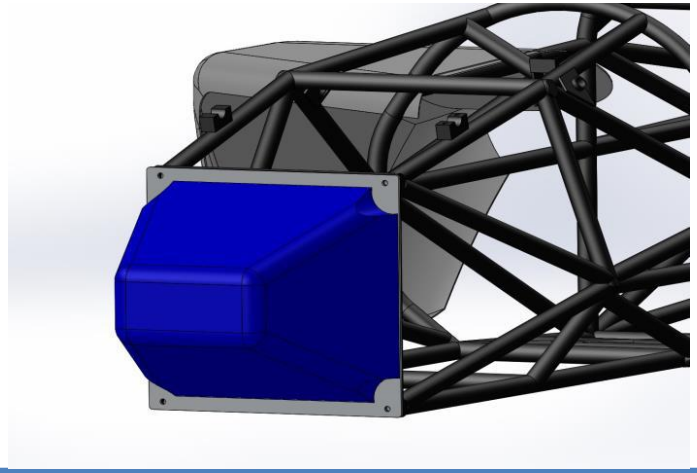
SES Guidance
(Structural Equivalency Spreadsheet)
(等価構造計算書)

F.8 Front Protection



Index

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

Index

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Attenuator and Diagonal

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

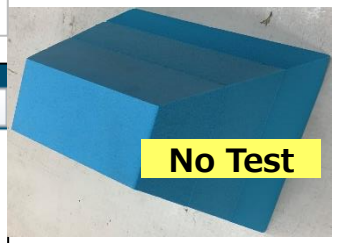
Attenuator and Diagonal

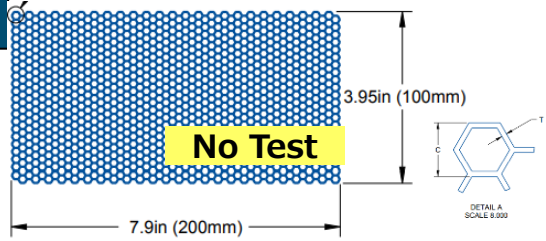
No Test: +

		BLANK		
F.8.4.1	Impact Attenuator Type:			BLANK
				N/A
		355mm (14in)		N/A
F.8.4.3	Front Bulkhead Outside to Outside Height:		mm	BLANK
	Front Bulkhead Outside To Outside Width:		mm	BLANK
		BLANK		
F.8.4.3	Diagonal Tube, Attenuator Test, or Composite			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		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):	9.10E-05	m^2	N/A
	Tube second moment of inertia (I):	6.70E-09	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*I_1 <= E_2*I_2:	1.84E+03		N/A
	S_1*A_1 <= S_2*A_2:	2.78E+04		N/A
Bending Deflection Energy	4*S_1*I_1/r <= 4*S_2*I_2/r:	6.43E+02		N/A
	Bending_1/(48*EI):	1.00E-02		N/A
	0.5*Bending^2/(48*EI):	3.22E+00		N/A

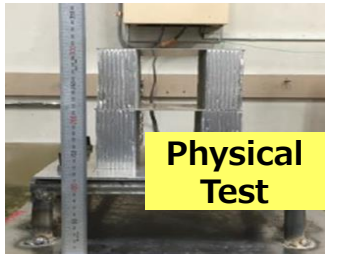
- Standard Foam
- Standard Honeycomb
- Custom - Non-Composite
- Custom - Composite

モノコック構造を意味する





IAタイプとFBHの構造で必要な対応が異なります。
The need and type of testing depends on the structure of the IA and FBH.



Samples

No Test:	Standard Foam + Matched FB
No Test:	Standard Honeycomb +
Physical Test:	Custom IA + AIP + FB Replica
Dynamic Test:	Composite IA + AIP + FB Replica

•
•
•

それぞれの項目を選択すること
Select answers for all questions

Attenuator and Diagonal

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

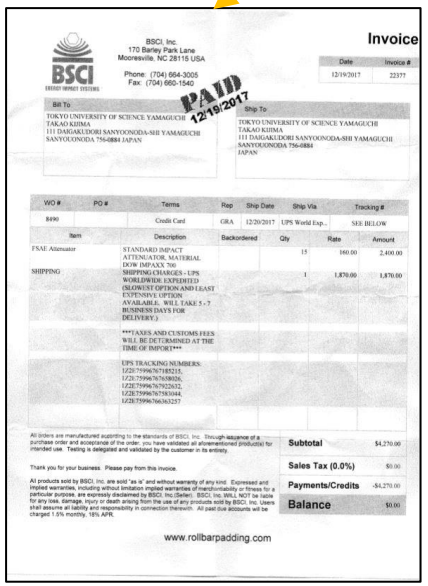
Insert Pictures - may be added left or below:

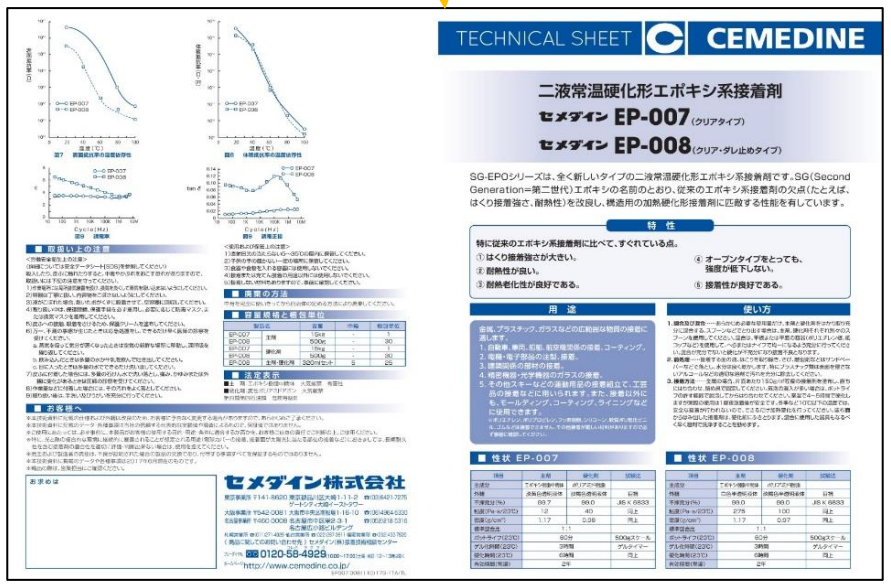
(a.) Standard Impact Attenuator Receipt

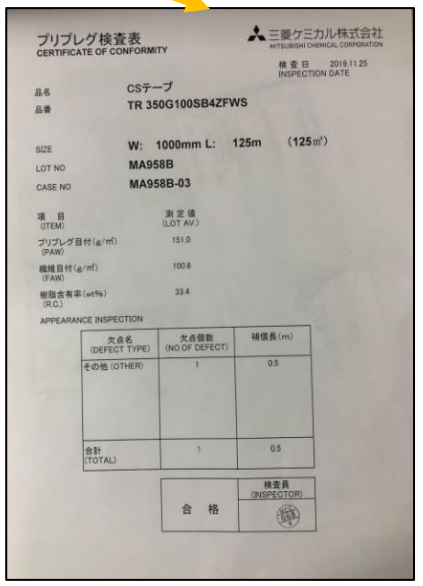
(b.) Adhesive Material Properties -
Indicate selected value, include units conversion

(c.) Composite Material Receipts
(if not already on 3-Point test tab)

これらは凡例であり、
形式は問わない
These are examples and the format does not matter.







