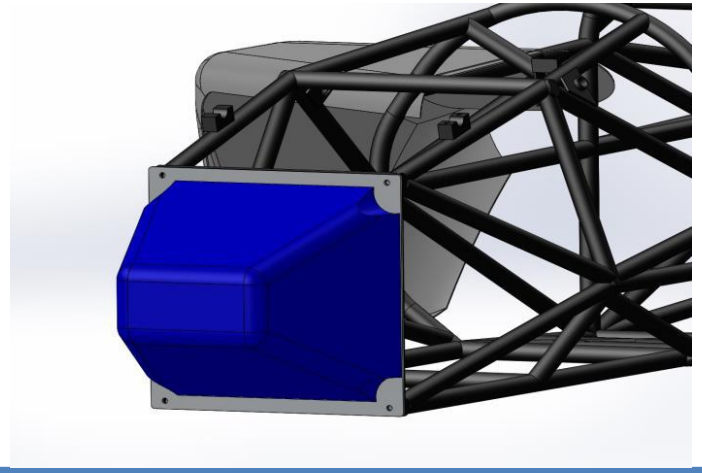
2024 SES (Structural Equivalency Spreadsheet) guidance

F.8 Front Protection



Attenuator and Diagonal

There are 4 choices for IA, and the test method should follow each type.

BLANK Attenuator and Diagonal

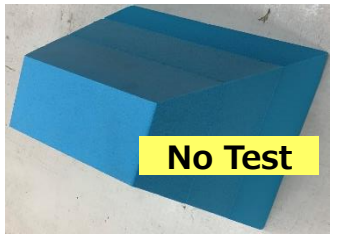
No Test: +

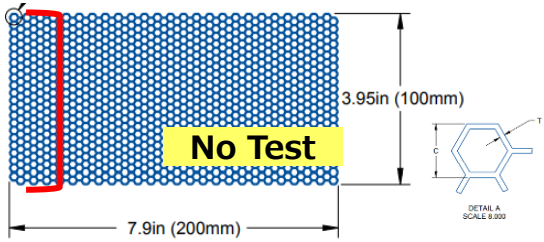
		BLANK		
F.8.4.1	Impact Attenuator Type:	4択		BLANK
	Standard Foam Attenuator Height:	304mm (12in)		N/A
	Standard Foam Attenuator Width:	355mm (14in)		N/A
F.8.4.3	Front Bulkhead Outside to Outside Height:		mm	BLANK
	Front Bulkhead Outside To Outside Width:		mm	BLANK

		BLANK		
F.8.4.3	Diagonal Tube, Attenuator Test, or Composite			BLANK
		Minimum	Tube Used	EQ
F.3.2.1	Example: 25.4mm x 1.2mm round	Steel		BLANK
F.3.4.1	Diagonal Minimum Tube:	Size C		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):	9.10E-05	m^2	EQ
	Tube second moment of inertia (I):	6.70E-09	m^4	EQ
F.3.4.2	Young's Modulus (E):	2.00E+11	0.00E+00 Pa	BLANK
F.3.5	Sy:	3.05E+08	0.00E+00 Pa	BLANK
Critical Buckling Modulus	E_1*I_1 <= E_2*I_2:	1.34E+03		EQ
Sy:	S_1*A_1 <= S_2*A_2:	2.78E+04		EQ
Bending Deflection Energy	4*S_1*I_1/r <= 4*S_2*I_2/r:	6.43E+02		EQ
	Bending_1/(48*EI):	1.00E-02		EQ
	0.5*Bending^2/(48*EI):	3.22E+00		EQ

Select answers for all questions

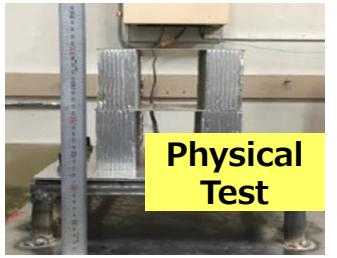
- **Standard Foam**
- **Standard Honeycomb**
- **Custom-Non-Composite**
- **Custom-Composite : Meaning of monocoque structure**





There are 4 types of test methods depending on the IA type.

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



Attenuator and Diagonal

Attach the requested evidence

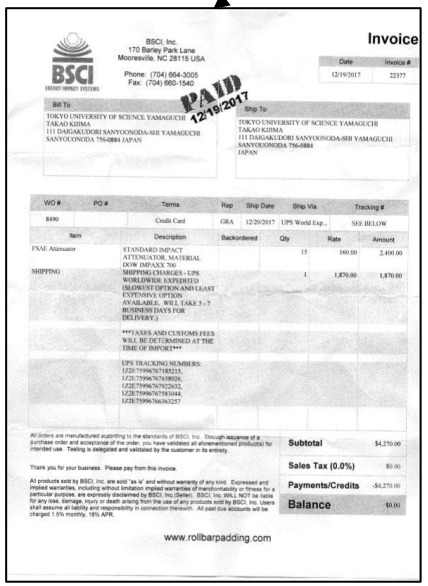
Insert Pictures - may be added left or below:

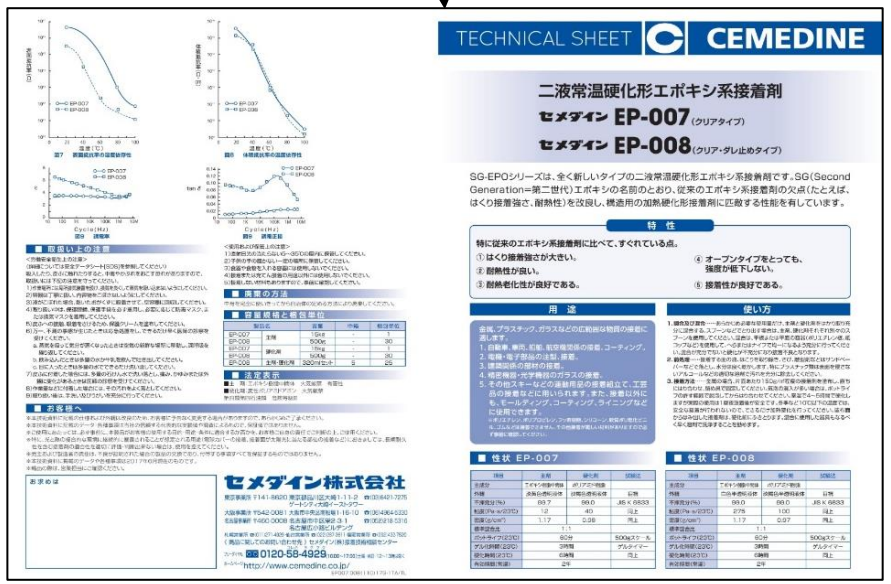
(a.) Standard Impact Attenuator Receipt

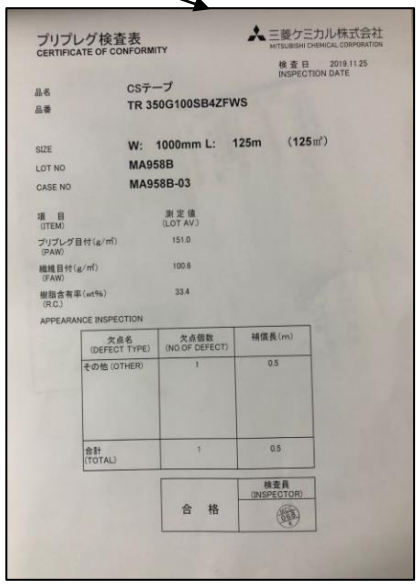
(b.) Adhesive Material Properties -
Indicate selected value, include units conversion

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

These are examples and the format does not matter.

