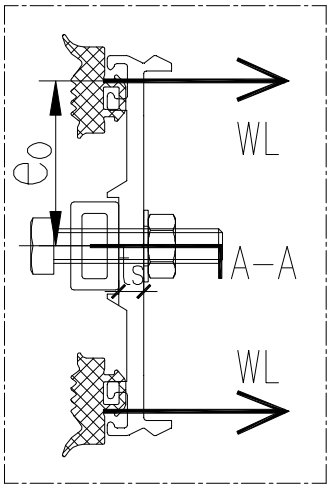
横框校核分析

立柱线荷载设计值 $q_{uls} := 3.26\ \frac{N}{mm}$

上分格承载力极限状态组合线性荷载设计值 $q_{ut} := 1.302\ \frac{kN}{m}$

下分格承载力极限状态组合线性荷载设计值 $q_{ub} := 1.302\ \frac{kN}{m}$

立柱内压板校核分析



校核A-A截面

荷载偏心距 $e_o := 29mm$

螺栓间距@ $s_{spacing} := 300mm$

最不利截面厚度 $t\_yb := 4.5mm$

螺栓孔径 $d_{hole} := 6mm + 1mm$

危险截面最大弯矩 $M_{yb} := \frac{q_{uls}}{2} \cdot s_{spacing} \cdot e_o$

$M_{yb} = 1.418 \times 10^{4} \cdot N \cdot mm$

危险截面抵抗矩 $w_{yb} := \frac{1}{6} \cdot \left(s_{spacing} - d_{hole}\right) \cdot t\_yb^{2}$

$w_{yb} = 988.875 \cdot mm^{3}$

危险截面最大正应力 $\sigma_{yb} := \frac{M_{yb}}{w_{yb}}$

$\sigma_{yb} = 14.341 \cdot MPa$

承载力设计值 $f_{ts.6063\_T5} = 90 \cdot MPa$

应力分析 $HENCE\left(\sigma_{yb} \le f_{ts.6063\_T5}\right) = \text{"满足规范要求"}$

压板连接螺栓校核分析

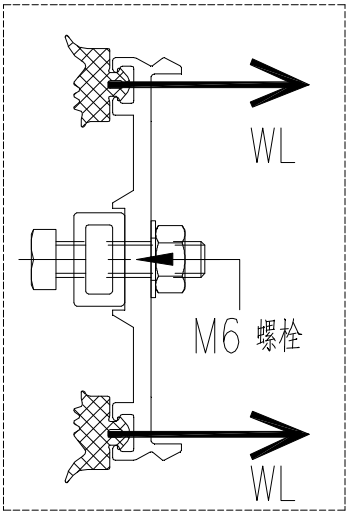
螺栓材质　　A2-70

螺栓许用拉应力　　$f_{tb.A2\_70} = 280 \cdot MPa$

螺栓许用剪应力　　$f_{vb.A2\_70} = 265 \cdot MPa$

螺栓公称直径　　$d_{ls} := 6mm$

螺距　　$p := 1mm$



$$A_{ls}(d_{ls}, p) := \frac{\pi}{4} \cdot \left[\frac{d_{ls} - \frac{3 \cdot \sqrt{3}}{8} \cdot p + \left[d_{ls} - \frac{5 \cdot \sqrt{3}}{8} \cdot p - \frac{1}{6} \cdot \left(\frac{\sqrt{3}}{2} \cdot p \right) \right]}{2} \right]^2$$

螺纹有效面积　　$A_s := A_{ls}(d_{ls}, p)$

$A_s = 20.123 \cdot mm^2$

螺栓抗拉承载力　　$F_{tb} := f_{tb.A2\_70} \cdot A_s$

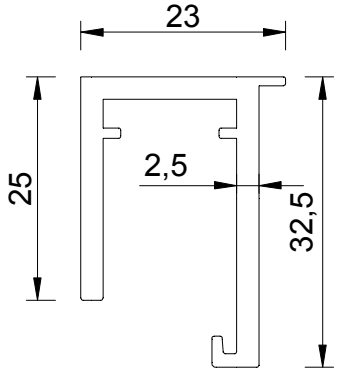
$F_{tb} = 5.635 \cdot kN$

螺栓最大拉力设计值　　$F_t := q_{uls} \cdot s_{spacing}$

$F_t = 978\,N$

拉应力分析　　$HENCE(F_t \le F_{tb}) = \text{"满足规范要求"}$

附框校核分析



截面几何参数表(主单位为cm)