Attenuator and Diagonal

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

	EQ				
F.8.4.1	Impact Attenuator Type:	Custom - Non-Composite			EQ
		304mm (12in)			N/A
		355mm (14in)			N/A
F.8.4.3	Front Bulkhead Outside to Outside Height:	400	mm		EQ
	Front Bulkhead Outside To Outside Width:	500	mm		EQ
F.8.4.1	**Custom Impact Attenuators requires annual physical test.**				

	BLANK				
F.8.4.3	**Diagonal Tube, Attenuator Test, or Composite**				LANK
		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			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):	9.10E-05		m^2	N/A
	Tube second moment of inertia (I):	6.70E-09		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 Buckling Modulus Sy:	3.05E+08	0.00E+00	Pa	N/A
	E_1*I_1 <= E_2*I_2:	1.34E+03			N/A
	S_1*A_1 <= S_2*A_2:	2.78E+04			N/A
	4*S_1*I_1/r <= 4*S_2*I_2/r:	6.43E+02			N/A
	Bending Deflection Energy Bending_1/(48*EI):	1.00E-02			N/A
	0.5*Bending^2/(48*EI):	3.22E+00			N/A

F.8.4.3.a Tube frame teams should weld a diagonal to the Front Bulkhead.
F.8.4.3.a Monocoque teams should install diagonals with 2 * 30kN attachment to reduce testin
The structure must go across the entire front bulkhead opening on the diagonal.
If a front bulkhead or removable panel with no openings is not feasible, preferably a s
tube is welded or bonded to the AIP. Round tubes may not be welded or bonded to th

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

	BLANK				
Diagonal	Composite		to	Steel	BLANK
					N/A
	mm			mm	N/A
					N/A
0.00E+00	Pa			0.00E+00 Pa	N/A
	Typo mm			Typo mm	N/A
	Typo mm			Typo mm	N/A
	mm			mm	N/A
	mm			mm	N/A
					N/A
				mm	N/A
				N	N/A
					N/A
				0.00E+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。
If Diagonal is required for FBH in Standard IA, don't forget to input these as well.

Index

- Attenuator and Diagonal
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- IA Attachment
- Wing Detachment
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- AIP Attachment
- Physical Tests

Anti-Intrusion Plate

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:			BLANK
	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:**		0		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
F.8.3.1			Max Bending Moment, Vertical (120kN Partial UDL):	Nm	N/A
			Max Bending Moment, Horizontal (120kN Partial UDL):	Nm	N/A
			Max Bending * Max y / I = Max Stress, Vertical:	Pa	N/A
			Max Bending * Max y / I = Max Stress, Horizontal:	Pa	N/A
			UTS (S) / Max Stress = Safety Factor, Bending:		N/A
			Perimeter Shear Stress, 120kN Load:	Pa	N/A
			Safety Factor, Perimeter Shear:		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
			I UDL):	Nm	EQ
			I UDL):	Nm	EQ
			/ertical:	Pa	EQ
			izontal:	Pa	EQ
			ending:		EQ
			Perimeter Shear Stress, 120kN Load:	Pa	EQ
			Safety Factor, Perimeter Shear:		EQ

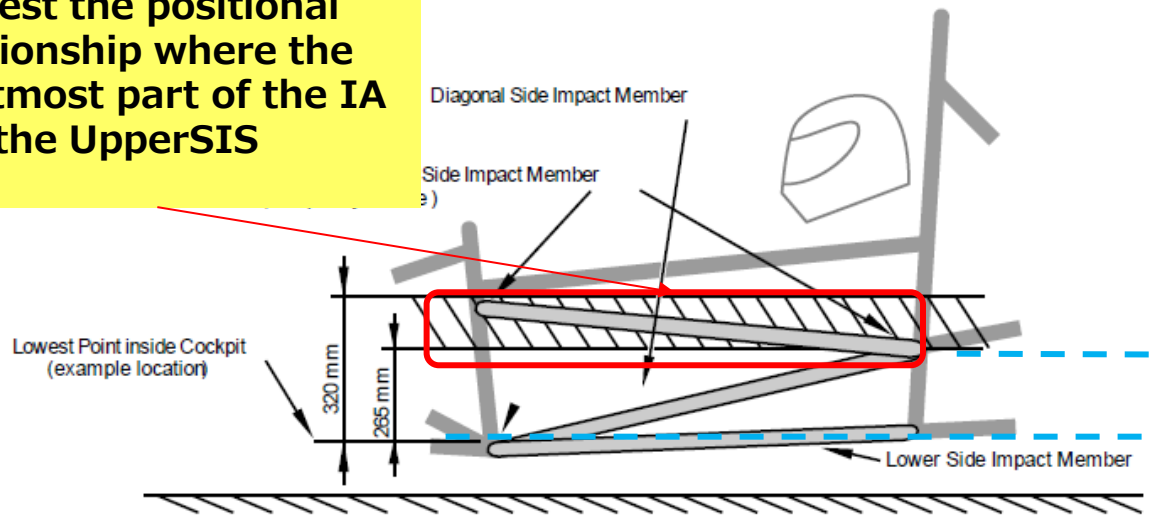
「BLANK」となっている項目の入力が必須
「EQ」とならなければならない
"BLANK" is not accepted
Must be “EQ”

Index

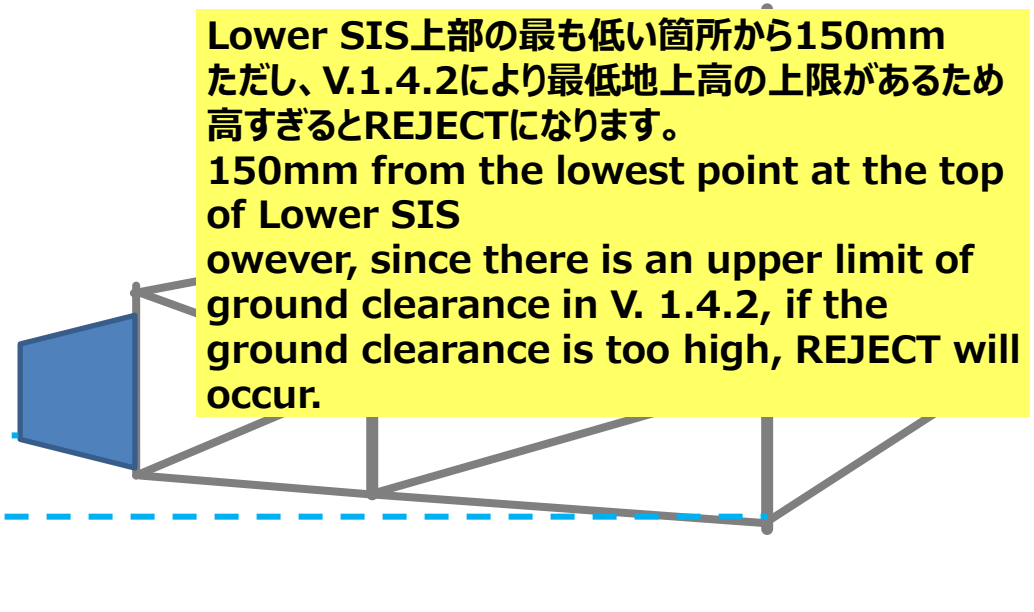
IA Attachment

		BLANK			
	Ground clearance under lowest part of Lower SIS, setup ride height:		mm		BLANK
.6.4.4.b F.8.5.6.a	IA lower leading edge < 150mm above lower SIS:		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
c	Minimum bond area:		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



Lower SIS上部の最も低い箇所から150mm
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。
150mm from the lowest point at the top of Lower SIS
owever, since there is an upper limit of ground clearance in V. 1.4.2, if the ground clearance is too high, REJECT will occur.



Anti-Intrusion Plate, IA Attachment

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.

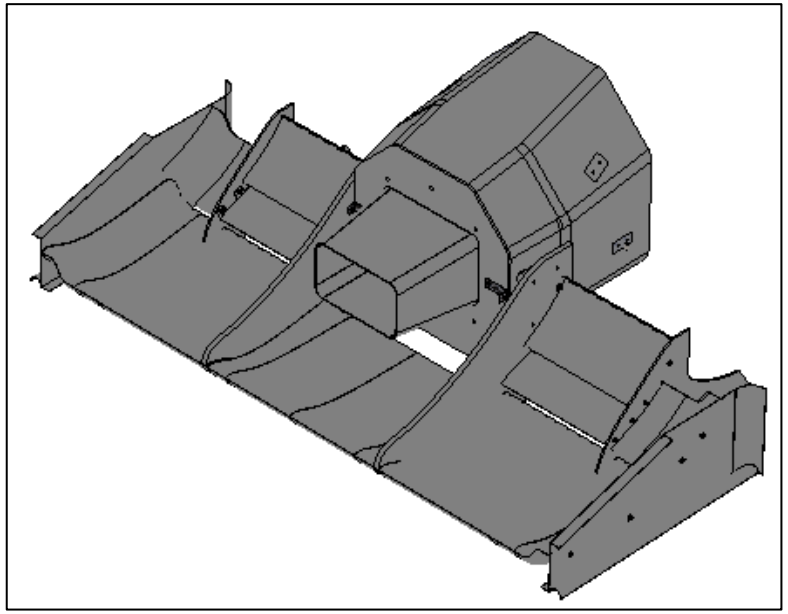
Insert Pictures - continued:

(d.) Wing Detachment Material Properites

(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 <50% of the face.



