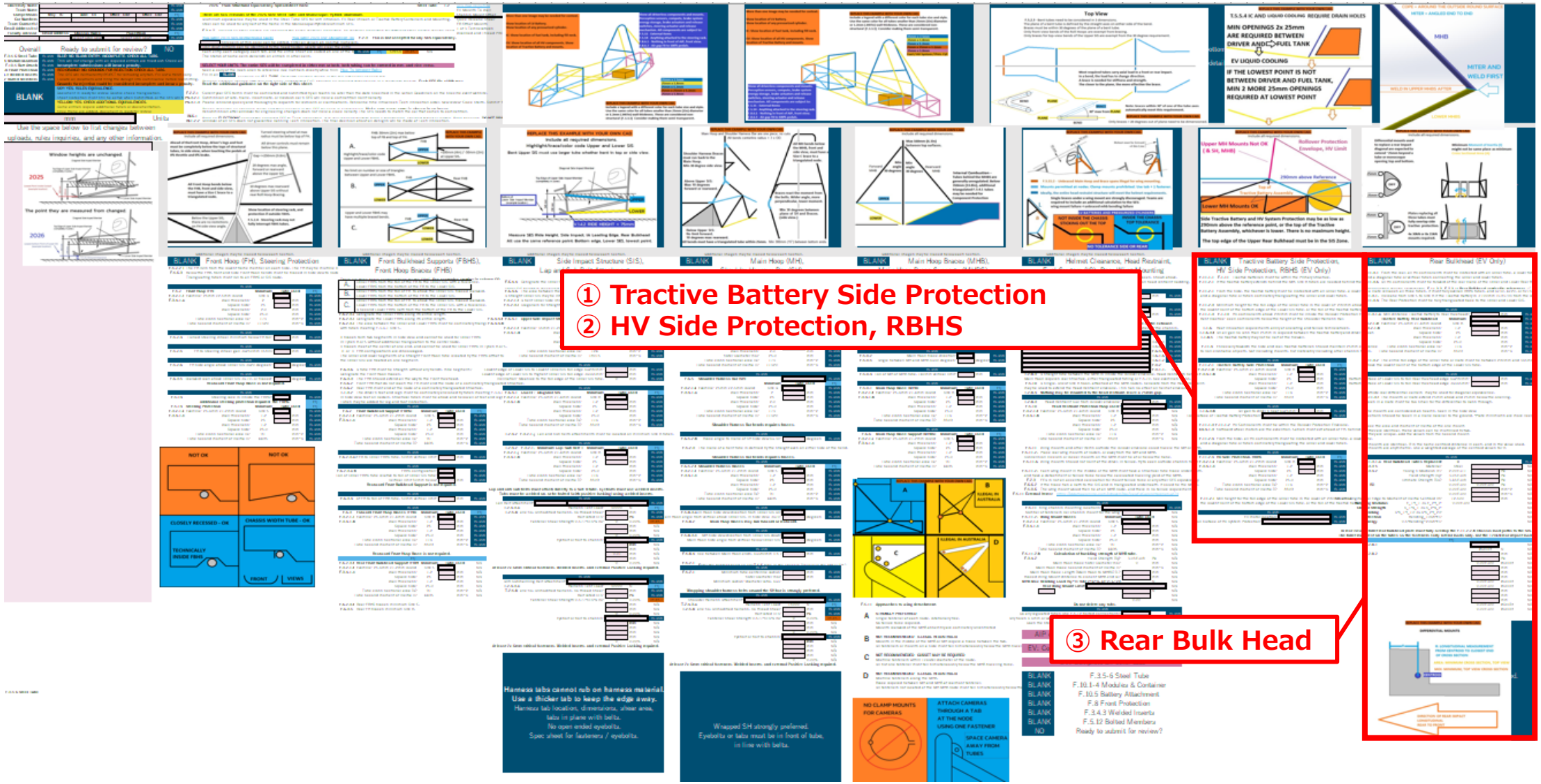
# 07-1_SES guidance EV Battery Protection