A(cm^2)	1.9551	Ip(cm^4)	3.1510
Ix(cm^4)	1.9194	Iy(cm^4)	1.2316
ix	0.9908	iy	0.7937
Wx(上)(cm^3)	1.5738	Wy(左)(cm^3)	1.0986
Wx(下)(cm^3)	0.9453	Wy(右)(cm^3)	1.0447
绕X轴面积矩	0.8448	绕Y轴面积矩	0.7353
形心离左边缘距离	1.1211	形心离右边缘距离	1.1789
形心离上边缘距离	1.2196	形心离下边缘距离	2.0304
主矩I1(cm^4)	2.0352	主矩1方向	(0.935,0.355)
主矩I2(cm^4)	1.1158	主矩2方向	(-0.355,0.935)

抵抗矩参数 $w_y := 1.0447cm^3$

危险截面最大弯矩
(按多跨连续梁计算) $M_{fk} := \frac{\max(q_{ut}, q_{ub}) \cdot s_{spacing}^2}{10}$

$M_{fk} = 1.172 \times 10^4 \cdot N \cdot mm$

$\sigma_{fk} := \frac{M_{fk}}{w_y} = 11.217 \cdot MPa$

设计应力 $f_{ts.6063\_T5} = 90 \cdot MPa$

应力分析 $HENCE(\sigma_{fk} \le f_{ts.6063\_T5}) = "满足规范要求"$

附框压块校核分析

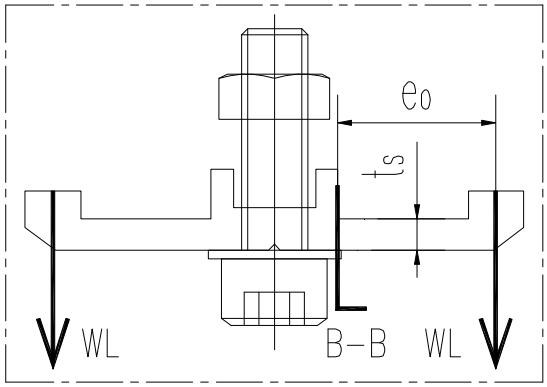
校核B-B截面

荷载偏心距 $e_{\_yk} := 14.5mm$

螺栓间距@ $s_{spacing} = 300 \cdot mm$

最不利截面厚度 $t_{\_yk} := 2.8mm$

计算长度 $L_s := 100mm$



危险截面最大弯矩 $M_{yk} := \max(q_{ut}, q_{ub}) \cdot s_{spacing} \cdot e_{\_yk}$

$M_{yk} = 5.664 \times 10^3 \cdot N \cdot mm$

危险截面最大截面抵抗矩 $w_{yk} := \frac{1}{6} \cdot L_s \cdot t_{\_yk}^2$

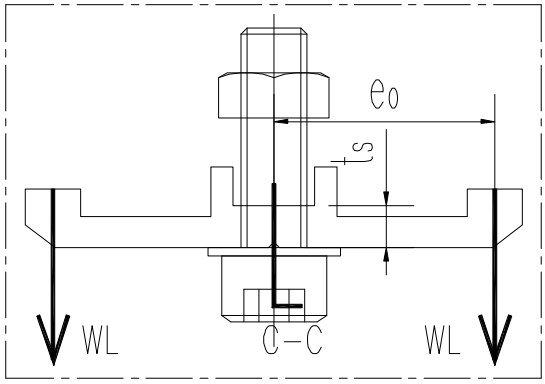
$w_{yk} = 130.667 \cdot mm^3$

$\sigma_{yk} := \frac{M_{yk}}{w_{yk}} = 43.345 \cdot MPa$

承载力设计值 $f_{ts.6063\_T5} = 90 \cdot MPa$

应力分析 $HENCE(\sigma_{yk} \le f_{ts.6063\_T5}) = "满足规范要求"$

校核C-C截面



荷载偏心距 $e_{yk\_c} := 20mm$

螺栓间距@ $s_{spacing} = 300 \cdot mm$

最不利截面厚度 $t_{yk\_c} := 3.8mm$

计算长度 $L_s = 100 \cdot mm$

螺栓孔径 $d_{hole} = 7 \cdot mm$

危险截面最大弯矩 $M_{yk\_c} := \max\left(q_{ut}, q_{ub}\right) \cdot s_{spacing} \cdot e_{yk\_c}$