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。例年、これらの不備が多く再審査の原因
Regarding AIP and IA fixing methods, in addition to the isometric drawings below, enter detailed information on brackets, stays, bolts, etc. in a three-view drawing and attach it.
In previous years, many of these deficiencies are the cause of reexamination.

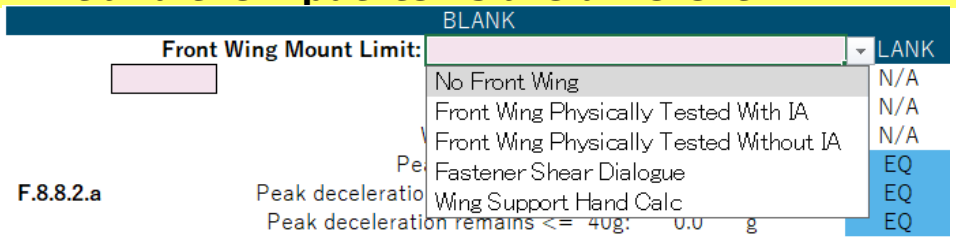
引用したCAD図は東海大学のものである
大変分かりやすく、審査しやすい図面である
詳細は示さないが、敬意を持って紹介する
The diagram cited is from Tokai University.
It is an exemplary diagram, so I respectfully introduce it as a reference.

Index

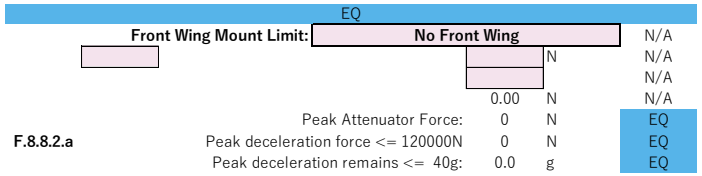
Wing Detachment

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.

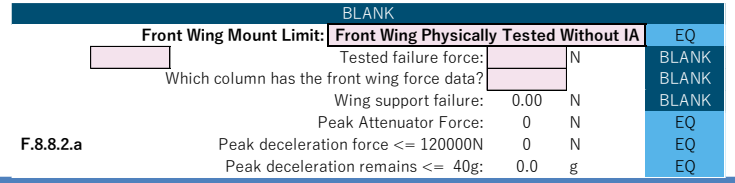
Front Wing Mount Limit は5種類あり入力項目が違うので要注意
Please note that there are 5 types of Front Wing Mount Limit and the input items are different.

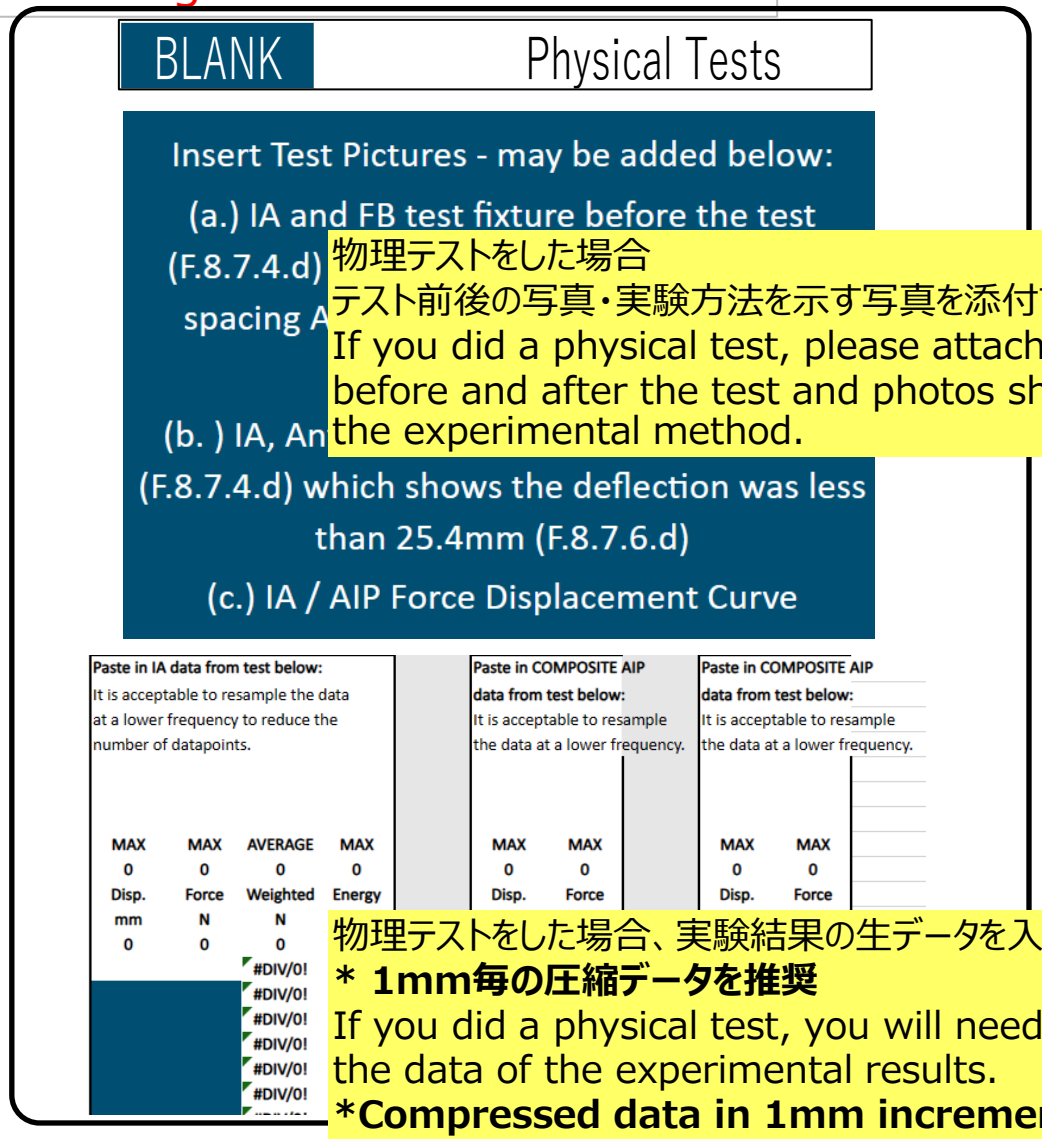


Front Wingが無い場合とIAと共に物理テストをした場合は
項目選択以外の入力不要
If there is no front wing or if the physical test was performed with IA, no input other than item selection is required.



IA無しで物理テストをした場合、ファスナーの剪断力で計算する場合、
その他独自の計算をする場合は、計算結果＋IAのピーク負荷で算出
If you perform a physical test without IA, if you calculate using the shear force of the fastener, or if you perform other original calculations, calculate using the calculated result + the peak load of IA.



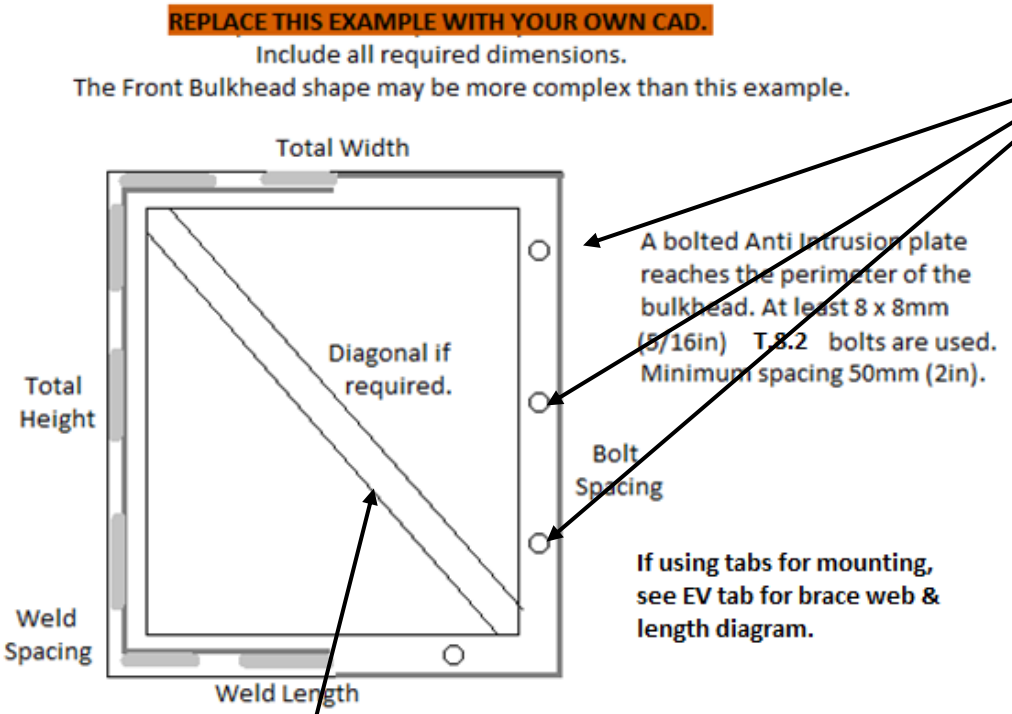


物理テストをした場合
テスト前後の写真・実験方法を示す写真を添付すること
If you did a physical test, please attach photos before and after the test and photos showing the experimental method.