## F.3.5-6 **Steel Tube**

- ✓ Tractive Battery Side Protection,
- ✓ HV side Protection, RBHS (EV Only)
- ✓ Rear Bulkhead （EV only）

# Sheet Map


① Tractive Battery Side Protection
② HV Side Protection, RBHS
③ Rear Bulk Head

# ① Tractive Battery Side Protection

Attach evidences confirming that the entered values are correct.

| BLANK | | | | |
|---|---|---|---|---|
| **F.11.2.1** | **Tractive Battery Side Protection** | **Minimum** | **Tube Used** | EQ |
| **F.3.2.1.m** | Example: 25.4mm x 1.6mm round | Size B | | BLANK |
| **F.3.4.1.b** | Wall thickness: | 1.2 | mm | BLANK |
| | Square side: | 25 | mm | BLANK |
| | Wall thickness: | 1.2 | mm | BLANK |
| | Square side: | 25.0 | mm | BLANK |
| | Tube cross sectional area (A): | 114 | mm^2 | BLANK |
| | Tube second moment of inertia (I): | 8509 | mm^4 | BLANK |

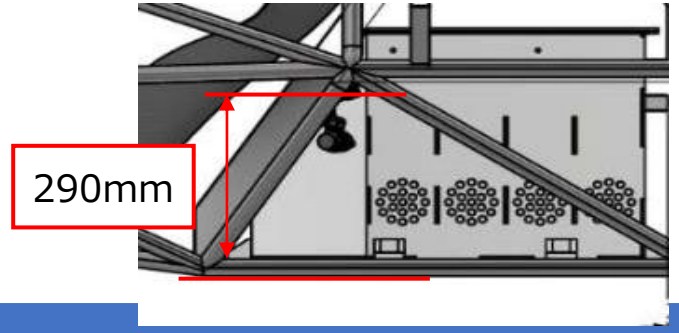
| BLANK | | | |
|---|---|---|---|
| **T.1.6.3.b** | Air gap to driver's seat >=25mm: | mm | BLANK |
| Top surface of Tractive Battery Protection: | | | BLANK |

>=290mm
Above Tractive Battery Assembly

**F.11.1.3** **F.11.1.2** HV Components must be within the Rollover Protecti
**EV.4.1.3** Outboard wheel motors are the exception. Cables must exit ahead of FH, behind MH.

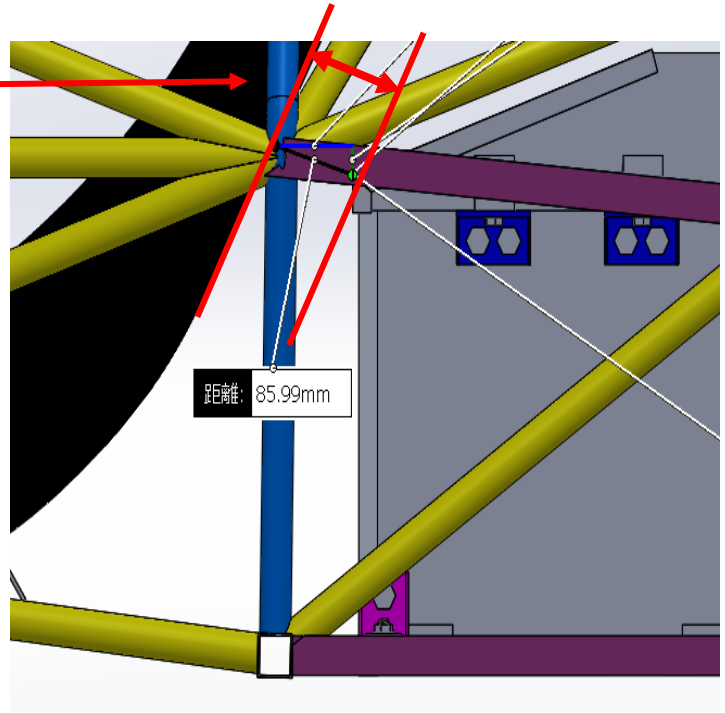
**F.11.2.4** From the side, all HV components must be protected with an upper tube, a lower tube, and a diagonal tube or tubes completely triangulating the upper and lower tubes.