$M_{yk\_c} = 7.812 \times 10^{3} \cdot N \cdot mm$

危险截面最大截面抵抗矩 $w_{yk\_c} := \frac{1}{6} \cdot \left(L_s - d_{hole}\right) \cdot t_{yk\_c}^{2}$

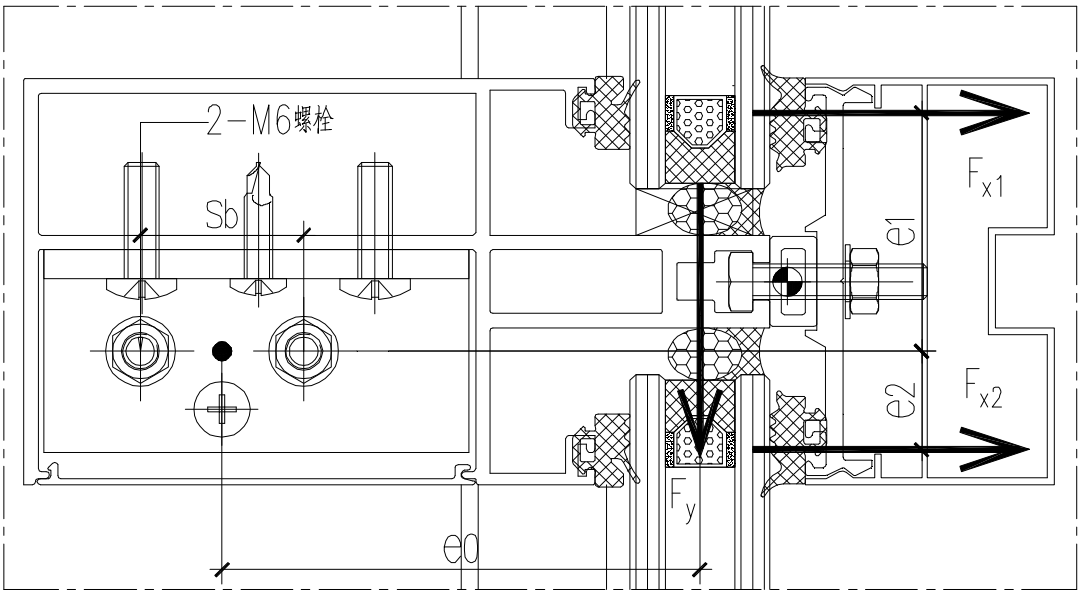
$w_{yk\_c} = 223.82 \cdot mm^{3}$

危险截面最大正应力 $\sigma_{yk\_c} := \frac{M_{yk\_c}}{w_{yk\_c}} = 34.903 \cdot MPa$

承载力设计值 6063-T5 $f_{ts.6063\_T5} = 90 \cdot MPa$

应力分析 $\text{HENCE}\left(\sigma_{yk\_c} \le f_{ts.6063\_T5}\right) = \text{"满足规范要求"}$

横梁立柱连接螺栓校核分析



螺栓材质	A2-70	
螺栓许用拉应力	$f_{tb.A2\_70} = 280 \cdot MPa$	*<GB50429>表4.3.5-1*
螺栓许用剪应力	$f_{vb.A2\_70} = 265 \cdot MPa$	
螺栓公称直径	$d_{ls.} := 8mm$	
螺距	$p := 1.25mm$	
	$A_{.s} := A_{ls}(d_{ls.}, p)$	
螺纹有效面积	$A_{.s} = 36.609 \cdot mm^2$	
螺栓抗拉承载力	$F_{.tb} := f_{tb.A2\_70} \cdot A_{.s}$	
	$F_{.tb} = 10.25 \cdot kN$	
	$F_{vb} := f_{vb.A2\_70} \cdot A_s$	
螺栓许用剪力	$F_{vb} = 5.333 \cdot kN$	
螺栓数量	$n_b := 2$	
受剪截面(单个螺栓)	$n_v := 2$	
荷载偏心距	$e_p := 82mm$	
	$e_1 := 41mm$	
	$e_2 := 17mm$	
螺栓的中心距	$S_b := 28mm$	
上分格水平最大剪力	$F_{x1} := 0.391\ kN$	
下分格水平最大剪力	$F_{x2} := 0.391\ kN$	
幕墙重力荷载标准值	$F_g := 1.084 \times 10^3\ N$	
重力荷载分项系数	$\gamma_g := 1.35$	
幕墙重力荷载设计值	$F_y := \gamma_g \cdot F_g = 1.463 \times 10^3\ N$	