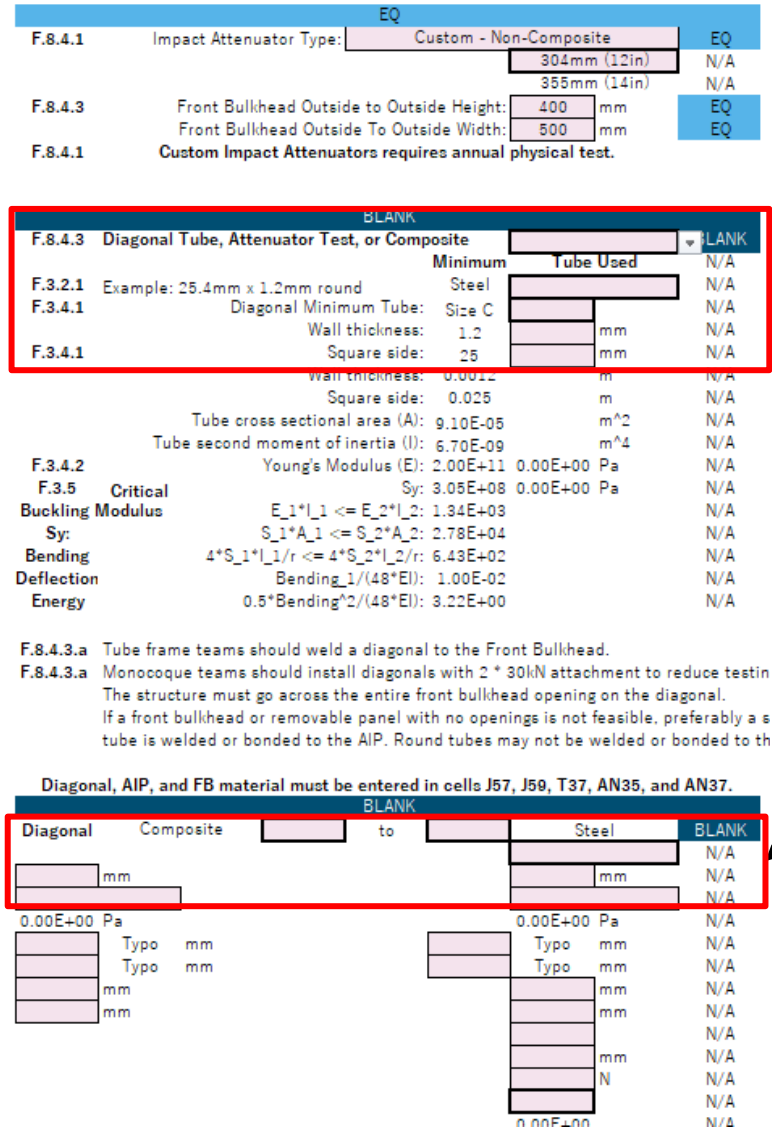






Attenuator and Diagonal

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
	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

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

If Diagonal is required for FBH in Standard IA, don't forget to input these as well.

Anti-Intrusion Plate

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
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 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
	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
	ment, Vertical (120kN Partial UDL):		Nm	EQ
	nt, Horizontal (120kN Partial UDL):		Nm	EQ
	Max Bending * Max y / I = Max Stress, Vertical:		Pa	EQ
	Max Bending * Max y / I = Max Stress, Horizontal:		Pa	EQ
	UTS (S) / Max Stress = Safety Factor, Bending:			EQ
	Perimeter Shear Stress, 120kN Load:		Pa	EQ
	Safety Factor, Perimeter Shear:			EQ

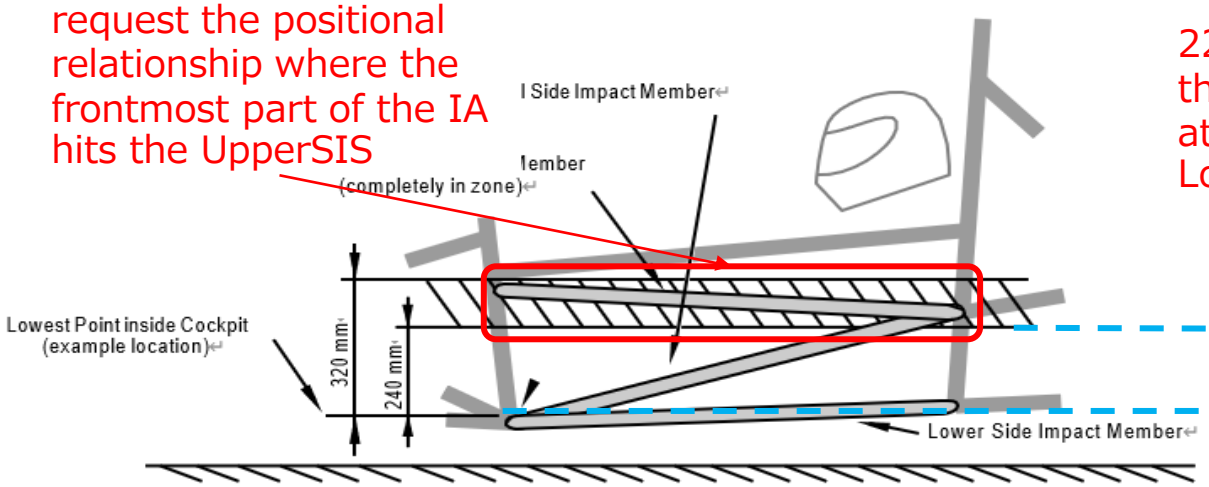
Added in 2024
Added rules regarding core thickness

"BLANK" is not accepted
Must be "EQ"

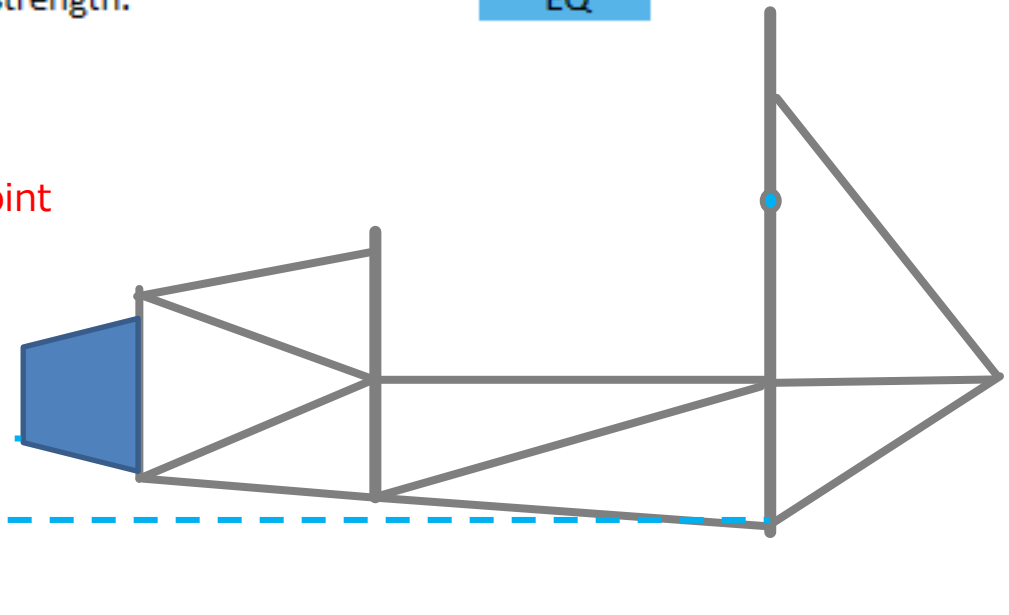
IA Attachment

		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 < 220mm above lower SIS:		mm	BLANK
	F.8.5.2	IA to AI plate mounting method:	Bonded		EQ
					N/A
				mm	N/A
		What is the brand name of the adhesive?:			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
	F.8.5.3.c	Minimum bond area:		mm^2	BLANK
		Calculated bond strength:			EQ