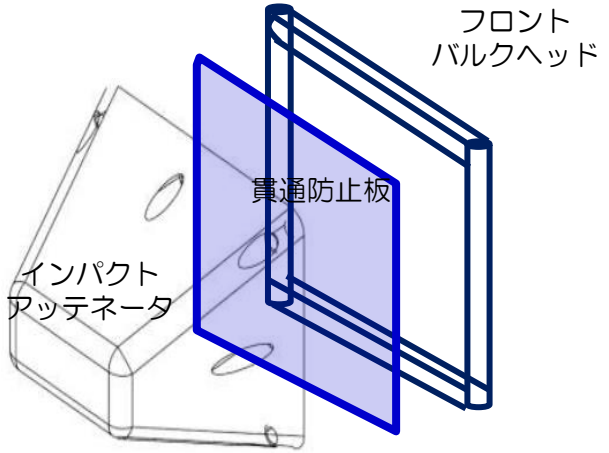
物理テストをした場合、実験結果の生データを入力する事
＊ 1mm毎の圧縮データを推奨
If you did a physical test, you will need to input the data of the experimental results.
***Compressed data in 1mm increments is recommended.**

Index

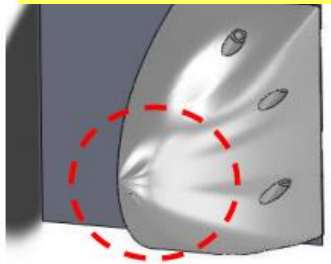
Front Bulkhead



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

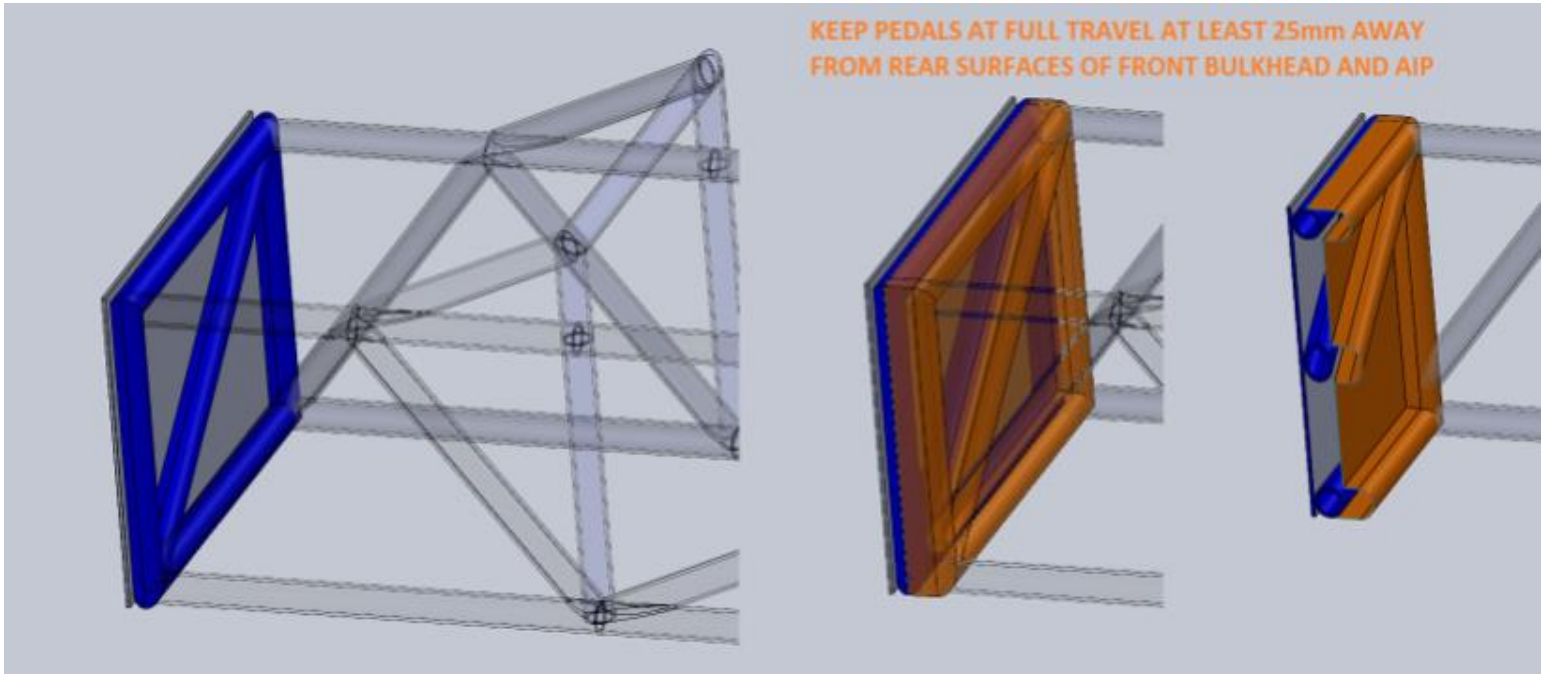


NOT PERMITTED: changed design or dimensions for Standard IA TYPE12

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.

F.8.4.3 標準IA（Form）でフロントバルクヘッドの外側寸法が400 x 350 mmより大きい場合と、標準IA（Honeycomb）を使用している場合は、Diagonalが必要。
F.8.4.3 Diagonal is required if standard IA (Form) with front bulkhead external dimensions greater than 400 x 350 mm and if standard IA (Honeycomb) is used.

Front Bulkhead



Front Bulkhead CAD with dimensions required.

Show 25mm gap to pedal assembly.

Pedal attachments preferably >25mm behind FB

https://www.fsaeonline.com/cdsweb/rqa/ViewFAQ.aspx?faqnum=368

ペダルアッセンブリにおいて、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ー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。

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).

Front Bulkhead

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					
F.6.1	**Front Bulkhead**		Tube		EQ
		Minimum	**Tube Used**		EQ
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	BLANK
F.3.5 Critical	S_Yield(S):	3.05E+08	0.00E+00	Pa	BLANK
Buckling Modulus	E_1*I_1 <= E_2*I_2:	1.70E+03			EQ
S_Yield(S):	S_1*A_1 <= S_2*A_2:	3.48E+04			EQ
Bending	4*S_1*I_1/r <= 4*S_2*I_2/r:	8.17E+02			EQ
Deflection	Bending_1/(48*EI):	1.00E-02			EQ
Energy	0.5*Bending^2/(48*EI):	4.09E+00			EQ

「Tube」の場合
In the case of "tube"