螺栓实际所受剪力（重力荷载产生的剪力）

$$F_{vy.1} := \frac{F_y}{n_v \cdot n_b} = 365.85\,N$$

重力荷载和风荷载偏心产生的扭矩产生的剪力

$$F_{vy.2} := \left(\left| F_{x1} \cdot e_1 + \frac{F_y}{n_v} \cdot e_p - F_{x2} \cdot e_2 \right| \right) \cdot \frac{\frac{S_b}{2}}{2\left(\frac{S_b}{2}\right)^2}$$

$$F_{vy.2} = 2.478 \times 10^3\,N$$

$$F_{vy} := F_{vy.1} + F_{vy.2} = 2.844 \times 10^3\,N$$

$$F_{vx} := \frac{F_{x1} + F_{x2}}{n_v \cdot n_b} = 195.5\,N$$

单根螺栓最大剪力

$$F_v := \sqrt{F_{vy}^{\,2} + F_{vx}^{\,2}} = 2.851 \times 10^3\,N$$

剪应力分析

$$\text{HENCE}\left(F_v \le F_{vb}\right) = \text{"满足规范要求"}$$

局部承压承载力校核

连接面局部壁厚

$$t_c := 3mm$$

连接件局部承压强度设计值（按6063-T5设计）

$$f_{cb.6063\_T5} = 185 \cdot MPa$$

螺栓公称直径

$$d_{ls.} = 8 \cdot mm$$

局部承压承载力

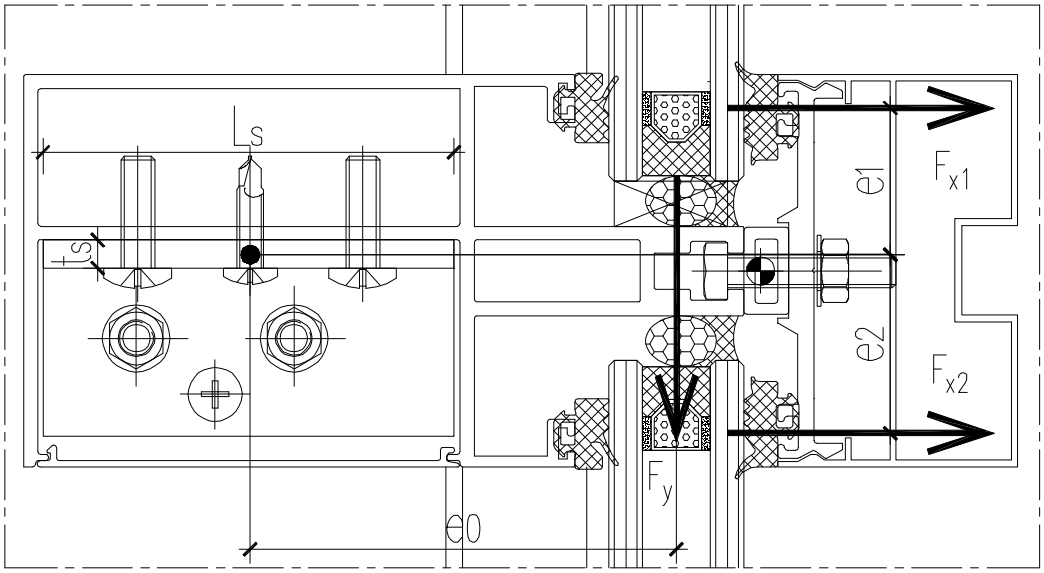
$$N_{cb} := f_{cb.6063\_T5} \cdot t_c \cdot d_{ls.}$$

$$N_{cb} = 4.44 \cdot kN$$

承载力分析

$$\text{HENCE}\left(F_v \le N_{cb}\right) = \text{"满足规范要求"}$$

横梁连接角码校核分析



偏心距参数

$e_p = 82 \cdot mm$

$e_1 = 41 \cdot mm$

$e_2 = 17 \cdot mm$

截面参数

$L_{.s} := 73mm$

$t_{\_jm} := 5mm$

截面受扭抵抗矩

$W_t := 0.5 L_{.s} \cdot t_{\_jm}^{2}$

$W_t = 912.5 \cdot mm^3$

最不利截面扭矩

$M_t := F_y \cdot e_o + \left| F_{x1} \cdot e_1 - F_{x2} \cdot e_2 \right|$

$M_t = 5.182 \times 10^4 \cdot N \cdot mm$

截面最大剪应力

$$\tau_{severe} := \frac{\sqrt{\left(F_{x1} + F_{x2}\right)^2 + F_y^{\,2}}}{L_{.s} \cdot t_{\_jm}} + \frac{M_t}{W_t}$$