下図のように290mm以上であること示すこと、または
Side Protection がTractive Battery最上面より高い位置にあることを示すこと
Indicate that it is 290 mm or more
or
Indicate that Side protection is above Tractive Battery Assembly




| | |
|---|---|
| **T.1.6** | Heat insulation requirements apply at operating and failure temperatures. |
| **T.1.6.3.b** | An air gap no less than 25mm is required between the tractive battery and driver's seat. |

図のようにTractive Batteryとシートとの最小距離を入力すること
Enter the minimum distance between Tractive Battery and driver's sheet as shown in the figure.

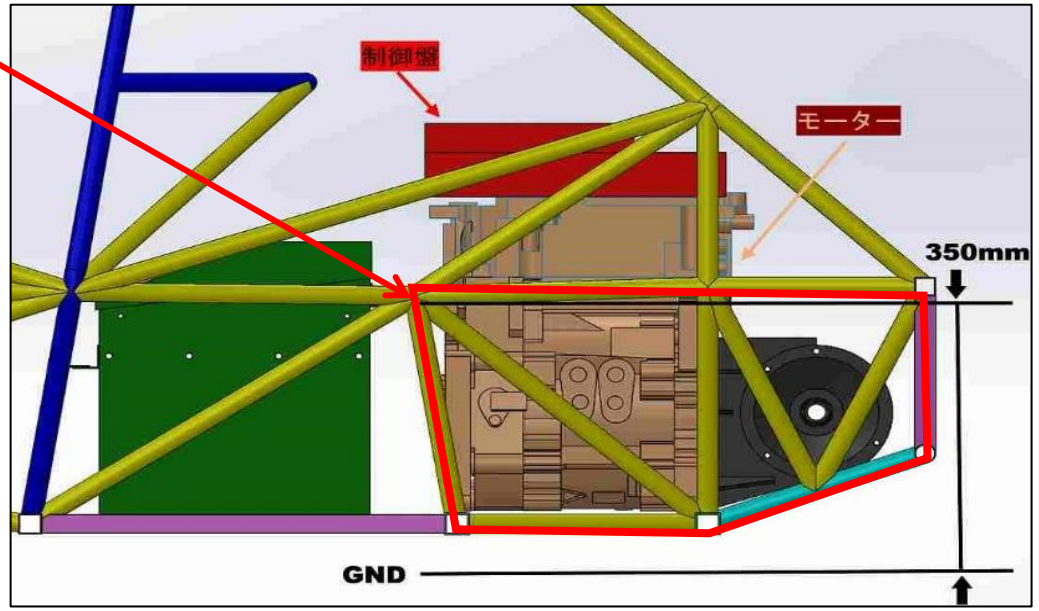


# ② HV Side Protection, RBHS

Attach evidences confirming that the entered values are correct.

**F.11.2.4** Tractive System components other than Tractive Battery Pack in a position below 350 mm from the ground must be protected from side impact by structure that meets **F.5.16 Component Protection**

地上から350mmとなる部分を図で示し、HVがSide Impact で保護されてることを示すこと
Photographs illustrating the protection of HV from lateral impact not exceeding 350 mm above the ground must be provided.