EQ					
F.7.2	Front Bulkhead Construction:	**Tube**	**0**		N/A
	Front Bulkhead Tubes Replaced Size B:	**0**	Diagonal Size C:	**0**	N/A
	Type SES Tab Name Of Layup Used:				N/A
		Front Bulkhead			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
		Front Bulkhead Height:		mm	N/A
		Front Bulkhead Width:		mm	N/A
		Cutout Height:		mm	N/A
		Cutout Width:		mm	N/A
		Composite Panel Height:	0	mm	N/A
F.3.4.2.a	Young's Modulus (E):	2.00E+11	Layup	Pa	N/A
	Ultimate Tensile Strength (S):	3.65E+08	Name	Pa	N/A
	Shear:	2.11E+08	0.00E+00	Pa	N/A
F.7.2.2		**25mm FBHS Section**			N/A
		Core thickness:	0	mm	N/A
		Outer skin thickness:	0	mm	N/A
		Inner skin thickness:	0	mm	N/A
		Thickness of panel:	0	mm	N/A
F.3.4.2.a	Young's Modulus (E):	2.00E+11	0.00E+00	Pa	N/A
	Ultimate Tensile Strength (S):	3.65E+08	0.00E+00	Pa	N/A
	Shear:	2.11E+08	0.00E+00	Pa	N/A
		0 x Steel Tube	**Flat (h)**		N/A
F.3.2.1	Minimum FB wall thickness:	0.0012	0	m	N/A
	Outer Diameter / Panel Thickness:	0.025	#VALUE!	m	N/A
F.3.4.1	Additive cross section (A):	0.00E+00	#VALUE!	m^2	N/A
	Additive second moment of inertia (I):	0.00E+00		m^4	N/A
Buckling Modulus	E_1*I_1 <= E_2*I_2+E_3*I_3:	0.00E+00			N/A
UTS	S_1*A_1 <= S_2*A_2+S_3*A_3:	0.00E+00			N/A
Bending	4*S_1*I_1/r <= 4*(S_2*I_2+S_3*I_3)/r:	0.00E+00			N/A
Deflection	Bending_1/(48*EI):	0.00E+00			N/A
Energy	F.4.3.2-3 comparison:	0.00E+00			N/A
F.7.3.3	1.5mm Steel Shear Equivalence:	3.16E+08			N/A

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

EQ					
F.6.1	**Front Bulkhead**		Composite		EQ
		Minimum	**Tube Used**		N/A
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	N/A
F.3.5 Critical	S_Yield(S):	3.05E+08	0.00E+00	Pa	N/A
Buckling Modulus	E_1*I_1 <= E_2*I_2:	1.70E+03			N/A
S_Yield(S):	S_1*A_1 <= S_2*A_2:	3.48E+04			N/A
Bending	4*S_1*I_1/r <= 4*S_2*I_2/r:	8.17E+02			N/A
Deflection	Bending_1/(48*EI):	1.00E-02			N/A
Energy	0.5*Bending^2/(48*EI):	4.09E+00			N/A

BLANK					
F.7.2	Front Bulkhead Construction:	**Composite**	**0**		EQ
	Front Bulkhead Tubes Replaced Size B:	**2**	Diagonal Size C:	**0**	EQ
	Type SES Tab Name Of Layup Used:				BLANK
		Front Bulkhead			EQ
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
		Front Bulkhead Height:		mm	BLANK
		Front Bulkhead Width:		mm	BLANK
		Cutout Height:		mm	BLANK
		Cutout Width:		mm	BLANK
		Composite Panel Height:	0	mm	EQ
F.3.4.2.a	Young's Modulus (E):	2.00E+11	Layup	Pa	BLANK
	Ultimate Tensile Strength (S):	3.65E+08	Name	Pa	BLANK
	Shear:	2.11E+08	Typo	Pa	BLANK
F.7.2.2		**25mm FBHS Section**			EQ
		Core thickness:	0	mm	EQ
		Outer skin thickness:	0	mm	EQ
		Inner skin thickness:	0	mm	EQ
		Thickness of panel:	0	mm	EQ
F.3.4.2.a	Young's Modulus (E):	2.00E+11	0.00E+00	Pa	EQ
	Ultimate Tensile Strength (S):	3.65E+08	0.00E+00	Pa	EQ
	Shear:	2.11E+08	0.00E+00	Pa	EQ
		2 x Steel Tube	**Flat (h)**		EQ
F.3.2.1	Minimum FB wall thickness:	0.0016	0	m	EQ
	Outer Diameter / Panel Thickness:	0.025	#VALUE!	m	EQ
F.3.4.1	Additive cross section (A):	2.28E-04	#VALUE!	m^2	EQ
	Additive second moment of inertia (I):	1.70E-08		m^4	EQ
Buckling Modulus	E_1*I_1 <= E_2*I_2+E_3*I_3:	3.40E+03			EQ
UTS	S_1*A_1 <= S_2*A_2+S_3*A_3:	8.32E+04			EQ
Bending	4*S_1*I_1/r <= 4*(S_2*I_2+S_3*I_3)/r:	1.96E+03			EQ
Deflection	Bending_1/(48*EI):	1.20E-02			EQ
Energy	F.4.3.2-3 comparison:	#REF!		#REF!	#REF!
F.7.3.3	1.5mm Steel Shear Equivalence:	3.16E+08			EQ

「Composite」の場合
In the case of
“ Composite”

Index

AIP Attachment

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

BLANK AIP and Diagonal Attachment

F.8.2.2 A welded AIP must reach tube centerlines. Any other AIP must match the bulkhead
F.8.2.3.b Anti Intrusion Plates bolted through welded inserts on the centerline of Size B tube automatically meet the 15kN load requirement. **The centerline method is strongly**
F.8.2.3.c Bonding is legal for composite bulkheads with no openings. The entire surface mus
F.8.3 An integrated composite AIP may also qualify as the monocoque front bulkhead.
F.8.2.3.d If the AIP does not meet FB equivalence, it may be fully enclosed in a monocoque the front bulkhead layup.

	BLANK		
F.8.2.2	AIP to FB Attachment:		BLAN
	Al plate must match entire Front Bulkhead		EQ
F.8.4.3.d	Scroll to bottom		BLANK
	Scroll to bottom		BLANK

Welded
Bolted
Bonded
Laminated

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

Weldedの場合 In the case of “Welded”

	BLANK		
F.8.2.2	AIP to FB Attachment:	Welded	EQ
	Al plate must at least reach the centerline of Front Bulkhead tubes.		EQ
F.8.2.3.a	At least half the perimeter must be welded:	%	BLANK
	Shortest weld >= 25mm (1in):	mm	BLANK

Boltedの場合 In the case of “Bolted”

F.8.2.2	AIP to FB Attachment:	Bolted	EQ
	Al plate must match entire Front Bulkhead perimeter.		EQ
F.8.2.3.b	Number of 8mm critical fasteners (8 required):		BLANK
	Minimum distance between bolt centers:	mm	BLANK

	BLANK		
	Bolting AIP to tube Front Bulkhead		LANK
F.8.2.3.b	Locate Al bolts through FB tube inserts or on tabs:		BLANK
	Maximum Fastener centerline offset from tube surface:		BLANK
	Mount cross section on tube surface:		BLANK
	ickness (B):		BLANK
	t length (L):	mm	BLANK
	ickness (T):	mm	BLANK
	nt face (H):	mm	BLANK
	<= Su-Weld:		EQ
	<= Su-Weld:		EQ
	a <= Shear:		EQ

Nut And Bolt
Quick Release

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

Bondedの場合 In the case of “Bonded”

	Bonding AIP to composite Front Bulkhead			EQ
F.8.2.3.c	Is there an opening in the Front Bulkhead?			EQ
	What is the brand name of the adhesive?			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
	Minimum bond area:		mm^2	BLANK
	Calculated bond strength:			EQ

Laminatedの場合 In the case of “Laminated”

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:		mm	BLANK
	Scaling option, layup repeats:	Laminate thickness:	Typo mm	EQ
		Skin shear area - centerline x 1 thickness:	#VALUE! m^2	EQ
		Skin shear strength:	Typo Pa	EQ
F.8.2.3.d		Single tearout path >=120000N:	0.00%	EQ
		Front Hoop Lamination:		BLANK
		Lap joint strength:	Typo Pa	EQ
	Total bond width including both sides of the Front Hoop:		mm	BLANK
		Bond shear area:	0 m^2	EQ
F.8.2.3.d		Bond failure >=120000N:	#VALUE! #VALUE!	EQ

Quick Relese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	N		EQ
	Shear Diameter:	mm	Fastener UTS (Screenshot):	MPa	BLANK
	Number of positive locking diameters in shear:				BLANK
	Fasteners: Number_of_fasteners * 0.577 * UTS * pi * OD^2 / 4:	0	0.00%		BLANK
	--Tearout--Front Bulkhead Min Fastener Spacing, Tube Radius, Or Edge:		mm		BLANK
	FB: Number_of_fasteners * FB_thickness * FB_shear * Tearout:	#VALUE!	#VALUE!		#VALUE!
	--Tearout--AIP Min Fastener Spacing Or Edge:		mm		BLANK
	AIP: Number_of_fasteners * AIP_thickness * AIP_shear * Tearout:	0	0.00%		BLANK
	Quick Release must pass entirely through front bulkhead and AIP.				

