deflection		Bending_1/(48*EI):	1.00E-02
Energy		0.5*Bending^2/(48*EI):	4.09E+00

Composite

BLANK			
F.7.2	Front Bulkhead Construction:	Composite	0
Front Bulkhead Tubes Replaced Size B:		2	Diagonal Size C: 0
Type SES Tab Name Of Layout Used:			
Front Bulkhead			
F.4.3.2.d	50% < Core < 100%:	Typo	Core thickness: mm
Scaling option, layup repeats:		Outer skin thickness:	Layup mm
Scaling option, layup repeats:		Inner skin thickness:	Typo mm
		Thickness of panel:	#VALUE! mm
		Front Bulkhead Height:	mm
		Front Bulkhead Width:	mm
		Cutout Height:	mm
		Cutout Width:	mm
F.3.4.2.a	Composite Panel Height:	0	mm
		Young's Modulus (E):	2.00E+11 Layup Pa
		Ultimate Tensile Strength (S):	3.65E+08 Name Pa
		Shear:	2.11E+08 Typo Pa
F.7.2.2	25mm FBHS Section		
		Core thickness:	0 mm
		Outer skin thickness:	0 mm
		Inner skin thickness:	0 mm
		Thickness of panel:	0 mm
F.3.4.2.a	Young's Modulus (E):	2.00E+11	0.00E+00 Pa
		Ultimate Tensile Strength (S):	3.65E+08 0.00E+00 Pa
		Shear:	2.11E+08 0.00E+00 Pa
		2 x Steel Tube	Flat (h)

Composite

- Attenuator and Diagonal
- Anti-Intrusion Plate
- IA Attachment
- Wing Detachment
- Front Bulkhead
- **AIP Attachment**
- Physical Tests
- Appendix1
- Appendix2

要求されたエビデンスを添付すること

F.8.2.2	AIP to FB Attachment:	Welded	EQ
F.8.2.3.a	At least half the perimeter must be welded:		BLANK
	Shortest weld >= 25mm (1in):		BLANK
Bolting AIP to tube Front Bulkhead		Laminated	N/A

選択肢は4種類
それぞれ入力項目が違う
There are 4 types of input options The contents of the filling are different depending on what you choose

Bonded		BLANK	
F.8.2.3.c	Bonding AIP to composite Front Bulkhead		EQ
	Is there an opening in the Front Bulkhead?		EQ
	What is the brand name of the adhesive?		EQ
	Minimum shear / peel strength of adhesive:		BLANK
	50% adhesive reduction for safety factor:	0	EQ
	Minimum bond area:		BLANK
	Calculated bond strength:		EQ

Welded

F.8.2.2	AIP to FB Attachment:	Welded	EQ
F.8.2.3.a	At least half the perimeter must be welded:		BLANK
	Shortest weld >= 25mm (1in):		BLANK

Bolted

F.8.2.2	AIP to FB Attachment:	Bolted	EQ
F.8.2.3.b	Number of 8mm critical fasteners (8 required):		BLANK
	Minimum distance between bolt centers:		BLANK

Bolting AIP to tube Front Bulkhead		Nut And Bolt	EQ
F.8.2.3.b	locate AIP bolts through FB tube inserts or on tabs:		BLANK
	Maximum Fastener centerline offset from tube surface:		BLANK
	Mount cross section on tube surface:		BLANK
	Mount thickness (B):		BLANK
	Mount length (L):		BLANK
	Mount thickness (T):		BLANK
	Mount face (H):		BLANK
	<= Su-Weld:		EQ
	<= Su-Weld:		EQ
	area <= Shear:		EQ

ボルトを選択した場合、
2種類の選択肢がある
If you select a bolt, two types of options will appear

Laminated

Laminated		BLANK	
F.8.2.3.d	Laminated AIP to composite Front Bulkhead		EQ
	Does the AIP form the front bulkhead of the monocoque?		EQ
	Type SES Tab Name Of Enclosing Layup Used:		BLANK
	Skin used:		BLANK
	AIP Perimeter Length:		BLANK
	Scaling option, layup repeats:		EQ
	Laminate thickness:		EQ
	Skin shear area - centerline x 1 thickness:	#VALUE!	EQ
	Skin shear strength:		EQ
F.8.2.3.d	Single tearout path >=120000N:	0.00%	EQ
	Front Hoop Lamination:		BLANK
	Lap joint strength:		EQ
	Total bond width including both sides of the Front Hoop:		BLANK
	Bond shear area:	0	EQ
F.8.2.3.d	Bond failure >=120000N:	#VALUE! #VALUE!	EQ