| BLANK | | | | |
|---|---|---|---|---|
| **F.11.2.4** | **HV Side Protection, RBHS** | **Minimum** | **Tube Used** | EQ |
| **F.3.2.1.n** | Example: 25.4mm x 1.2mm round | Size B | | BLANK |
| **F.3.4.1.c** | Wall thickness: | 1.2 | mm | BLANK |
| | Square side: | 25 | mm | BLANK |
| | Wall thickness: | 1.2 | mm | BLANK |
| | Square side: | 25.0 | mm | BLANK |
| | Tube cross sectional area (A): | 114 | mm^2 | BLANK |
| | Tube second moment of inertia (I): | 8509 | mm^4 | BLANK |

| BLANK | | |
|---|---|---|
| EV motor location: | | BLANK |
| Top surface of HV System Protection: | | BLANK |

| |
|---|
| >=290mm |
| Above Tractive Battery Assembly |

適切なものを選択し、HV system の上面の保護状態を示すこと
Select and Show the Top surface of the HV System Protection

| |
|---|
| Inside Frame Envelope |
| Outboard Wheel Motors |

適切なものを選択し、EVモーターの搭載状態が分かる図を示すこと
Show the EV motor location

# ③ Rear Bulkhead

Attach evidences confirming that the entered values are correct.

| BLANK | | | | | |
|---|---|---|---|---|---|
| F.11.3.1.a | Min distance Tractive Battery to Rear Bulkhead? | | | mm | BLANK |
| | **Tractive Battery Rear Bulkhead** | **Minimum** | | | BLANK |
| F.3.2.1.m | Example: 25.4mm x 1.6mm round | Size B | | | BLANK |
| F.3.2.1.b | Wall thickness: | 1.2 | | mm | BLANK |
| | Square side: | 25 | | mm | BLANK |
| | Wall thickness: | 1.2 | | mm | BLANK |
| | Square side: | 25.0 | | mm | BLANK |
| | Tube cross sectional area (A): | 114 | | mm^2 | BLANK |
| | Tube second moment of inertia (I): | 8509 | | mm^4 | BLANK |

Tractive battery と Rear Bulkheadの最小距離
Minimum distance Tractive battery to Rear Bulkhead

Tube
Diff Carrier Diagonal
Billet Plate

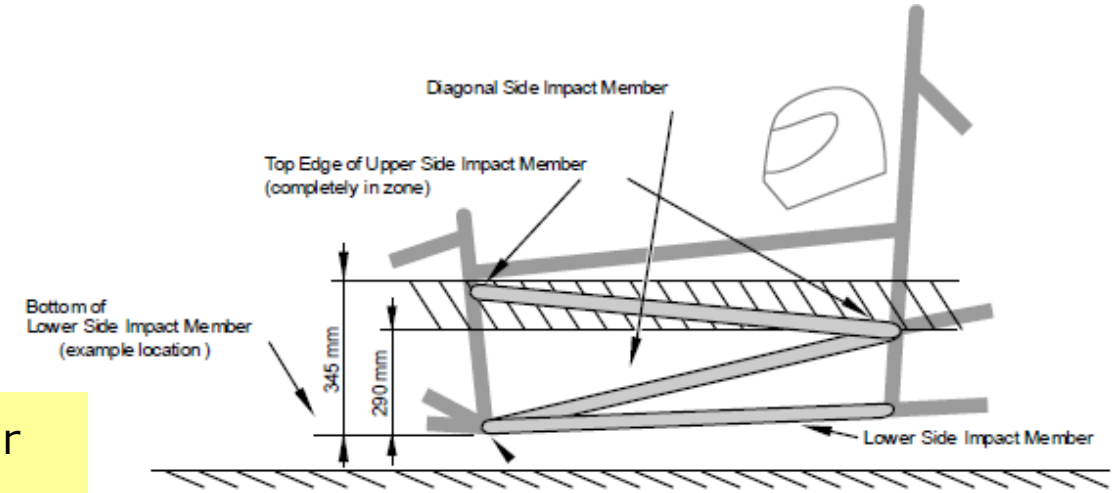
入力項目は選択により異なる
Entry fields vary by selection

**F.11.3.2** The entire top edge of the upper tube or plate must be between 290mm and 345mm above the lowest point of the bottom edge of the Lower SIS tube.

| BLANK | | | |
|---|---|---|---|
| Bottom surface of Lower SIS to top Rear Bulkhead edge >=290mm: | | mm | BLANK |
| Bottom surface of Lower SIS to top Rear Bulkhead edge <=345mm: | | mm | BLANK |

Rear Bulkheadの上端がLower SIS最下端から290~345mmの範囲にあること
The top of the Rear Bulkhead must be within 290~345 mm of Bottom surface of Lower SIS.