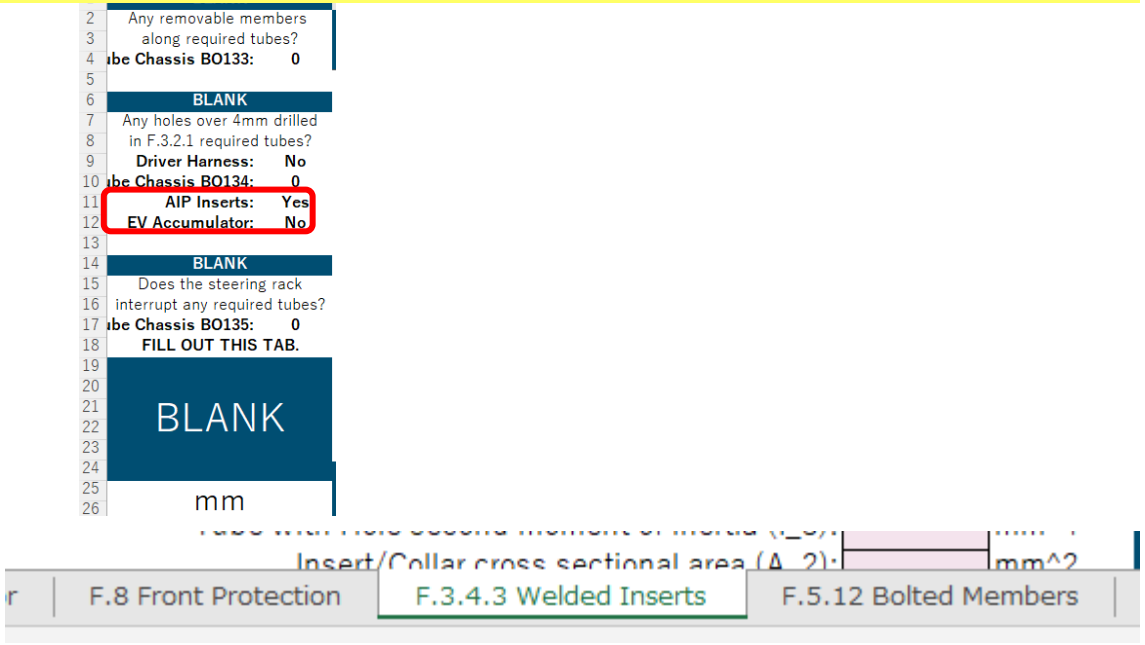
Caution：AIP Attachment

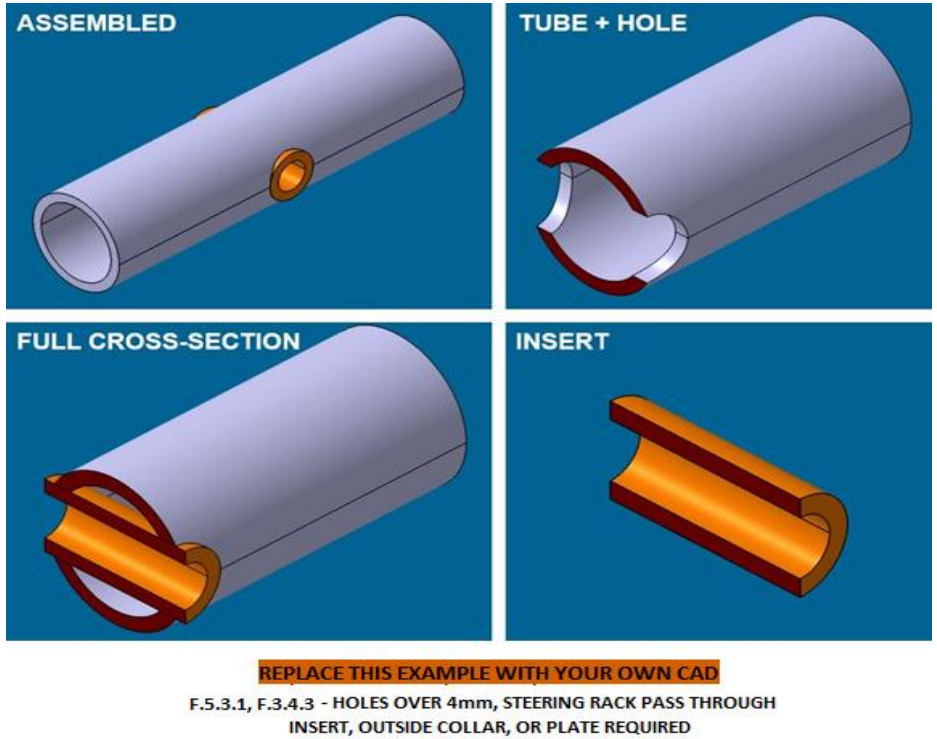
Centerline Insertsの場合「Welded Inserts」の対象となる
In the case of CentralLine Inserts, it is eligible for "Welded Inserts"

			EQ
	Bolting AIP to tube Front Bulkhead	Nut And Bolt	EQ
F.8.2.3.b	Locate Al 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.





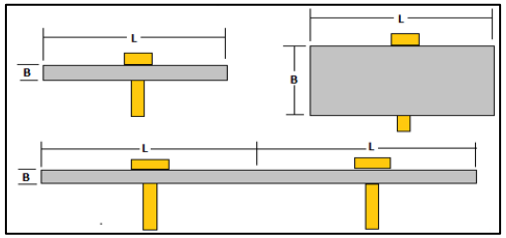
Caution：AIP Attachment

Offset Mountsの場合
In the case of “Offset Mounts”

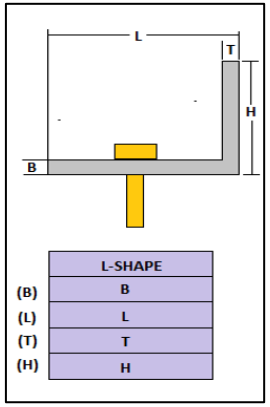
Bolting AIP to tube Front Bulkhead: Nut And Bolt — EQ
F.8.2.3.b Locate Al bolts through FB tube inserts or on tabs: Offset Mounts — EQ
Maximum Fastener centerline offset from tube surface: mm — BLANK
Mount cross section on tube surface: Single Layer — EQ
See diagrams: EV Acc tab AY28-BI28 Mount thickness (B): — BLANK
Mount length (L): — BLANK
Mount length (L): — BLANK
Mount thickness (B): — BLANK
F.3.5 0.0 [5kN shear bending M*y / I <= Su-Weld: — EQ
0.00E+00 0.0 [kN normal bending M*y / I <= Su-Weld: — EQ
0.00E+00 Parabolic shear 3*Test Load/2*area <= Shear: — EQ

Single Layer
H-Shape
L-Shape
U-Shape
Rectangular Tube

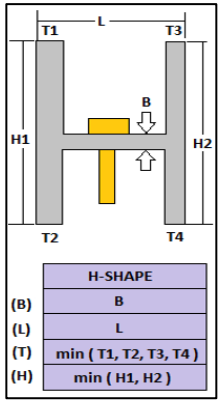
これらの絵は、「グレーのハッチング面が溶接面」と解釈する。



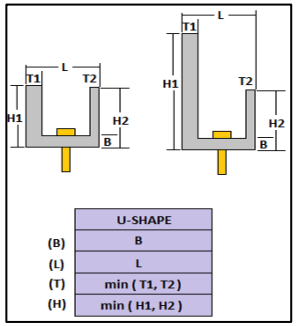
CROSS SECTION	SINGLE LAYER
MOUNT THICKNESS (B)	B
MOUNT LENGTH (L)	L
MINIMUM GUSSET THICKNESS (T)	L
MINIMUM GUSSET HEIGHT (H)	B



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

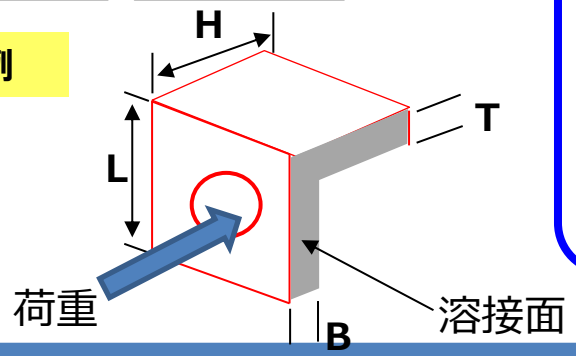


	H-SHAPE
(B)	B
(L)	L
(T)	min (T1, T2, T3, T4)
(H)	min (H1, H2)