Quick Releaseを選択した場合、
入力項目増えるので見逃さないように注意
If you select Quick Release, increase input items

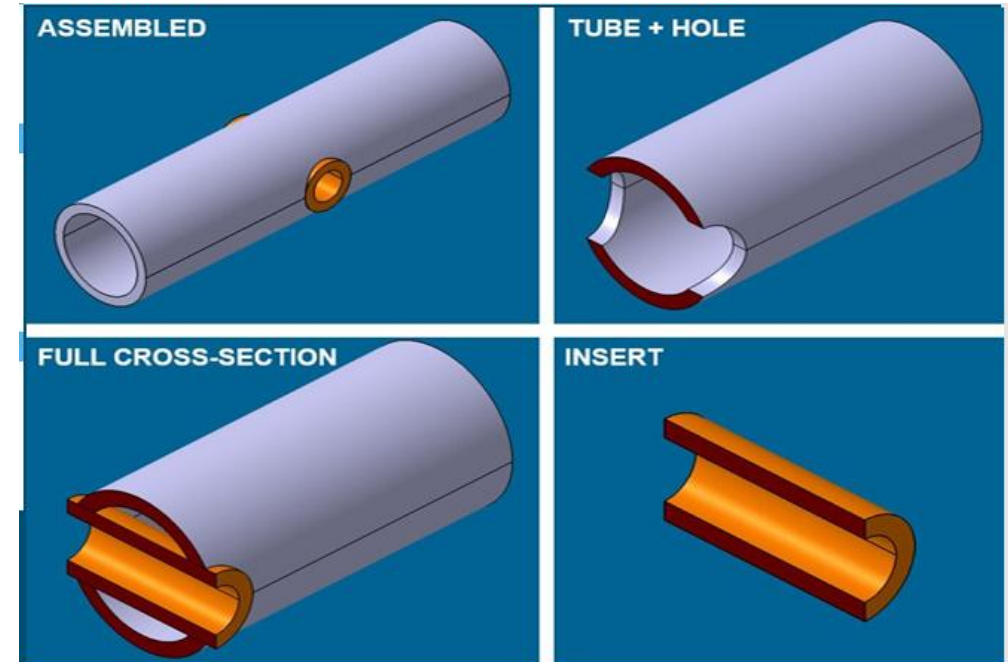
Shear Calculation for Positive Locking on Quick Release		EQ	
	Positive Locking Shear Requirement	95000	EQ
	Fastener UTS (Screenshot):		BLANK
	Number of positive locking diameters in shear:		BLANK
	Number_of_fasteners * 0.577 * UTS * pi * OD^2 / 4:	0	BLANK

Centerline Insertsの場合「Welded Inserts」の対象となる
 In the case of CentralLine Inserts, it is eligible for "Welded Inserts"

EQ	
Bolting AIP to tube Front Bulkhead	Nut And Bolt EQ
F.8.2.3.b .ocate AI bolts through FB tube inserts or on tabs:	Centerline Inserts EQ

「F. 3. 4. 3 Welded Inserts」のシート内でAIP Insertsが「Yes」に判定されるので、本シートへ入力すること
 In the "F. 3. 4. 3 Welded Inserts" sheet, Aip Inserts is determined to "Yes", so enter into this sheet.

BLANK	
Any removable members along required tubes?	
Tube Chassis BO133:	0
BLANK	
Any holes over 4mm drilled in F.3.2.1 required tubes?	
Driver Harness:	No
Tube Chassis BO134:	0
AIP Inserts:	Yes
Tractive Battery:	No
BLANK	
Does the steering rack interrupt any required tubes?	
Tube Chassis BO135:	0
FILL OUT THIS TAB.	



REPLACE THIS EXAMPLE WITH YOUR OWN CAD
 F.5.3.1, F.3.4.3 - HOLES OVER 4mm, STEERING RACK PASS THROUGH INSERT, OUTSIDE COLLAR, OR PLATE REQUIRED

注意: AIP Attachment

Offset Mountsの場合

In the case of "Offset Mounts"

F.8.2.3.b Locate all bolts through FB tube inserts or on tabs:

Maximum Fastener centerline offset from tube surface:

Mount cross section on tube surface:

See diagrams: EV Acc tab AY28-BI28 Mount thickness (B):

Mount length (L):

Minimum gusset thickness (T):

Minimum gusset height normal to mount face (H):

F.3.5 0.0 5kN shear bending $M^*y / I \leq$ Su-Weld:

0.00E+00 0.0 kN normal bending $M^*y / I \leq$ Su-Weld:

0.00E+00 Parabolic shear $3*Test Load/2*area \leq$ Shear:

Fill Out Welded Insert Tab

Bolt	EQ
Centerline Inserts	EQ
mm	N/A
	N/A
Single Layer	A
L-Shape	A
U-Shape	A
Rectangular Tube	A
	N/A

Tab形状を選択し、その形状に応じた(B),(L),(T),(H)を入力する
Select the tab shape and enter (b), (l), (t), and (h) according to the shape.