Assuming a collision with the side of the vehicle, request the positional relationship where the frontmost part of the IA hits the UpperSIS



220mm from the lowest point at the top of Lower SIS



Anti-Intrusion Plate, IA Attachment

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

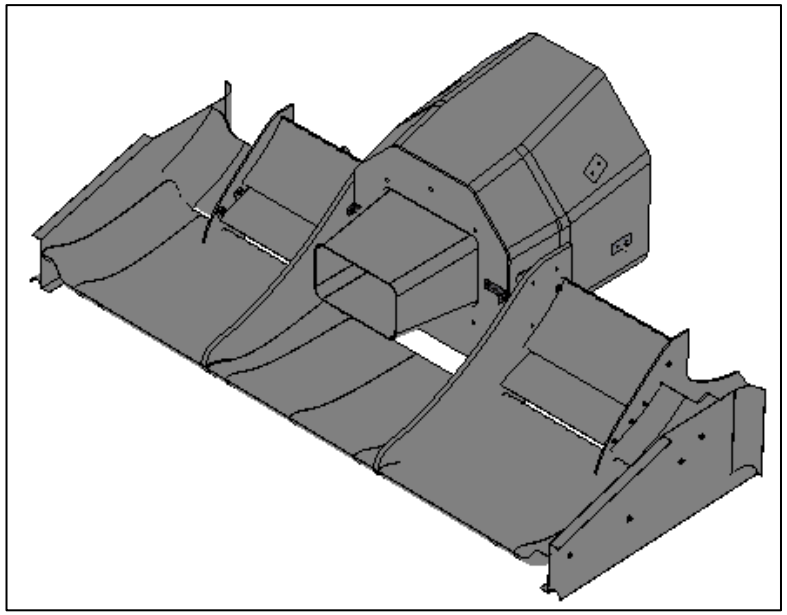
(e.) Other Wing Detachment Calculations (if not using standard fastener shear)

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.

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.

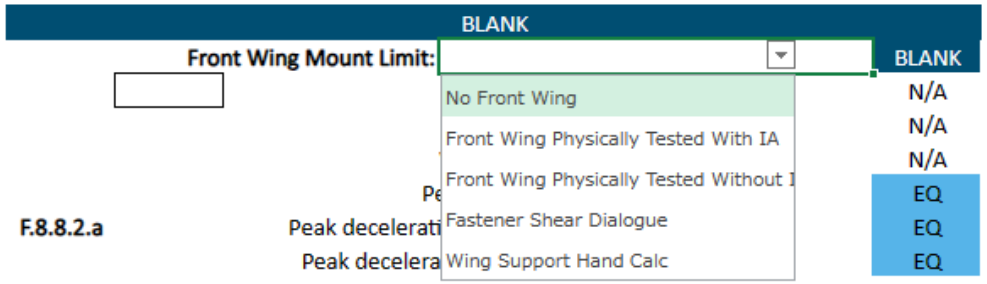


The diagram cited is from Tokai University.
It is an exemplary diagram, so I respectfully introduce it as a reference.

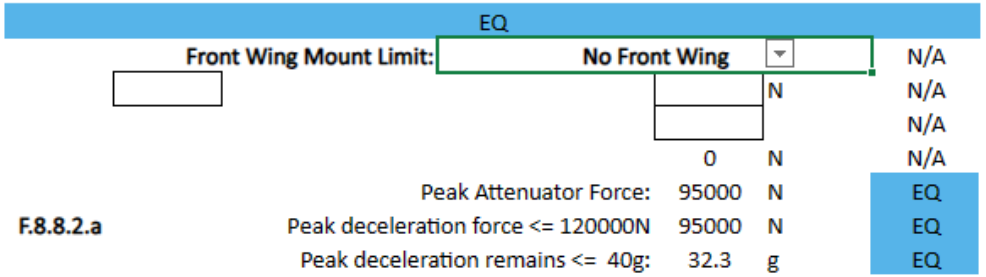
Wing Detachment

The concept when including the Front Wing is the same as before.

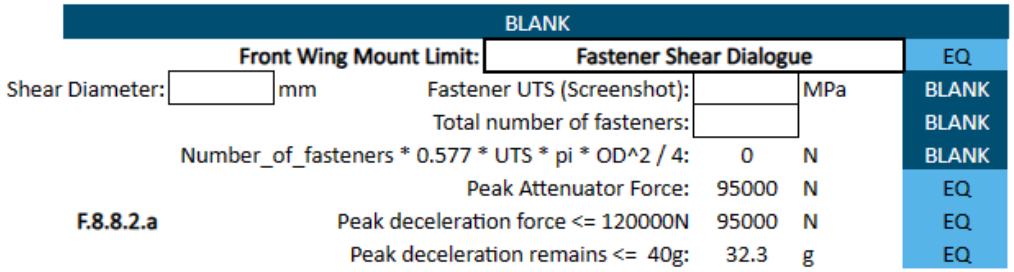
Please note that there are 5 types of Front Wing Mount Limit and the input items are different.