	U-SHAPE
(B)	B
(L)	L
(T)	min (T1, T2)
(H)	min (H1, H2)

「L-Shape」の例

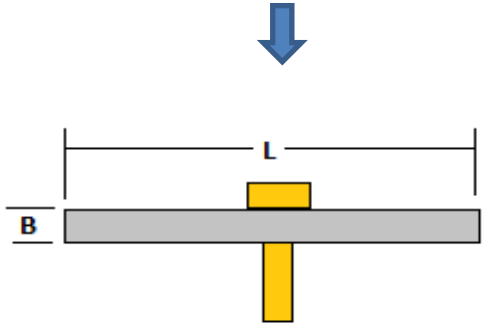


Tab形状を選択し、その形状に応じた(B),(L),(T),(H)を入力する

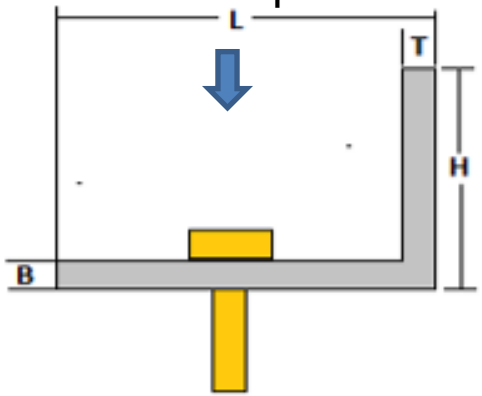
Select the tab shape and enter (b), (l), (t), and (h) according to the shape.

See diagrams: EV Acc tab AY28-BI28
Mount thickness (B): mm — BLANK
Mount length (L): mm — BLANK
Mount length (L): mm — BLANK
Mount thickness (B): mm — BLANK

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.

Index

Physical Tests

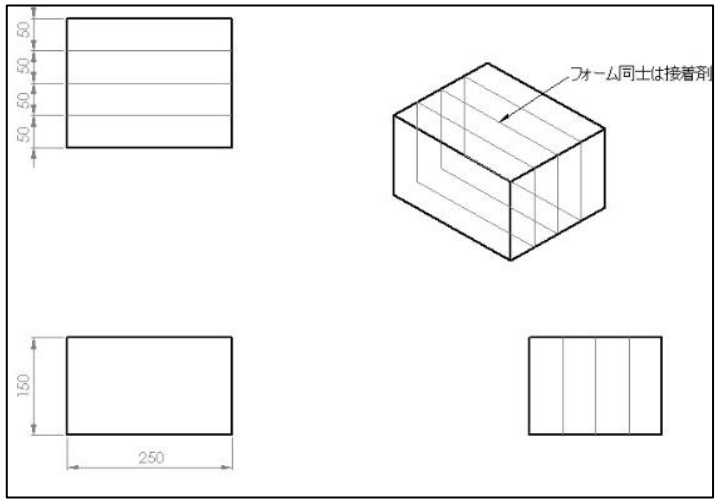
要求されたエビデンスを添付すること　Attach the requested evidence

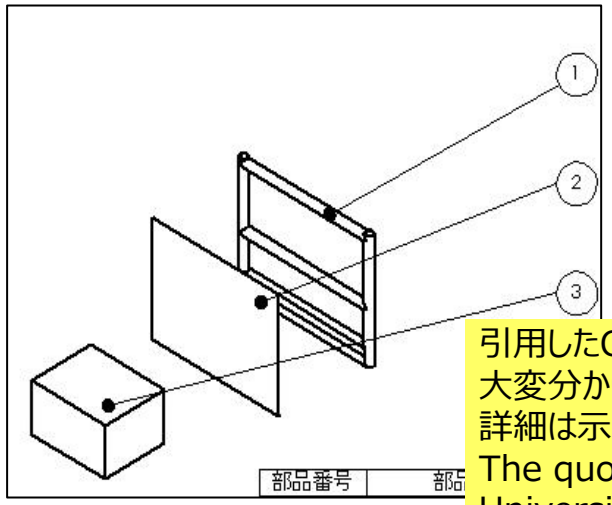
それぞれ空欄で要求される寸法が分かるCAD図や写真を記載すること
Describe diagrams and photos that shows the required dimensions

BLANK　Physical Test Fixture Guidance

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

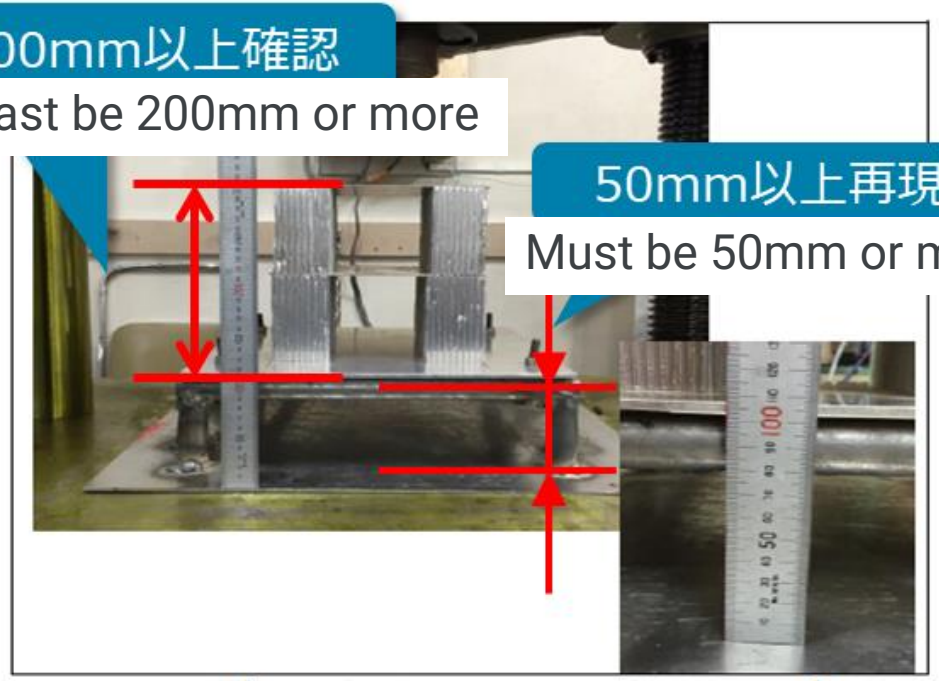
BLANK				
	Front Bulkhead Outside to Outside Height:	0	mm	BLANK
	Front Bulkhead Outside To Outside Width:	0	mm	BLANK
F.8.8.6.c	Fixture Thickness on table >=50mm:		mm	BLANK
F.8.4.2.a	Tested IA starting length > 200mm:		mm	BLANK
F.8.4.2.b	Custom IA WIDTH over 200mm length >= 200mm:		mm	BLANK
	Custom IA HEIGHT over 200mm length >= 100mm:		mm	BLANK





200mm以上確認
Mast be 200mm or more

50mm以上再現
Must be 50mm or more



引用したCAD図は茨城大学のものである
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 quoted figure is from Ibaraki University Introducing with respect as a good example

Physical Tests

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?:	Quasi Static / Dynamic		LANK
	Name of Test Facility:			BLANK
	Dates of tests:			BLANK
	Maximum crushed displacement:	0	mm	REJECT
	Post crush displacement, demonstrating any springback:		mm	BLANK
	Crushed attenuator height:		mm	BLANK
F.8.8.6.d	Al plate deformation:		mm	BLANK

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 dat
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 for

	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
	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		
	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
	Al plate deformation:		mm	N/A
F.8.3.1.b	Maximum AIP force > 120kN:		N	N/A

Physical Tests

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 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