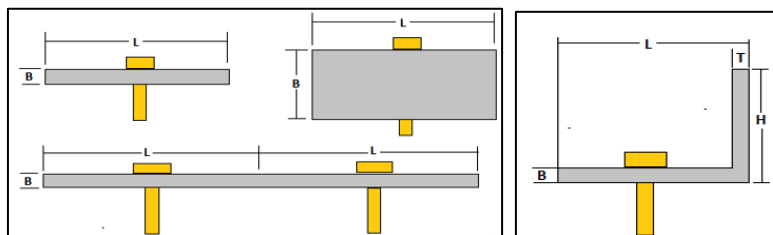
See diagrams: EV Acc tab AY28-BI28 Mount thickness (B): mm N/A

Mount length (L): mm N/A

Minimum gusset thickness (T): mm N/A

Minimum gusset height normal to mount face (H): mm N/A

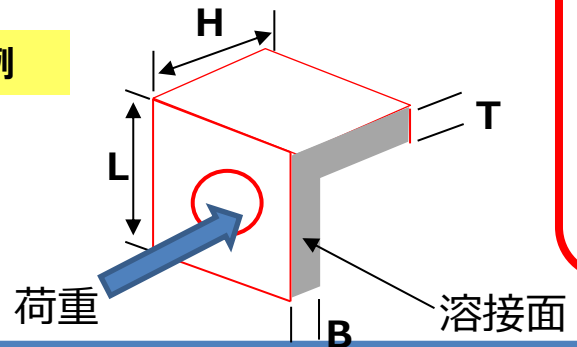
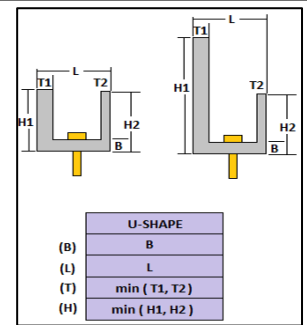
これらの絵は、「グレーのハッチング面が溶接面」と解釈する。



CROSS SECTION	SINGLE LAYER
MOUNT THICKNESS (B)	B
MOUNT LENGTH (L)	L
MINIMUM GUSSET THICKNESS (T)	L
MINIMUM GUSSET HEIGHT (H)	B

	L-SHAPE
(B)	B
(L)	L
(T)	T
(H)	H

「L-Shape」の例



Single Layer

L-Shape

グレーの溶接面に対して矢印方向の荷重が掛かると解釈し、TabのFBHへの取り付け方法を検討すること

Interpreted as a load in the direction of the arrow on the welded surface of the gray, and consider how to attach the TAB to the FBH.

- Attenuator and Diagonal
- Anti-Intrusion Plate
- IA Attachment
- Wing Detachment
- Front Bulkhead
- AIP Attachment
- **Physical Tests**
- Appendix1
- Appendix2

要求されたエビデンスを添付すること Attach the requested evidence

それぞれ空欄で要求される寸法が分かるCAD図や写真を記載すること
Describe diagrams and photos that shows the required dimensions