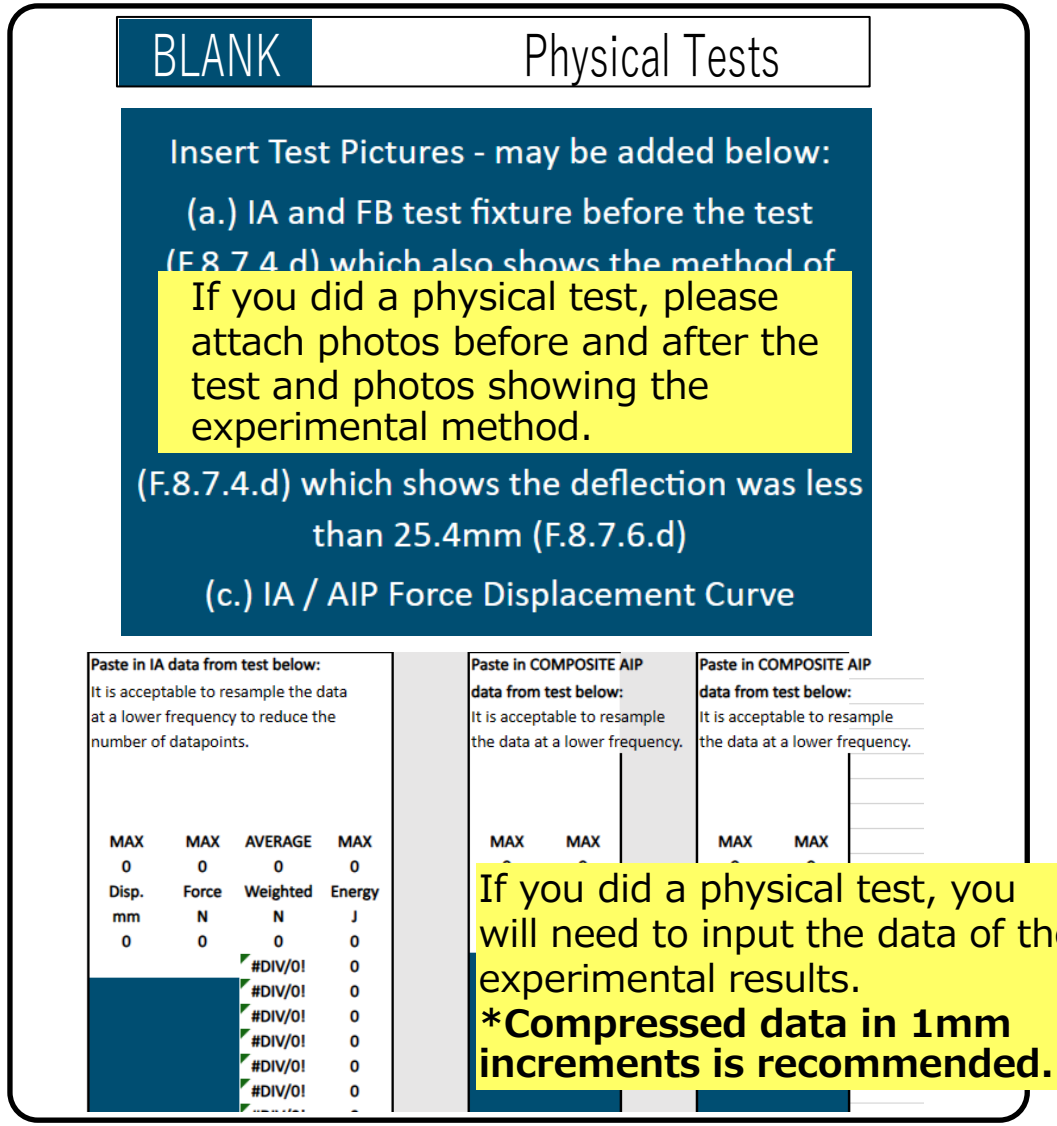


Front Wingが無い場合とIAと共に物理テストをした場合は項目選択以外の入力不要

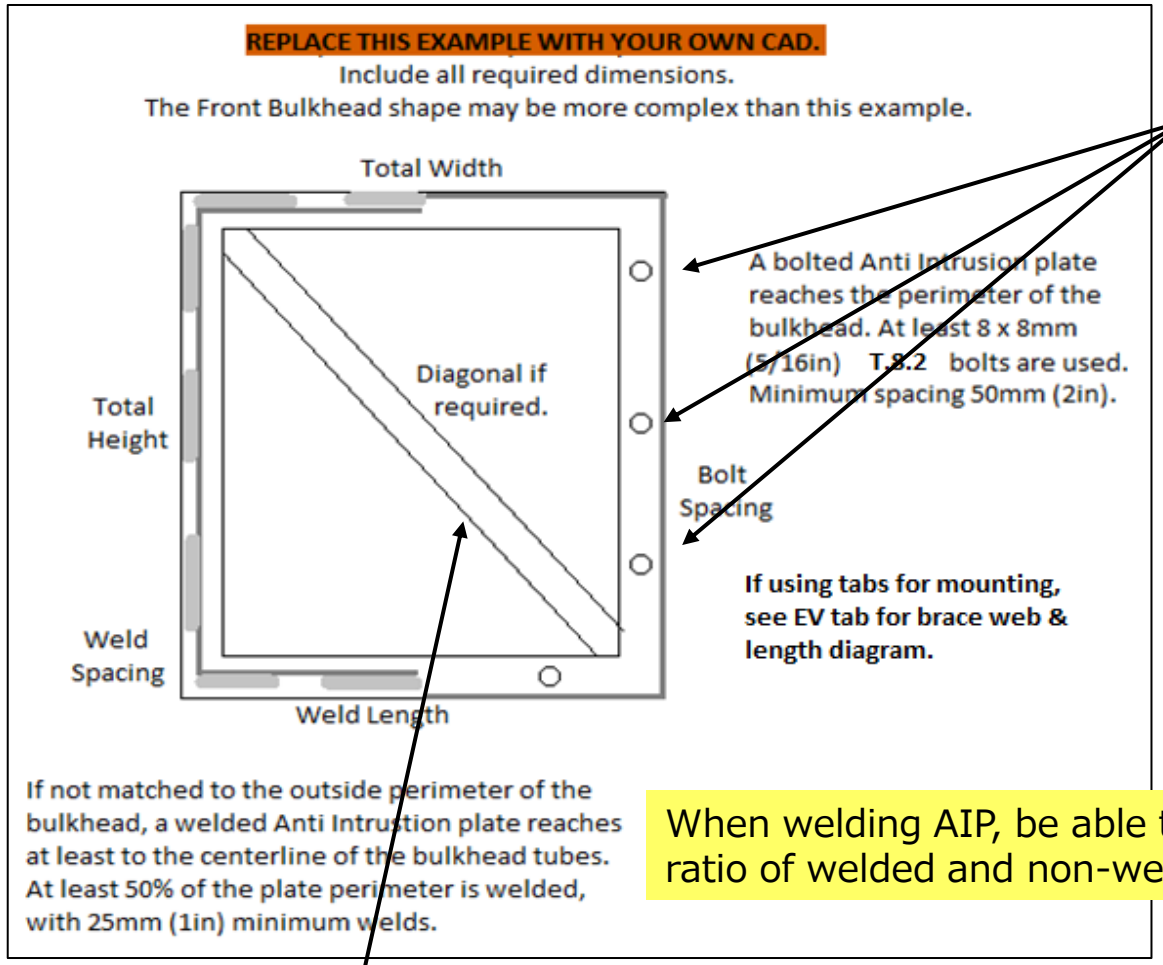


IA無しで物理テストをした場合、ファスナーの剪断力で計算する場合、その他独自の計算をする場合は、計算結果＋IAのピーク負荷で算出

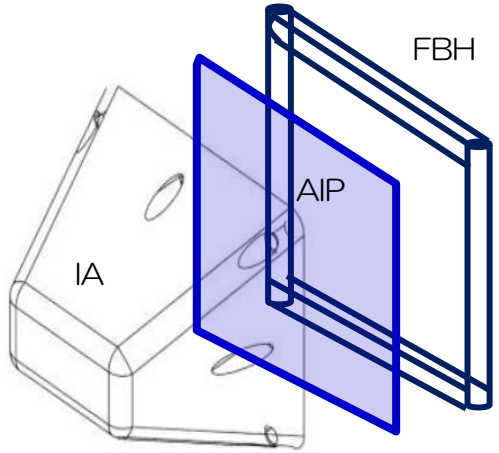




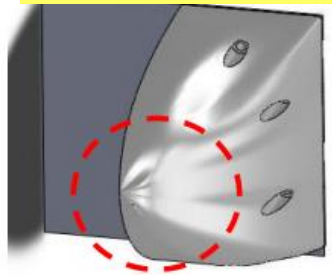
Front Bulkhead



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



Standard IA prohibits any processing or shape modification

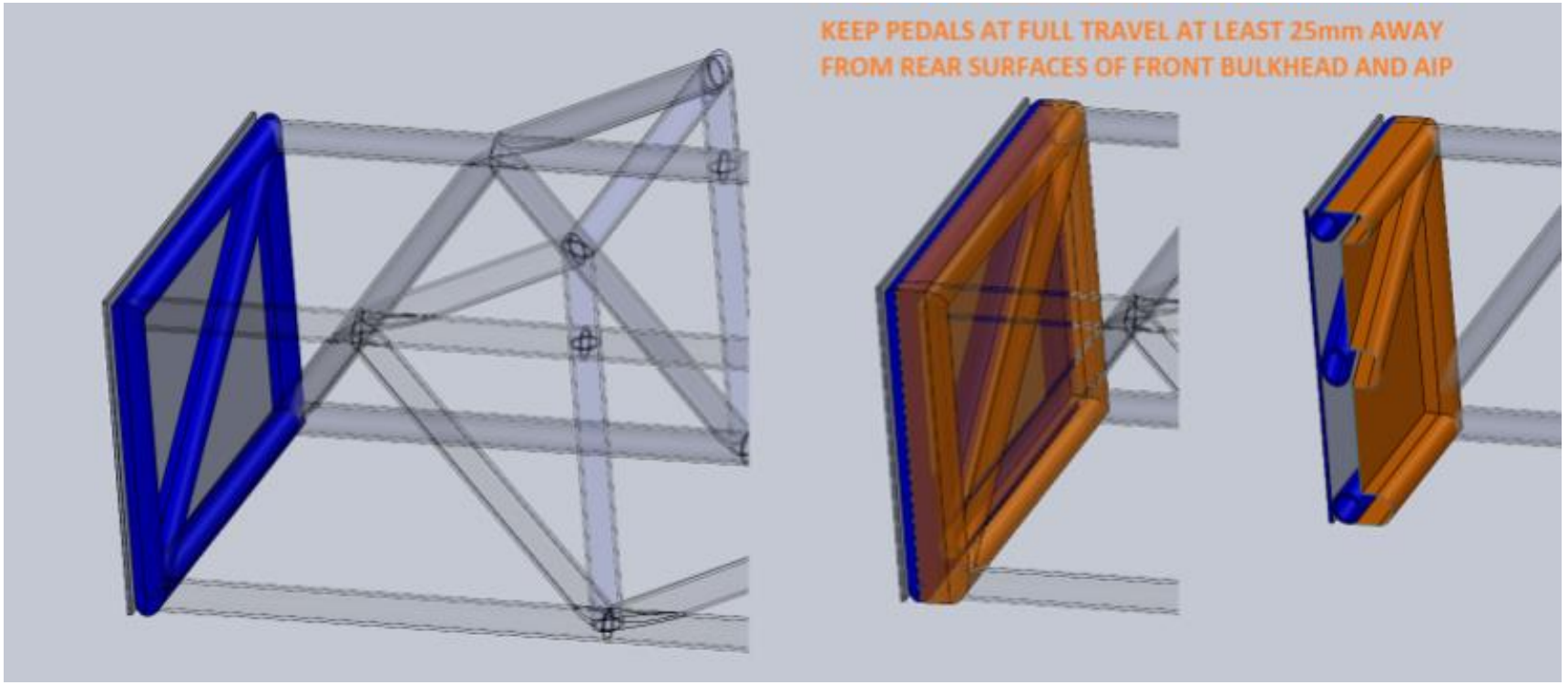


NOT PERMITTED: changed design or dimensions for Standard IA TYPE12

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

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.

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

Front Bulkhead

Tube and composite have different input items

F.8.2.4 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 8			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

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	Typo	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.8.2.4 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 8			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

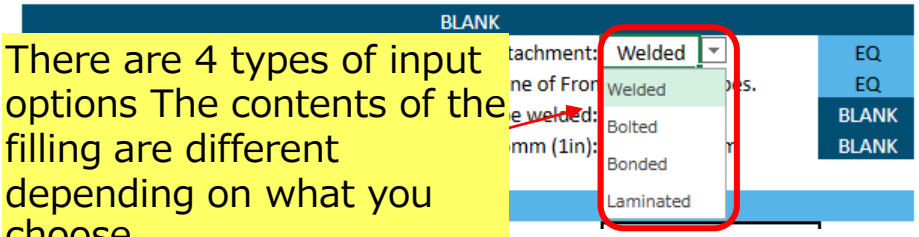
BLANK					
F.7.2	Front Bulkhead Construction:	Composite	0		EQ
	Front Bulkhead Tubes Replaced Size B:	2	Diagonal Size C:	0	EQ
	Type SES Tab Name Of Layup Used:				BLANK
	Front Bulkhead				EQ
F.4.3.2.d	50% < Core < 100%: Typo	Core thickness:		mm	BLANK
	Scaling option, layup repeats:	Outer skin thickness:	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:	########		########	########
F.7.3.3	1.5mm Steel Shear Equivalence:	3.16E+08			EQ