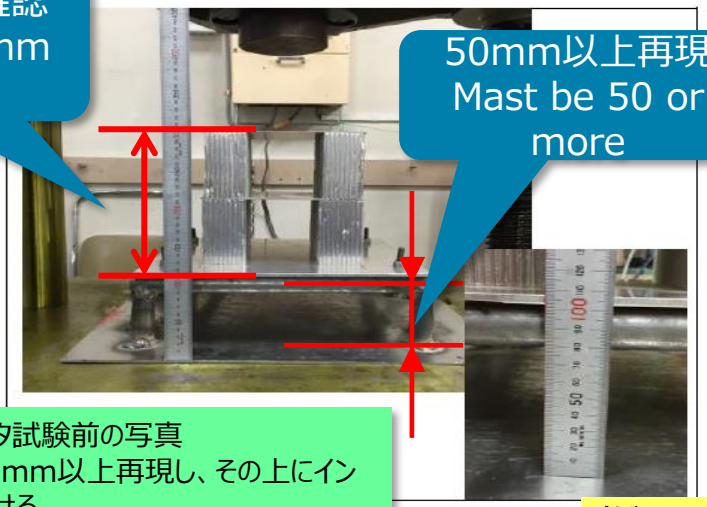
Impact Attenuator And / Or Wing Failure Test

BLANK		
Type of test used?:		BLANK
Name of Test Facility:		BLANK
Dates of tests:		BLANK
Maximum crushed displacem	0 mm	REJECT
Post crush displacement, demonstrating any sprin	mm	BLANK
Crushed attenuat	mm	BLANK

F.8.8.6.d

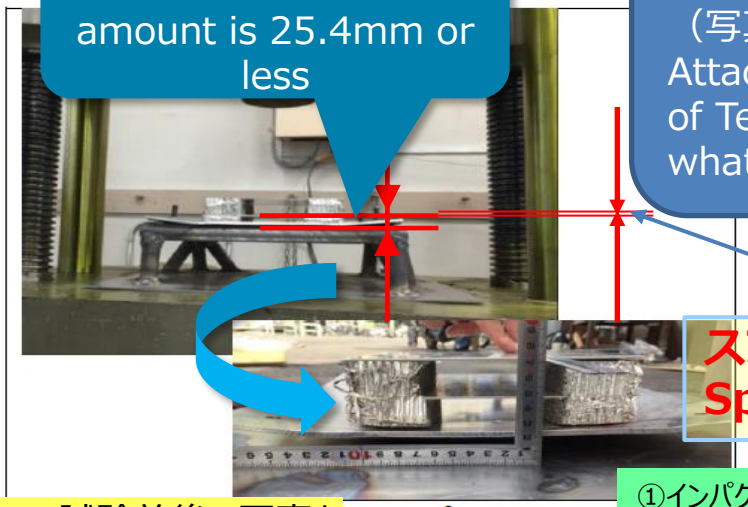
200mm以上確認
Mast be 200mm or more

50mm以上再現
Mast be 50 or more



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 Attenator test
②Reproduce 50mm or more from the penetration prevention board, and put an impact Attenator on it.

変形量は25.4mm以下
The deformation amount is 25.4mm or less



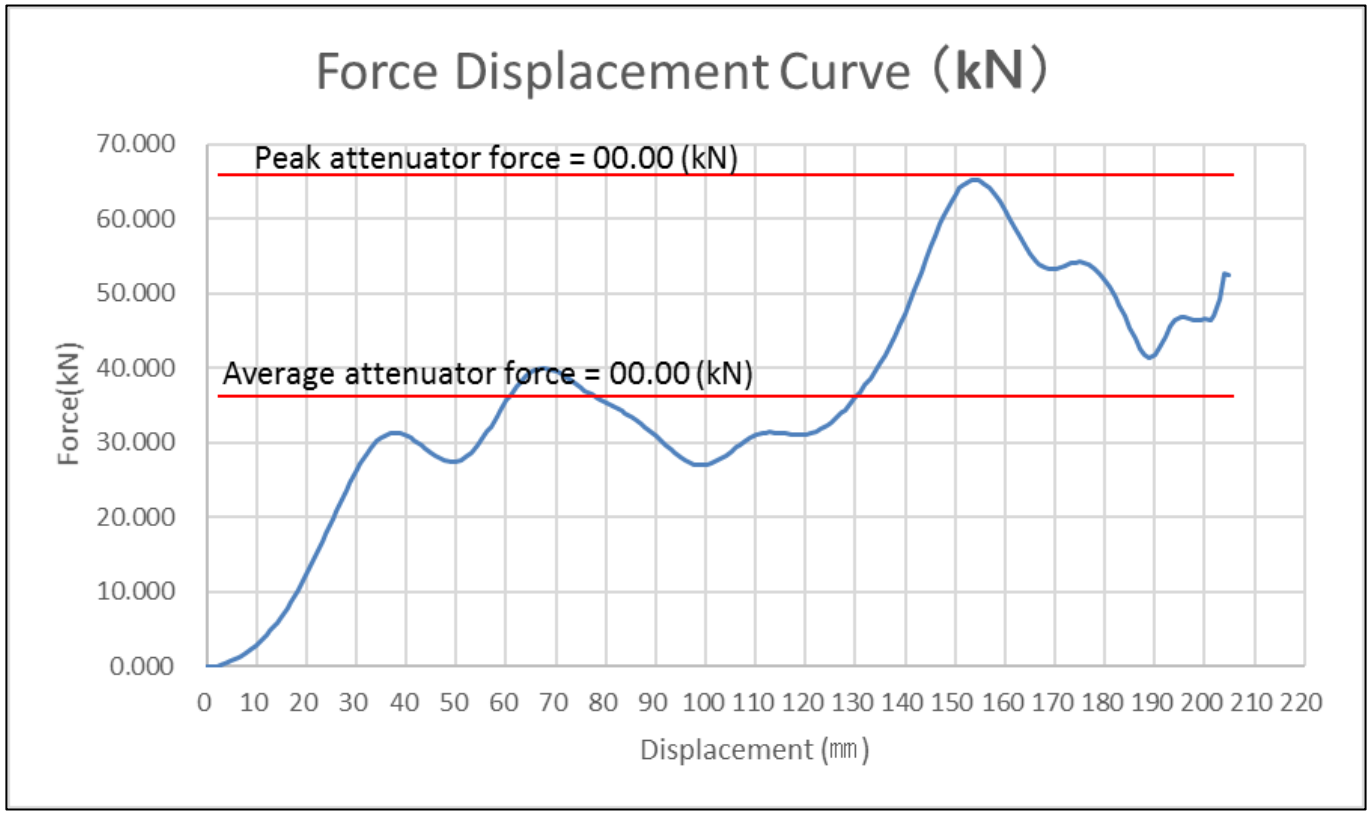
メジャーを入れて、試験前後の写真を記載すること
Describe photos before and after the exam with the scale

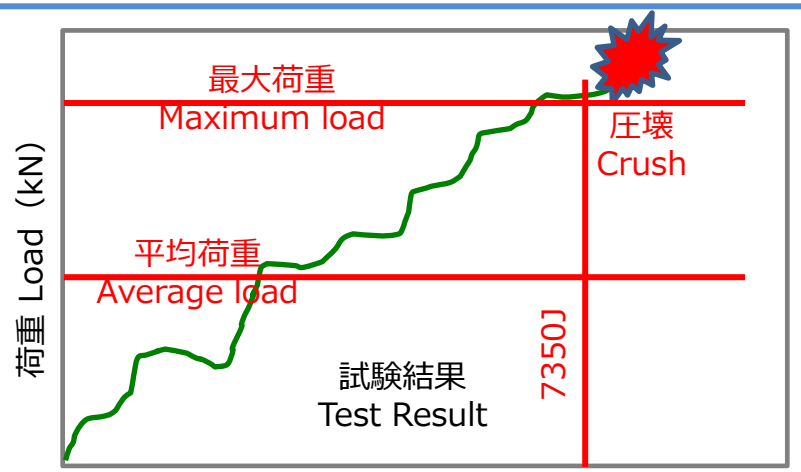
「Dates of tests」試験日を証明できる写真を添付すること。
（写真内に日付が分かるものを一緒に撮影する）
Attach a photo that can prove the "Dates of Tests" test date. (Take a picture of what you can see in the photo together)

スプリングバック量
Springback value

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 Attenator test
② Measure the amount of deformation of the AIP
③ Measure the springback amount of IA

Physical Tests





Paste in logged data from test below:
It is acceptable to resample the data at a lower frequency to reduce the number of datapoints. Repeat the weighted average force and energy calculations in columns three and four. Do not assume all steps are

Disp. mm MAX	Force N MAX	Weighted Average Force N	Energy J MAX
15	6511		12.386
0	0		0
1	4		
2	35		
3	169		
4	497		
5	694		
6	1160		
7	1432		
8	1732		
9	2421		
10	2813		
11	3694		
12	4186		
13	4713		
14	5875		
15	6511		

1㎜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