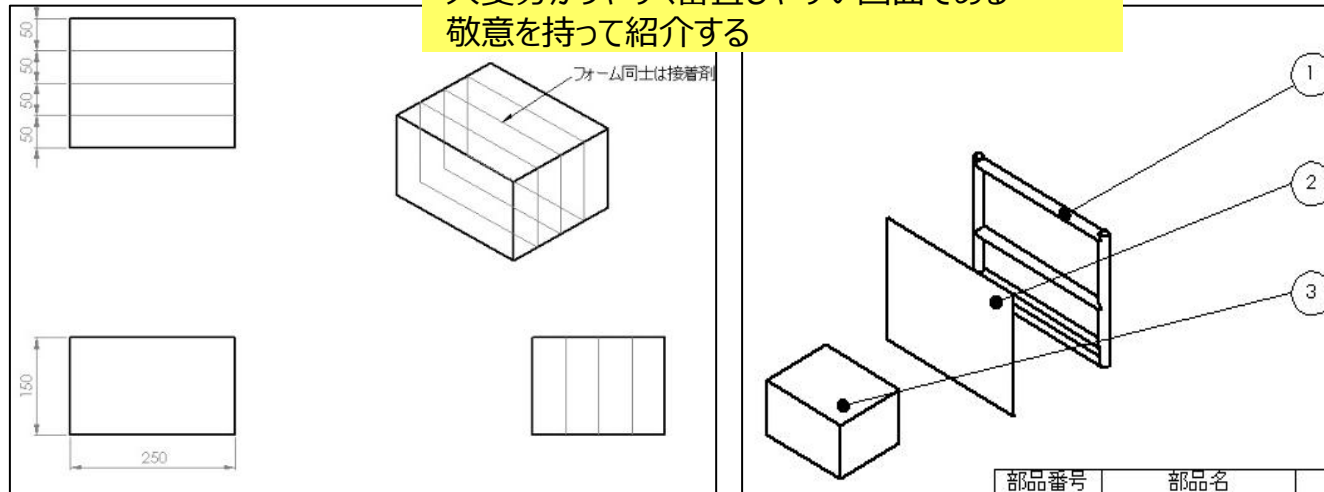
BLANK Physical Test Fixture Guidance

F.8.8.6.b The tested IA must be attached to a structurally representative section of the chassis.

BLANK			
ed.	Front Bulkhead Outside to Outside Height:	0	mm
	Front Bulkhead Outside To Outside Width:	0	mm
F.8.8.6.c	Bulkhead gap to fixture between corners ≥ 50 mm:		mm
F.8.4.2.a	Tested IA starting length > 200 mm:		mm
F.8.4.2.b	Custom IA WIDTH over 200mm length ≥ 200 mm:		mm
	Custom IA HEIGHT over 200mm length ≥ 100 mm:		mm

BLANK
BLANK
BLANK
BLANK
BLANK
BLANK

引用したCAD図は茨城大学が作成したもので、
大変分かりやすく審査しやすい図面である
敬意を持って紹介する



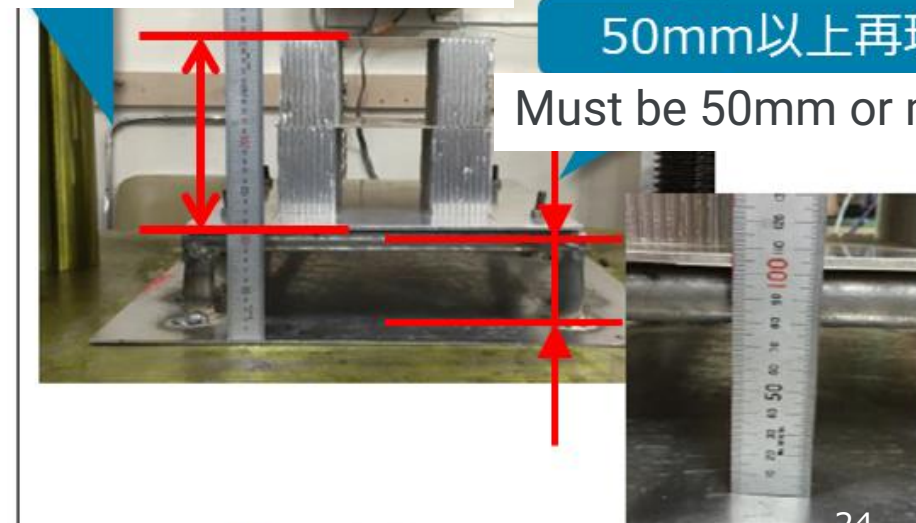
試験日が分かるものを一緒に表示すること
※新聞紙や電波時計など
Display items that show the exam date together
※Such as newspapers or radio-controlled clocks

200mm以上確認

Must be 200mm or more

50mm以上再現

Must be 50mm or more



Quasi Static と Dynamicで入力項目が違うそれぞれで要求される空欄全てに入力完了し判定が「EQ」とならなければならない
 The input items are different between quasi -static and Dynamic
 The input is completed in all the blanks required for each, and the judgment must be "EQ"

Impact Attenuator And / Or Wing Failure Test

BLANK	
Type of test used?	BLANK
Name of Test Facility	BLANK
Dates of tests	BLANK
Maximum cr	REJECT
Post crush displacement, demonstrating any springback:	mm BLANK
Crushed attenuator height:	mm BLANK
AI plate deformation:	mm BLANK

F.8.8.6.d

- F.8.8.2.b All calculated values must be based on a mass of 300kg and an initial velocity of 7m/s.
- F.8.8.8.a Average deceleration from a dynamic test must be calculated from raw, unfiltered data.
- F.8.8.8.b Peaks above 40g must not be seen after the application of specific filtering. See rule.