In case of "Composite"

AIP Attachment

Attach the requested evidence

There are 4 types of input options The contents of the filling are different depending on what you choose



For 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

For bolted

	BLANK	
	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 Nut And Bolt	EQ
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
See diagrams: EV Acc tab AY28-BI28	Mount thickness (B): mm	BLANK
	nt length (L): mm	BLANK
	thickness (T): mm	BLANK
	unt face (H): mm	BLANK
	<= Su-Weld:	EQ
	<= Su-Weld:	EQ
	rea <= Shear:	EQ

Nut And Bolt
Quick Release

If you select a bolt, two types of options will appear
↑ Added in 2024

For Bonded

	BLANK		
	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

For 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:		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

If you select Quick Release, increase input items ⇒

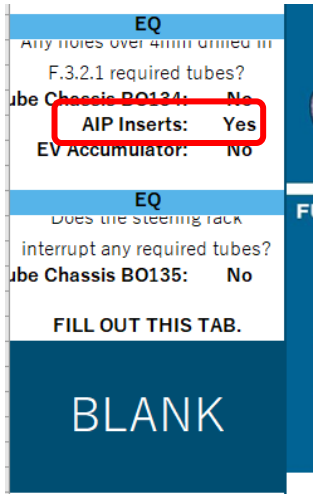
	BLANK			
	Shear Calculation for Positive Locking on Quick Release			EQ
	Positive Locking Shear Requirement	95000	N	EQ
Shear Diameter: mm	Fastener UTS (Screenshot):		MPa	BLANK
	Number of positive locking diameters in shear:			BLANK
	Number_of_fasteners * 0.577 * UTS * pi * OD^2 / 4:	0	0.00%	BLANK

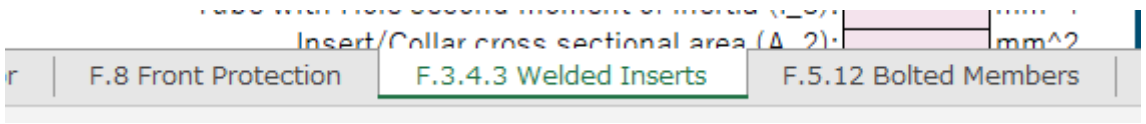
注意：AIP Attachment

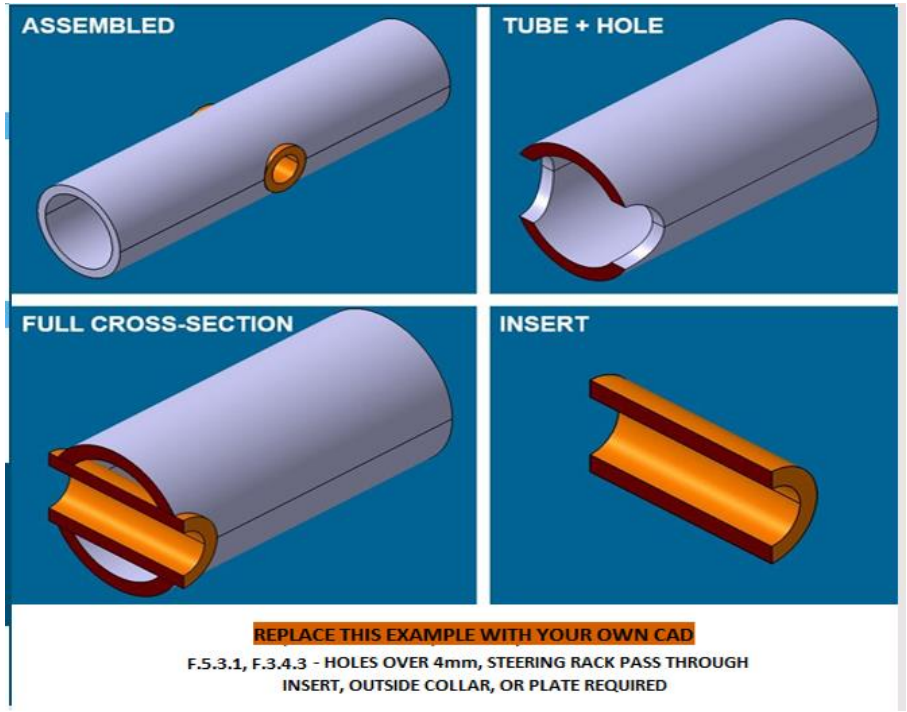
In the case of CentralLine Inserts, it is eligible for "Welded Inserts"

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

In the "F. 3. 4. 3 Welded Inserts" sheet, Aip Inserts is determined to "Yes", so enter into this sheet.