**F.11.3.2**
The entire top edge of the upper Rear Bulkhead tube or monocoque equivalent must be in the Upper Side Impact Structure zone F.6.4.4 / F.7.5.1




Remark : The vehicle may need to be modified if a second year vehicle is used.
注意：2年目車両を用いる場合、車両の修正が必要な場合がある

# ③ Rear Bulkhead

Attach evidences confirming that the entered values are correct.

| BLANK | | | | | |
|---|---|---|---|---|---|
| F.11.3.1.a | **Rear Bulkhead Tubes Replaced:** | **3** | | | EQ |
| F.3.3-5 | Material: | Steel | | | BLANK |
| F.3.4.2 | Young's Modulus (E): | 2.00E+11 | | Pa | BLANK |
| | Yield Strength (Sy): | 3.05E+08 | | Pa | BLANK |
| | Ultimate Strength (Su): | 3.65E+08 | | Pa | BLANK |
| (S) | | 0.00E+00 | 0.00E+00 | Pa | EQ |
| | Plate minimum cross sectional area (A): | 3.42E+02 | | mm^2 | BLANK |
| | Plate minimum second moment of inertia (I): | 2.55E+04 | | mm^4 | BLANK |
| | Mount Longitudinal Edge to Moment of Inertia Centroid (R): | 12.500 | | mm | BLANK |
| **Buckling Modulus** | E_1*I_1 <= E_2*I_2: | 5.11E+03 | | | BLANK |
| **Critical Strength** | S_1*A_1 <= S_2*A_2: | | | | BLANK |
| **Bending** | 4*S_1*I_1/r <= 4*S_2*I_2/r: | | | | BLANK |
| **Deflection** | Bending_1/(48*EI): | | | | BLANK |
| **Energy** | 0.5*Bending^2/(48*EI): | | | | BLANK |

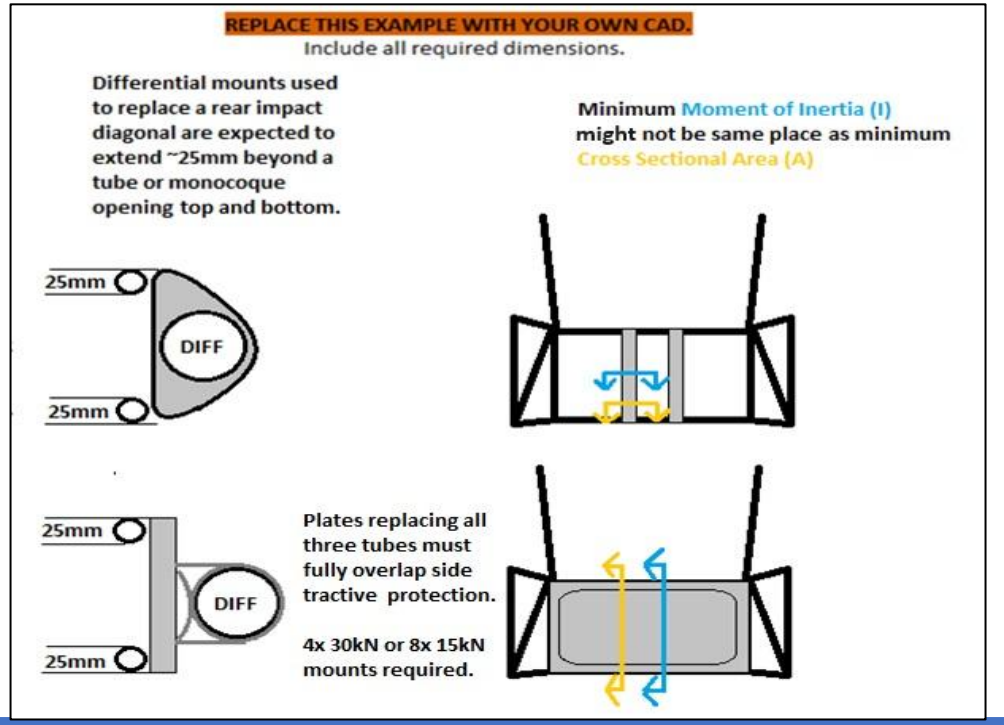
**In rear view, a billet rear bulkhead plate must fully overlap the F.11.2.2.b chassis load paths to the SIS. The billet must rest on the tubes so the fasteners carry lateral loads only, not the 120kN rear impact load.**