F.8.8.2b The impact attenuator must absorb at least 7350J. Springback may be ignored.
 Make sure to use stepwise integration: $current_force * (current_disp - prev_disp) + previous_total$
 Do not assume steps are identical. Use similar procedure for average force.
INCORRECT: $Final_force * final_displacement$, or negative energy slope when there is positive force.

BLANK	
F.8.8.2a	Peak attenuator force: 0 N EQ
	Peak attenuator only deceleration <= 40g: 0.00 g BLANK
	Average attenuator force: 0 N EQ
p.	Average attenuator only deceleration <= 20g: 0.00 g EQ
F.8.8.2b	Energy absorbed >= 7350J: 0.00 J REJECT
	Energy absorption check: 7350.00 J EQ
	EQ
	EQ
	EQ

Composite AIP 120kN Physical Test

Teams may use a crushed attenuator of the version installed on the car to test a composite AIP. Split the data following the IA test for the IA sections above and the 120kN test below.

EQ	
Type of test used?:	N/A
Name of Test Facility:	N/A
Dates of tests:	N/A
Maximum crushed displacement:	mm N/A
Post crush displacement, demonstrating any springback:	mm N/A
AI plate deformation:	mm N/A
F.8.3.1.b	Maximum AIP force > 120kN: N N/A

要求されたエビデンスを添付すること Attach the requested evidence

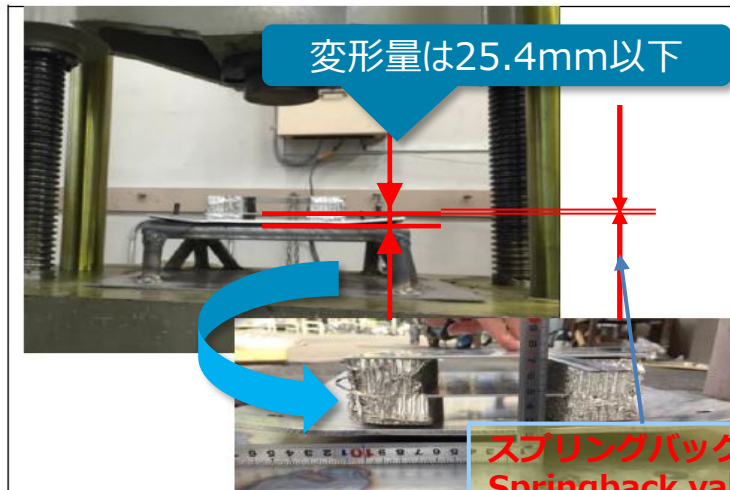
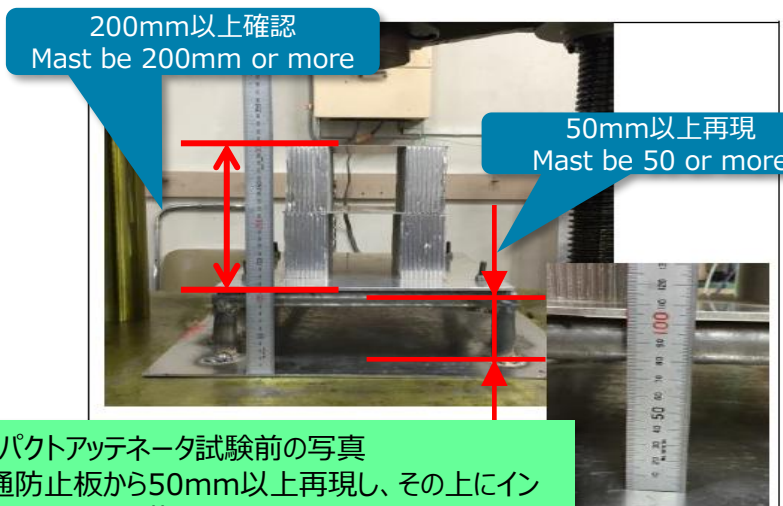
Insert Test Pictures - may be added below:

(a.) IA and FB test fixture before the test (F.8.7.4.d) which also shows the method of spacing AIP (F.8.7.4.d) which also shows the method of spacing AIP at least 50mm from any rigid structure (F.8.7.6.c)

(b.) IA, Anti-Intrusion Plate after the IA test (F.8.7.4.d) which shows the deflection was less than 25.4mm (F.8.7.6.d)