注意：AIP Attachment

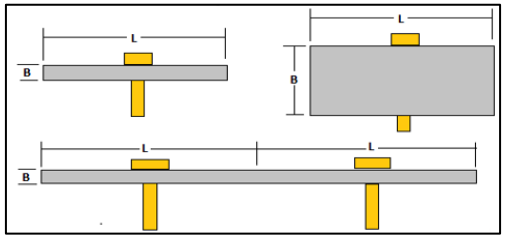
For "Offset Mounts"

	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:	Centerline Inserts	EQ
	Maximum Fastener centerline offset from tube surface:	mm	N/A
	Mount cross section on tube surface:		N/A
See diagrams: EV Acc tab AY28-BI28	Mount thickness (B):	Single Layer	N/A
	Mount length (L):	H-Shape	N/A
	Minimum gusset thickness (T):	L-Shape	N/A
	Minimum gusset height normal to mount face (H):	U-Shape	N/A
F.3.5	0.0 15kN shear bending M*y / I <= Su-Weld:	Rectangular Tube	N/A
0.00E+00	0.0 15kN normal bending M*y / I <= Su-Weld:		N/A
0.00E+00	Parabolic shear 3*Test Load/2*area <= Shear:		N/A

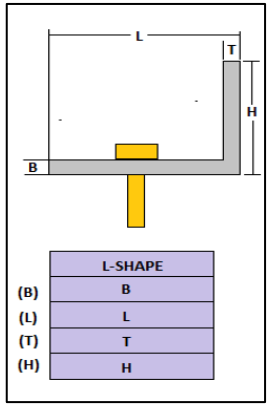
Select the tab shape and enter (b), (l), (t), and (h) according to the shape.

ns: EV Acc tab AY28-BI28	Mount thickness (B):	mm
	Mount length (L):	mm
	Minimum gusset thickness (T):	mm
	Minimum gusset height normal to mount face (H):	mm

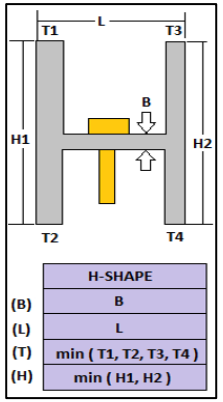
これらの絵は、「グレーのハッチング面が溶接面」と解釈する。



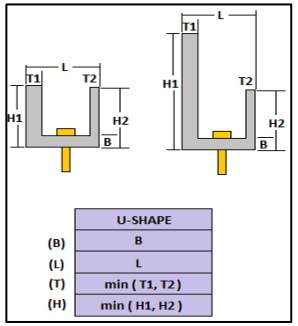
CROSS SECTION	SINGLE LAYER
MOUNT THICKNESS (B)	B
MOUNT LENGTH (L)	L
MINIMUM GUSSET THICKNESS (T)	L
MINIMUM GUSSET HEIGHT (H)	B



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

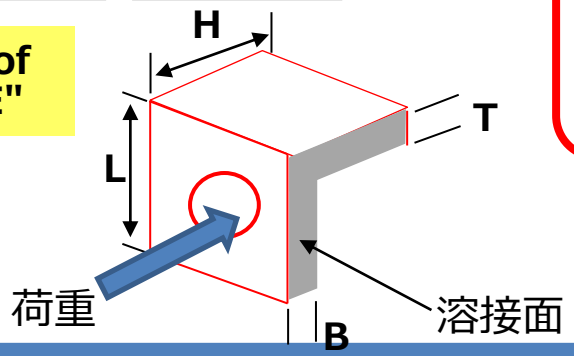


H-SHAPE	
(B)	B
(L)	L
(T)	min (T1, T2, T3, T4)
(H)	min (H1, H2)

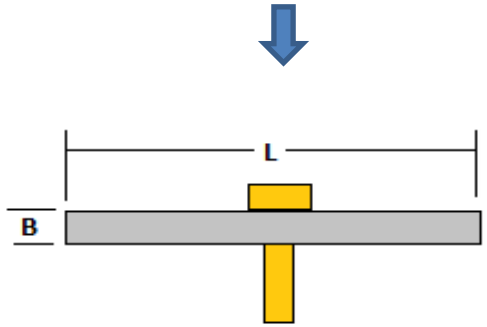


U-SHAPE	
(B)	B
(L)	L
(T)	min (T1, T2)
(H)	min (H1, H2)

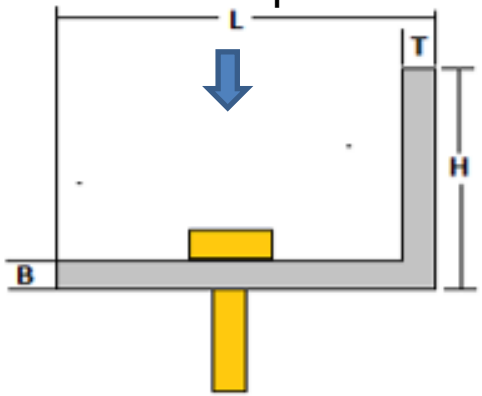
Example of "L-SHAPE"



Single Layer



L-Shape



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.

Physical Test Fixture Guidance

Attach the requested evidence

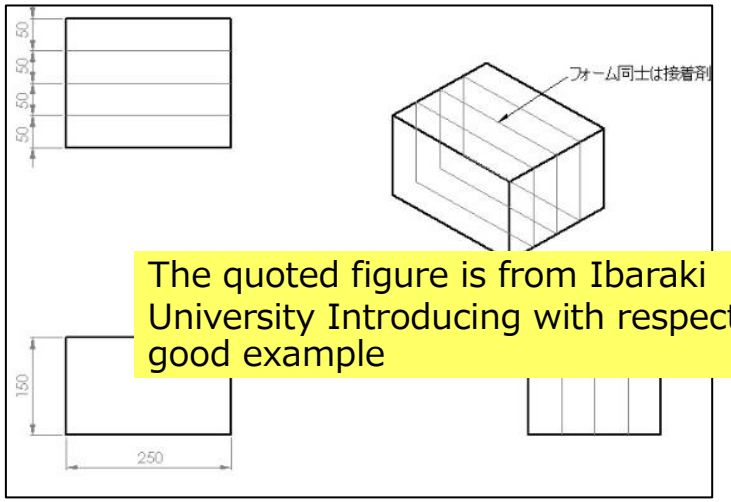
Describe diagrams and photos that shows the required dimensions