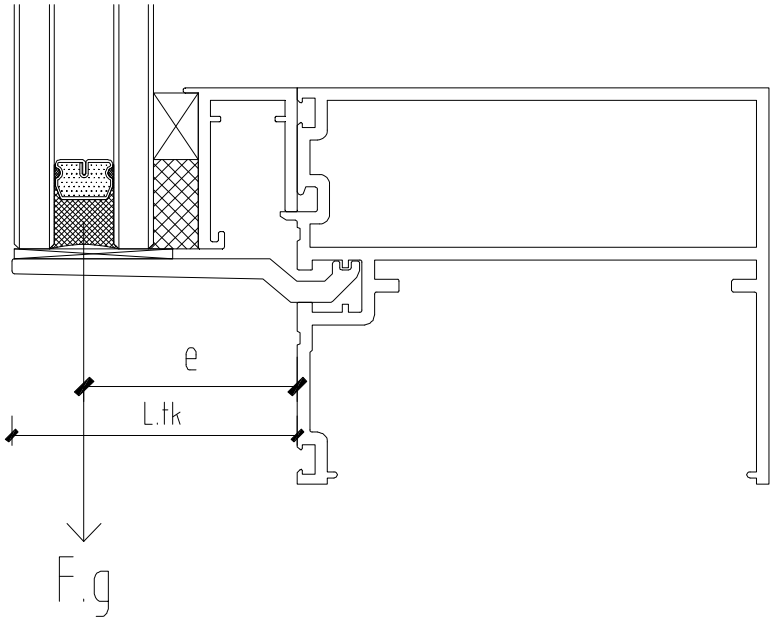
$\tau_{severe} = 61.338 \cdot MPa$

抗剪设计承载力

$f_{vs.6063\_T6} = 85 \cdot MPa$

$\text{HENCE}\left(\tau_{severe} \le f_{vs.6063\_T6}\right) = \text{"满足规范要求"}$

承托件校核分析



托块集中力(标准值)	$F_{tk} := \frac{F_g}{2} = 542\,N$
偏心	$e := 43mm$
托块长度	$L_{tk} := 57.5mm$
托块宽度	$H_{tk} := 100mm$
托块厚度	$t_{tk} := 4mm$
托块材质	$\sigma_{tk.lim} := f_{ts.6063\_T6} = 150 \cdot MPa$
计算模型	悬臂梁
重力荷载分项系数 (重力荷载主导)	$\gamma_{.g} := 1.35$
弯矩	$M_{tk} := \gamma_{.g} F_{tk} \cdot e = 3.146 \times 10^{4} \cdot N \cdot mm$
抵抗矩	$W_{tk} := \frac{H_{tk} \cdot t_{tk}^{2}}{6}$ $W_{tk} = 266.667 \cdot mm^{3}$
托块应力	$\sigma_{tk} := \frac{M_{tk}}{W_{tk}} = 117.987 \cdot MPa$
承载力分析	$HENCE\left(\sigma_{tk} \le \sigma_{tk.lim}\right) = "满足规范要求"$

铝合金弹性模量

$$E_{\_lv} = 70 \cdot GPa$$

截面惯性矩

$$I_{tk} := \frac{H_{tk} \cdot t_{tk}^{3}}{12} = 533.333 \cdot mm^{4}$$

最大挠度

$$d_f := \frac{F_{tk} \cdot e^{3}}{3 \cdot E_{\_lv} \cdot I_{tk}}$$

$$d_f = 0.385 \cdot mm$$

挠度限值

$$d_{f.lim} := 2 \cdot \frac{L_{tk}}{180} = 0.639 \cdot mm$$

挠度分析

$$\text{HENCE}\left(d_f \le d_{f.lim}\right) = \text{"满足规范要求"}$$