(c.) IA / AIP Force Displacement Curve

BLANK		Physical Tests	
F.8.4.3.b Teams may use quasi-static or dynamic testing on the Impact Attenuator tab to prove the AI plate deflects less than 25mm without a diagonal.			
F.8.7.7.b Dynamic tests may not be performed by students.			
Impact Attenuator And / Or Wing Failure Test			
BLANK			
Type of test used?:		BLANK	
Name of Test Facility:		BLANK	
Dates of tests:		BLANK	

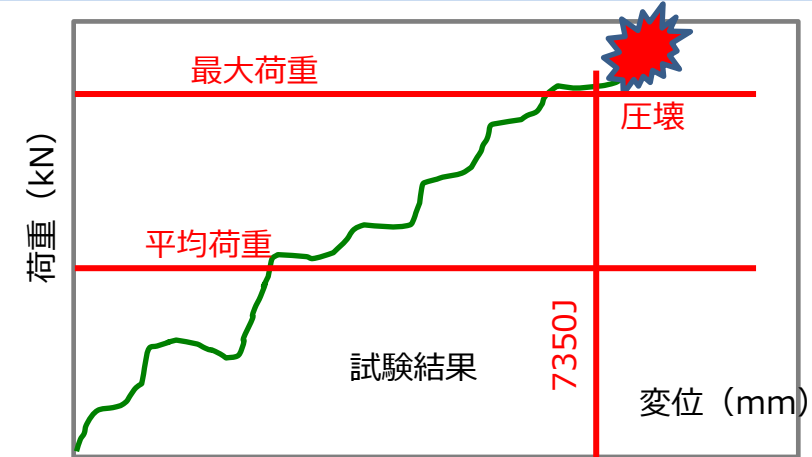
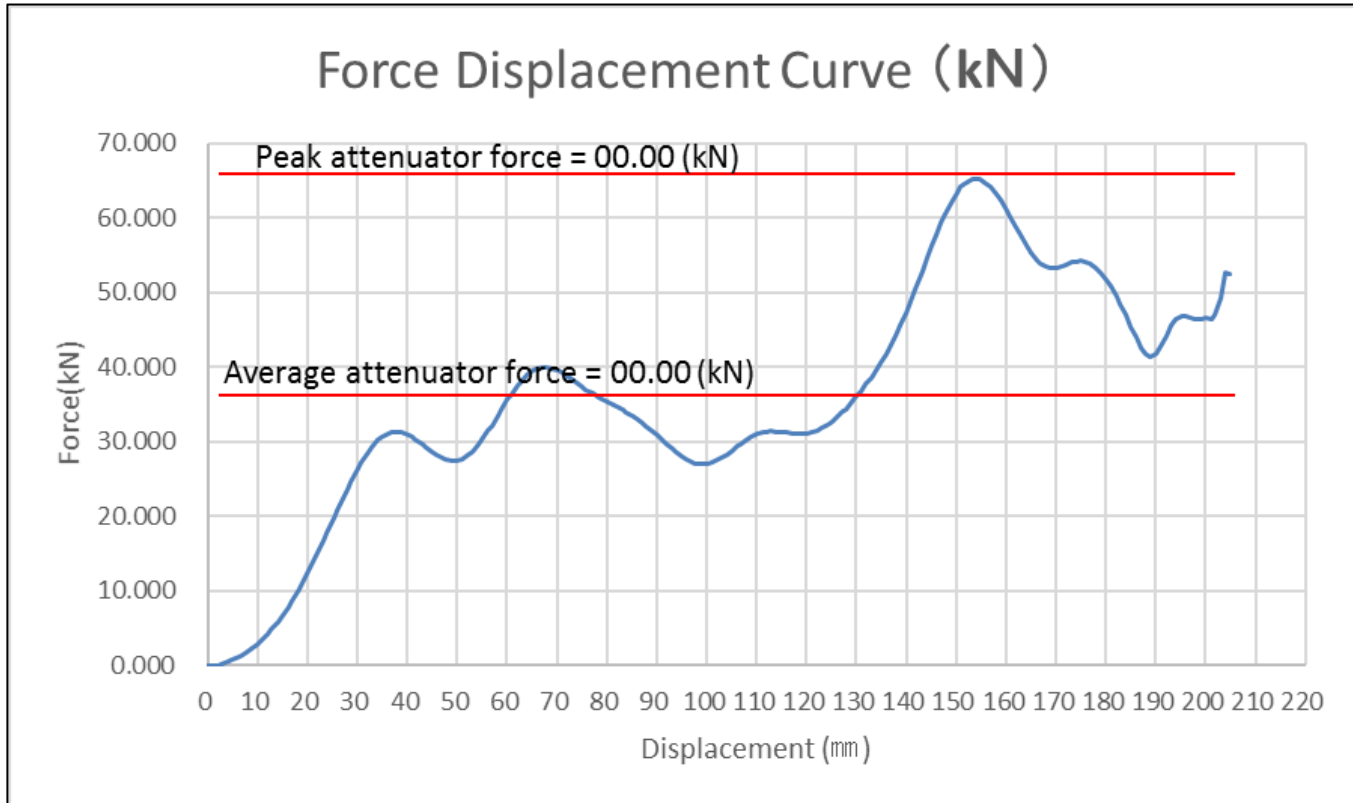