| BLANK | | | | | |
|---|---|---|---|---|---|
| F.7.8.1 | Number of plate to chassis fasteners: | | | | BLANK |
| | Fastener Test Load: | #DIV/0! | | N | EQ |
| F.7.8.7 | Plate fastener diameter: | | | mm | BLANK |
| | Plate fastener rated UTS: | | | Pa | BLANK |
| | Plate fastener shear stregnth 0.577*UTS*A (N): | 0.00E+00 | #DIV/0! | | #DIV/0! |
| | Billet plate shear thickness: | | | mm | BLANK |
| | --Pullout--Billet plate shear perimeter (normal to axis): | | | mm | BLANK |
| | --Tearout--Minimum - Fastener spacing, edge, or corner (Billet Plate): | | | mm | BLANK |
| | Plate pullout 0.577*UTS*thickness*perimeter >= Test Load: | 0.00E+00 | #DIV/0! | | #DIV/0! |
| | Plate tearout 2*0.577*UTS*thickness*edge distance >= Test Load: | 0.00E+00 | #DIV/0! | | #DIV/0! |
| | Chassis shear thickness: | | | mm | BLANK |
| | --Pullout--Chassis shear perimeter (normal to axis): | | | mm | BLANK |
| | --Tearout--Minimum - Fastener spacing, edge, or corner (Chassis): | | | mm | BLANK |
| | Chassis pullout 0.577*UTS*thickness*perimeter >= Test Load: | 0.00E+00 | #DIV/0! | | #DIV/0! |
| | Chassis tearout 2*0.577*UTS*thickness*edge distance >= Test Load: | 0.00E+00 | #DIV/0! | | #DIV/0! |

| BLANK | | | | |
|---|---|---|---|---|
| F.11.3.1.a | Min distance Tractive Battery to Rear Bulkhead? | | mm | BL |
| | **Tractive Battery Rear Bulkhead** | **Minimum** | | BL |
| F.3.2.1.m | Example: 25.4mm x 1.6mm round | Size B | | BL |
| F.3.2.1.b | Wall thickness: | 1.2 | mm | BL |
| | Square side: | 25 | mm | BL |
| | Wall thickness: | 1.2 | mm | BLANK |