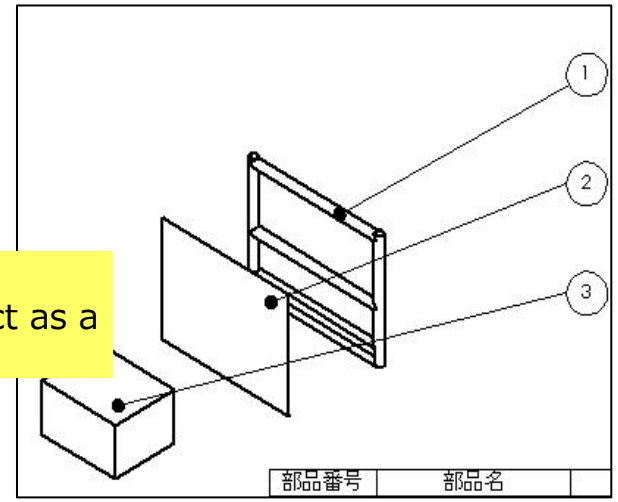
BLANK

Physical Test Fixture Guidance

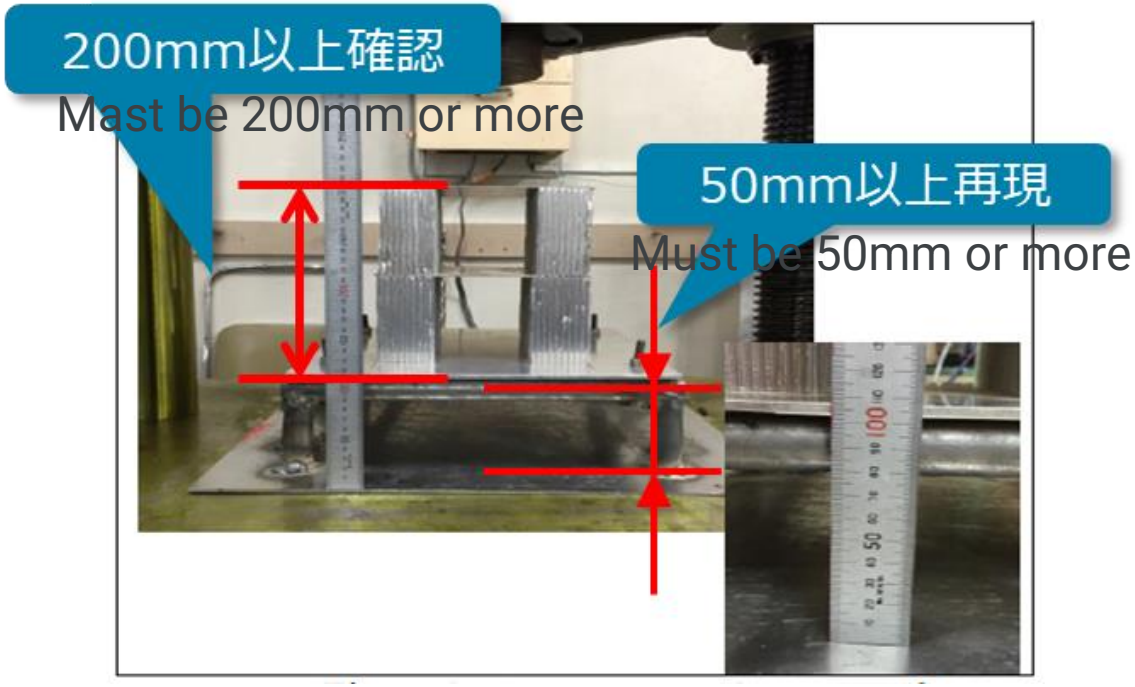
F.8.7.6.b The tested IA must be attached to a structurally representative section of the chassis.

BLANK				
	Front Bulkhead Outside to Outside Height:	0	mm	BLANK
	Front Bulkhead Outside To Outside Width:	0	mm	BLANK
F.8.7.6.c	Fixture Thickness on table >=50mm:		mm	BLANK
F.8.4.2.a	Tested IA starting length > 200mm:		mm	BLANK
F.8.4.2b	Custom IA WIDTH over 200mm length >= 200mm:		mm	N/A
	Custom IA HEIGHT over 200mm length >= 100mm:		mm	N/A





The quoted figure is from Ibaraki University Introducing with respect as a good example



Physical Tests

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:			LANK
	Dates of tests:			LANK
	Maximum crushed displacement:	0	mm	EJECT
	Post crush displacement, demonstrating any springback:		mm	BLANK
	Crushed attenuator height:		mm	BLANK
F.8.8.6.d	AI 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 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	g	BLANK
	Average attenuator force:	0	N	EQ
	Average attenuator only deceleration <= 20g:	0	g	EQ
F.8.8.2b	Energy absorbed >= 7350J:	0	J	REJECT
	Energy absorption check:	7350	J	EQ
	EQ			
	EQ		EQ	
	EQ			
	EQ			

Composite AIP 120kN Physical Test

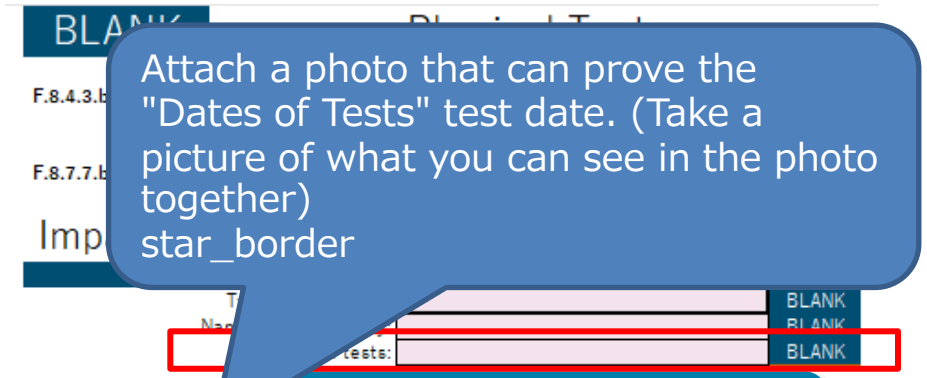
Teams may use a crushed attenuator of the version installed on the car to test a composite AIP.
Split the data following the IA test for the IA sections above and the 120kN test below.

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

Physical Tests

Attach the requested evidence

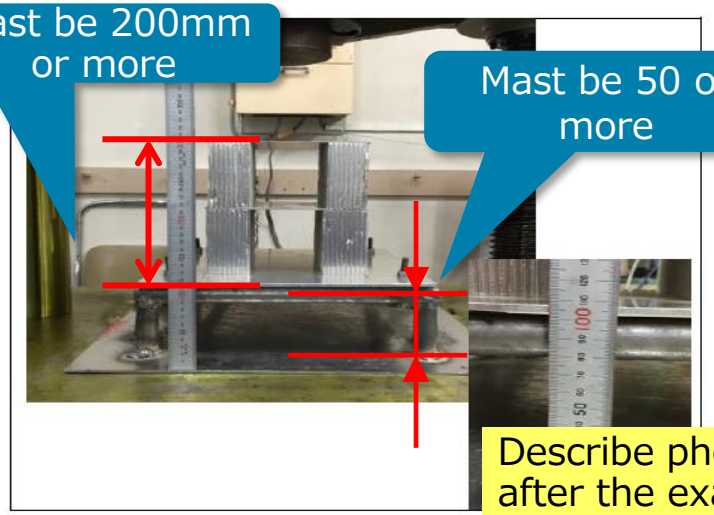
Insert Test Pictures - may be added below:
(a.) IA and FB test fixture before the test (F.8.7.4.d) which also shows the method of spacing AIP at least 50mm from any rigid structure (F.8.7.6.c)
(b.) IA, Anti-Intrusion Plate after the IA test (F.8.7.4.d) which shows the deflection was less than 25.4mm (F.8.7.6.d)
(c.) IA / AIP Force Displacement Curve
(d.) IA Energy Displacement Curve