「Dates of tests」試験日を証明できる写真を添付すること。
 (写真内に日付が分かるものを一緒に撮影する)
 Attach a photo that can prove the "exam date." (Take a photo that clearly shows the date within the frame.)

- ①インパクトアッテネータ試験前の写真
- ②貫通防止板から50mm以上再現し、その上にインパクトアッテネータを載せる
- ※足の先にプレートを置き、溶接を推奨!
- ① Photo before the impact Attenuator test
- ② Reproduce 50mm or more from the penetration prevention board, and put an impact Attenuator on it.

メジャーを入れて、試験前後の写真に記載すること
 Describe photos before and after the exam with the scale

- ①インパクトアッテネータ試験後の写真
- ②貫通防止板の変形量を測定
- ③IAのスプリングバック量も測定
- ① Photo after the impact Attenuator test
- ② Measure the amount of deformation of the AIP
- ③ Measure the springback amount of IA



Paste in IA data from test below:

It is acceptable to resample the data at a lower frequency to reduce the number of datapoints.

MAX	MAX	AVERAG	MAX
0	0	0	0
Disp.	Force	Weighted	Energy
mm	N	N	J
0	0	0	0

1mmごとの荷重値を記入することを推奨する
平均G、ピークG、吸収エネルギーは自動計算される。

It is recommended to enter the load value every 1 mm.
The average G, peak G and absorbed energy are automatically calculated.

最大変位量までデータを示す
Indicates data up to the maximum value

- Attenuator and Diagonal
- Anti-Intrusion Plate
- IA Attachment
- Wing Detachment
- Front Bulkhead
- AIP Attachment
- Physical Tests
- **Appendix1**
- Appendix2

ハニカムアッテネータの接着面積について Regarding the bonding area of the honeycomb attenuator

Honeycomb attenuators must be glued on a pre-crushed side. Do not count area of holes.

No wall wetting may be factored into the bond area. Use a calculation of pre-crushed area.

Multiple layers of honeycomb require pre-crushed bond on both sides of a plate between each layer.

上記はSESに記載されている文章である。

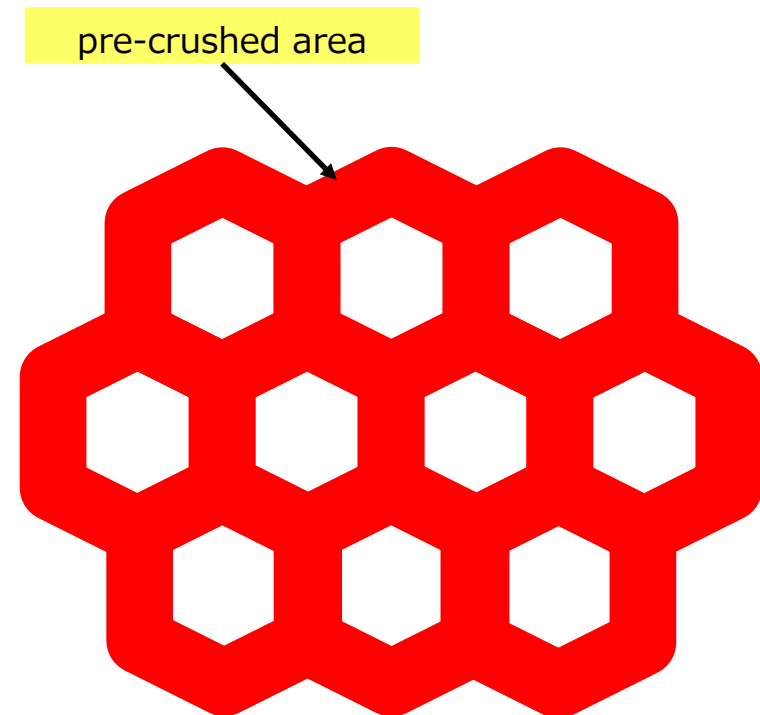
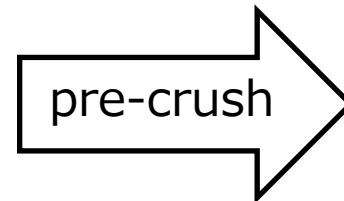
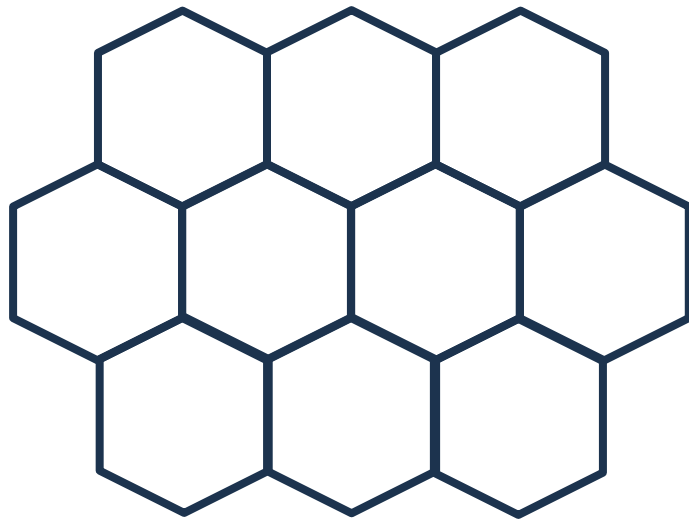
プレクラッシュした部分のみハニカムアッテネータの接着面積として扱われる。