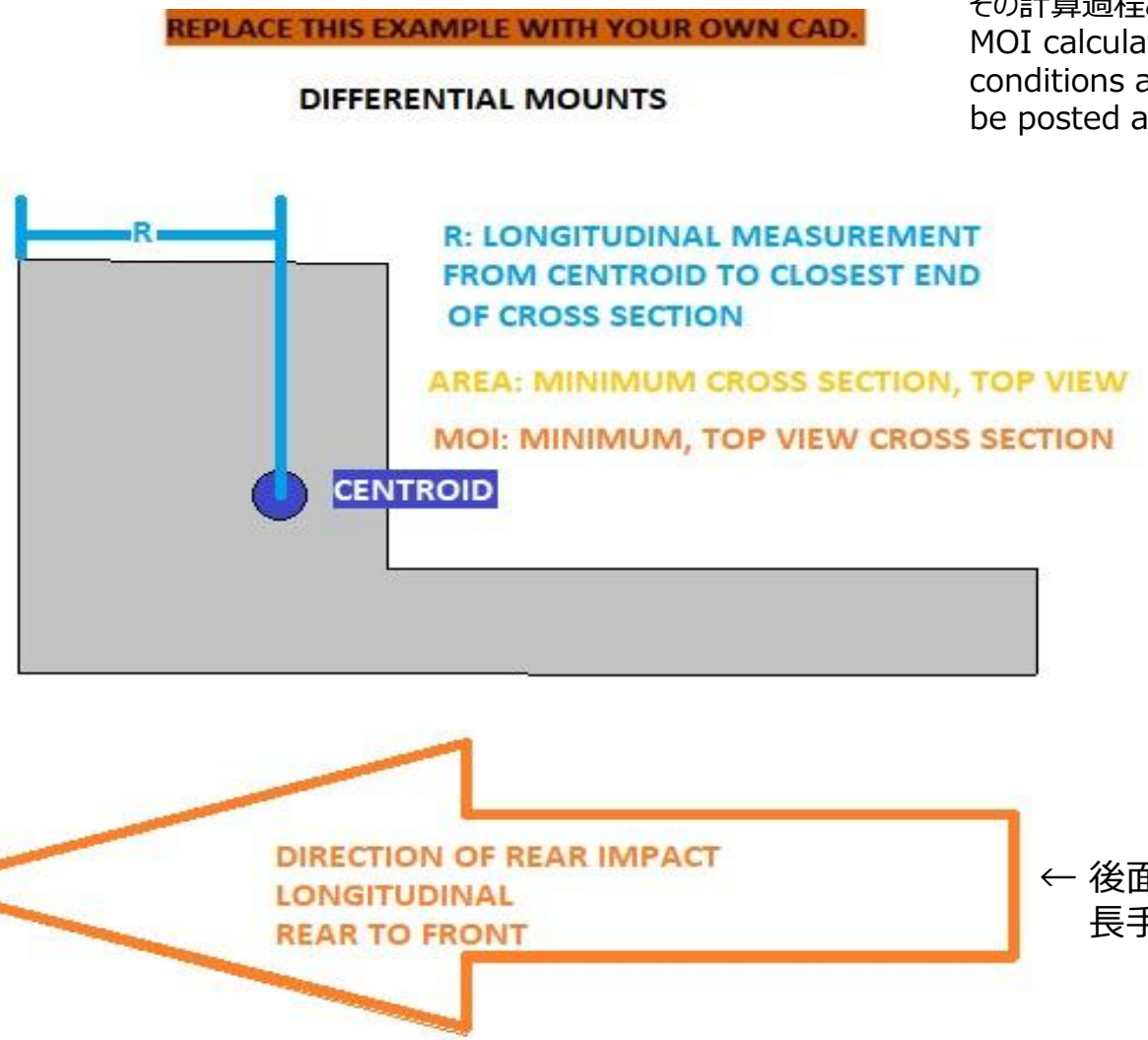
Tube
Diff Carrier Diagonal
Billet Plate

Φ25.4mm、t=1.6mm または、□25mm、t=1.2mm 以上のパイプで構成されたRear Bulkhead と同等以上の強度を持つことを証明すること
Proof of strength equal to or greater than that of a Rear Bulkhead consisting of a pipe of Φ25.4mm, t=1.6mm or □25mm, t=1.2mm or larger.



# ③ Rear Bulkhead

断面二次モーメントの計算は、以下の条件に基づいて算出し、
その計算過程と結果をエビデンスとして掲載すること
MOI calculations should be based on the following conditions and the calculation process and results should be posted as evidence.




← R:断面の中心から最も近い端までの
長手方向の測定値

← AREA：上面図での最小断面

← 断面二次モーメント(MOI)： 上面断面図での最小値

← 後面衝突の方向
長手方向後方から前方へ

# Fin.