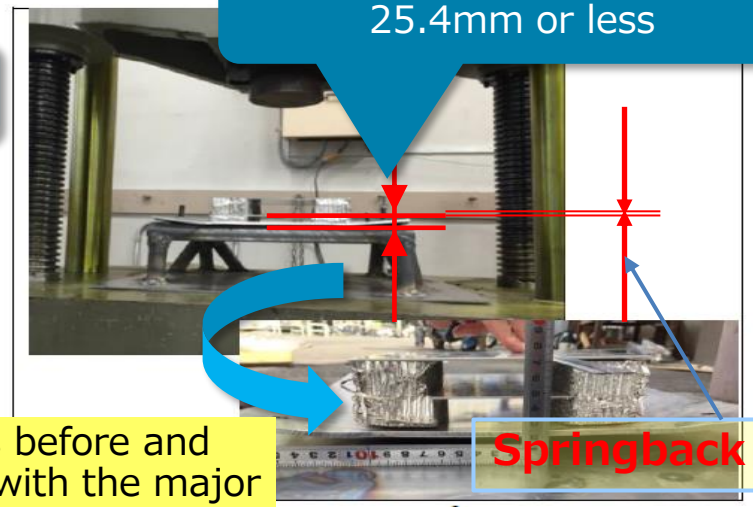
Attach a photo that can prove the "Dates of Tests" test date. (Take a picture of what you can see in the photo together)
star_border

Mast be 200mm or more

Mast be 50 or more



The deformation amount is 25.4mm or less



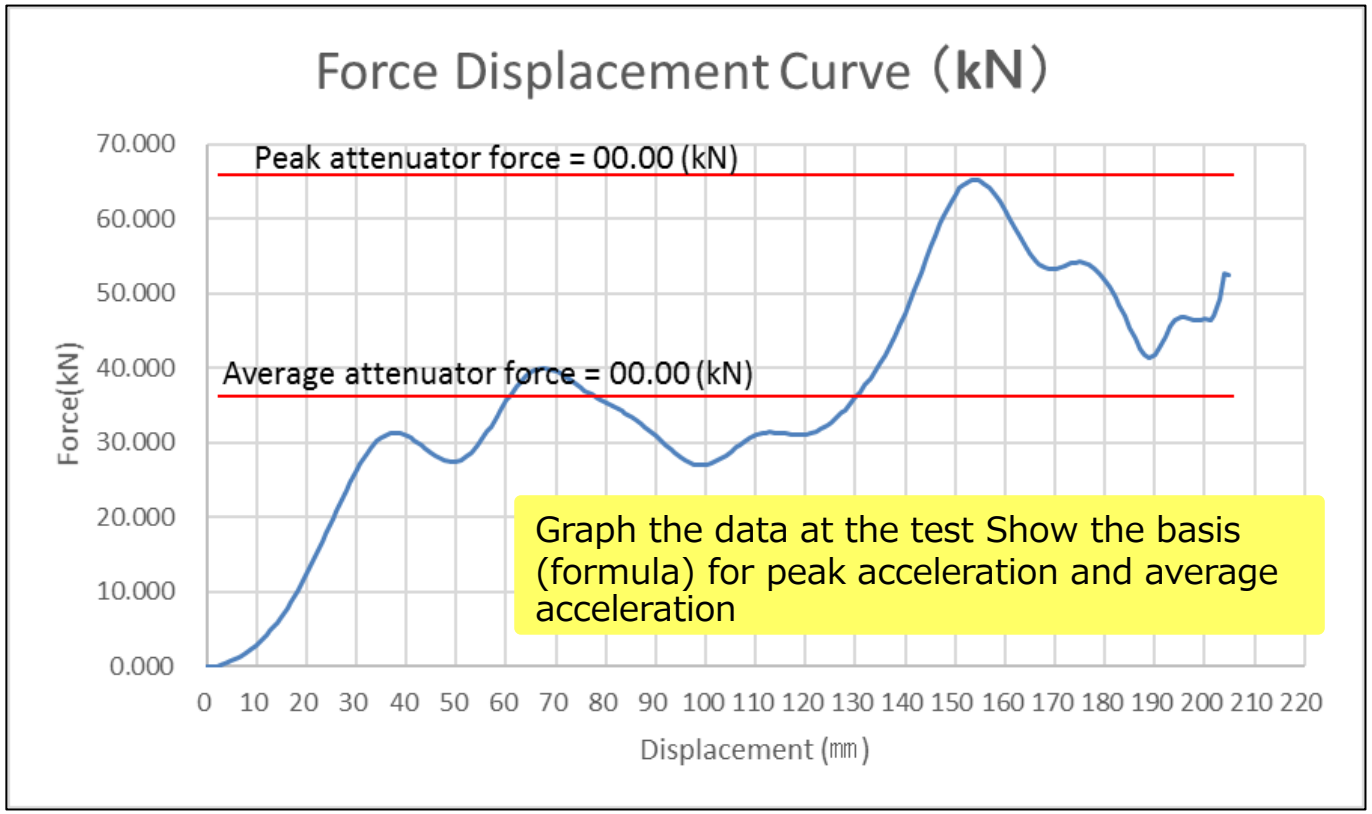
Springback amount

Describe photos before and after the exam with the major

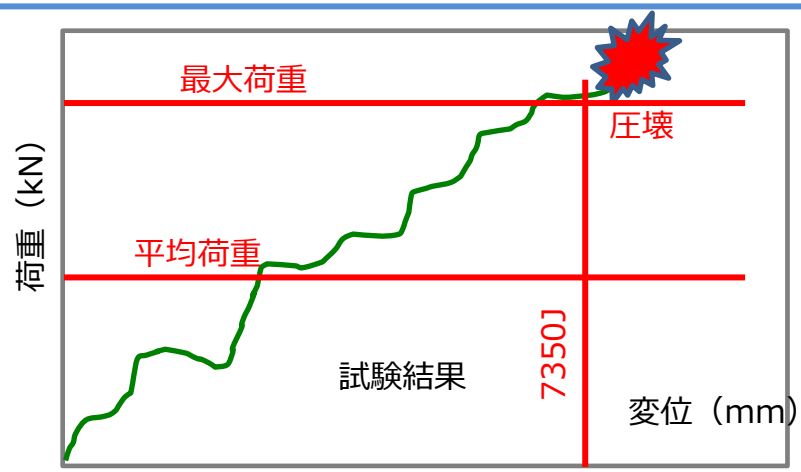
① Photo before the impact Attenator test
②Reproduce 50mm or more from the penetration prevention board, and put an impact Attonator on it.

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



Graph the data at the test Show the basis (formula) for peak acceleration and average acceleration



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	Force N	Weighted Average Force	Energy J
MAX	MAX		MAX
15	6511	N	12.386
0	0		0
9	2421		4.153
10	2813		5.234
11	3694		6.507
12	4186		7.88
13	4713		8.899
14	5875		10.588

It is recommended to fill in the data every 1 mm It is recommended to show the formula of how the average load and absorption energy were asked.

Indicates data up to the maximum amount

補足

Continuously compress the attenuator with a compressed test machine, and the reaction force (KN) for the stroke (mm) at that time is determined.　The ultimate energy requires that the energy required for a small deformation (measured force * deformed unit length deformation) is piled up and eventually becomes more than 7350J determined by the rule.

Energy = F [N]＊S [m] = F [kN] ＊1000 ＊ S [mm]/1000

Deceleration= F [N] /300kg＊ 9.8ms= F [N] /2940=○G

以下のサンプルを参考にIADを資料を作成する

Impact Attenuator Energy calculation sample sheet		
measuring data1		
	measuring data2	
		Energy=F*Displace J]
		unit [N*m]
Displacement [mm]	Force [kN]	Energy [J = kN*1000* /1000]
0	0	0
1	10	10
2	20	30
3	30	60
4	31	91
5	29.4	120.4
6	33	153.4
7	35	188.4
8	36	224.4
9	38	262.4

Attach the test data