接着面積の算出方法はそれぞれで異なるためここには記載しない。

The above text is from the SES documentation.

Only the pre-crushed portion is treated as the bonding area for the honeycomb attenuator.

The bonding area calculation method differs for each case and is not described here.



- Attenuator and Diagonal
- Anti-Intrusion Plate
- IA Attachment
- Wing Detachment
- Front Bulkhead
- AIP Attachment
- Physical Tests
- Appendix1
- **Appendix2**

Pedal assemblyの範囲 Pedal Assembly Range

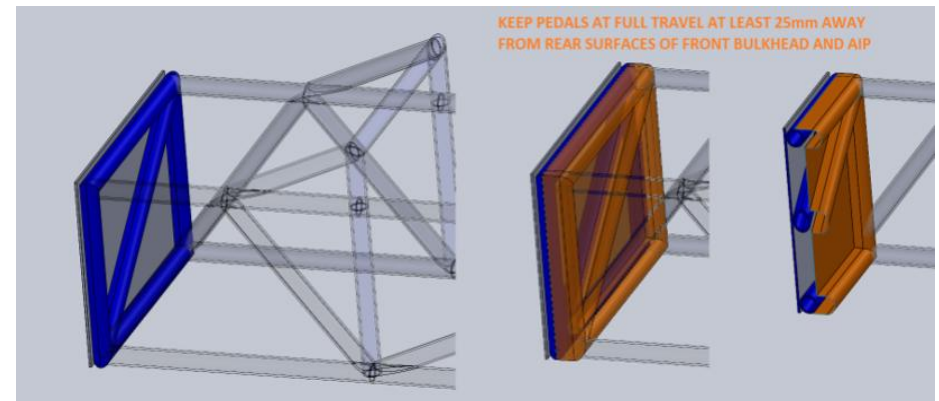
F8.6.3よりフルストローク時および調整可能範囲のフロントバルクヘッドに最も近い条件で、下図のオレンジ色のサーフェスに接触してはいけません。接触してはいけない「Pedal Assembly」は、ペダルはもとよりマスターシリンダー一部分も含むと考えるのが一般的です。

From F8.6.3, under conditions closest to the front bulkhead at full stroke and within the adjustable range, contact with the orange surface shown below must not occur. The “Pedal Assembly” that must not make contact is generally considered to include not only the pedal itself but also the master cylinder section.

Pedal full travelの定義 Definition of Pedal Full Travel

F.8.6.3は、車両が前方から衝突した際に車両前端が25 mm変形することを想定しています。ここでは、ドライバーの足の保護が求められています。衝突の原因がブレーキ抜けである可能性があるので、「Pedal full travel」には「over travel」も含むと考えることが適切です。

F.8.6.3 assumes that the vehicle’s front end will deform by 25 mm upon frontal collision. Here, protection for the driver’s feet is required. Since brake fade could cause the collision, it is appropriate to consider that “Pedal full travel” includes “over travel.”



おつかれさまでした！

Great work!

SESの作成がんばってください！

Keep up the good work on creating the SES!

大会会場でお会いしましょう！

See you at the tournament venue!